



Artificial Intelligence for Sustainable Learning in Higher Education: Insights from Local Universities, Bangladesh

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ABSTRACT

Artificial intelligence in higher education is increasingly seen as a way to meet learners' growing needs and make education more accessible. Despite global advances, understanding of the practical aspects of AI implementation in developing contexts like Bangladesh remains limited. In this work, we explore how students in local universities use AI tools, the potential benefits for sustainable learning, and the institutional and ethical challenges driving AI integration. Semi-structured interviews with students show that AI acts as a multi-purpose academic assistant: it helps with concept clarification, summarisation, academic writing, personalised feedback and self-paced learning. Users reported improved learning efficiency, higher academic achievement, and more independent study habits, suggesting AI's potential to promote SDG-related education sustainability. But the results also suggest impediments, such as inaccurate outputs, poor technological infrastructure, insufficient institutional support, teacher-level resistance, and deep privacy and ethical concerns, especially related to AI-morphed harassment and data abuse. Students underscored the need for formal AI education, clear ethical standards, better school infrastructure and organised classroom integration. It provides evidence-based, lived-experience-informed guidance on how Bangladeshi higher education institutions can responsibly use AI to develop sustainable, inclusive and future-ready learning systems.

Keywords: Artificial intelligence, AI-assisted learning, Sustainable Development Goals (SDG 4), Education sustainability, AI ethics in education, Student perceptions of AI

INTRODUCTION

Artificial intelligence has become a popular educational assistant in recent years. AI supports students as an easy, time-saving drafting tool. Over the past few years, AI has become an increasingly crucial issue worldwide for sustainable learning. In the 21st century, understanding AI adoption challenges and opportunities is essential not only for raising awareness, responsibility and solutions but also for reaching the United Nations Sustainable Development Goals (SDGs) (Inam et al., 2022). Sustainability is a strategy to maintain long-term progress without harming the environment, society, governance or the economy. This strategy is crucial for future certainty over present concerns to make the world a prosperous, sustainable, risk-free place to live. Sterling and Orr (2001) align with the sustainability in education context mentioned, stating that Sustainable education can foster a culturally diverse, creative and participatory learning culture that empowers learners to develop a better future (Lin et al., 2023).

However, after the Millennium Development Goals, the SDGs began in 2015. They work with the aim to solve world problems like quality education, poverty, inequality, and climate change (Mhlanga, 2023). UN proposed the SDGs as Agenda 2030, combining 17 environmental sustainability objectives and their 169 targets across 191 UN Member States, including SDG 4 to ensure inclusive and equitable quality education and encourage lifelong learning opportunities for all (Ferguson & Roofe, 2020) (UNDP, 2018; UNSD, 2025. (UNICEF, n.d; UNSD, n.d.). AI-driven adaptive learning supports work-related skills development through SDG 8 and helps economic growth, including AI-based employability knowledge and strategy generation; it contributes to SDG 10, reduces educational barriers for emerging-geography students, and ensures personalised knowledge experiences (Opesemowo & Adekomaya, 2024). AI adaptive learning holds promise for future resilience and a green world by supporting climate action. Universities intend to shape a better, sustainable world by reshaping educational systems and integrating environmental education that promotes SDG 13 (Apoki et al., 2022).

Since the 1980s, new technologies have continually emerged in university education (Watty et al., 2016). AI is a widely used tool for developing skills and creating personalised, lifelong learning environments (Kamalov et al., 2023; Kovari, 2025). Technological evolution has a great impact on teaching and learning. In past decades, the integration of new technology into the classroom and curriculum (Barnes et al., 2007; Watty et al., 2016) for sound educational

reasons has been a high-interest area for scholars and policymakers. These shifts in traditional learning systems open new opportunities for educators and students. However, despite this development, few studies have investigated the direct impact of AI on sustainable education. Therefore, our study will investigate the direct impact of AI adoption on education in Bangladeshi universities. This study addresses the challenges university administrations face in implementing AI and identifies the most-used AI tools that help students improve their learning. Data privacy and potential bias in AI-integrated education applications should be maintained to ensure equitable opportunities for all. It explores challenges and benefits, examines personalised learning convenience and administrative efficiency and emphasises green learning practices in curriculum implementation; however, it does not explicitly detail how faculty, students and related stakeholders overcome these challenges and utilise the opportunities. However, the study mentions specific ethical concerns related to integrating AI in transnational higher education contexts (Islam et al., 2024). In this vein, this study examines how AI plays a role in supporting sustainable education, despite its advantages and disadvantages. This overview helps clarify how students currently use AI to support the achievement of the United Nations Sustainable Development Goals.

Nevertheless, the AIHE research landscape has expanded in recent years, reflecting its growing importance as an educational tool. AI for education could be classified into three groups: instructional applications, administrative tasks and tools that boost student engagement (Kamalov et al., 2023). AI-based perceptions such as adaptive learning, customised content and teaching assessment, as well as educational equity, play a decisive role in improving Bangladesh's educational sustainability, but simulated classrooms and administrative burden have been identified as obstacles to achieving it (Sultana & Faruk, 2024). (2024) identified the challenges related to AI use in academic research and suggested AI has a positive impact on higher education. Abu Sayed Sikder, (2023) conducted a study leveraging AI for sustainable socio-economic development in Bangladesh, emphasising AI education to empower Bangladesh's workforce and skill development; this investigation mentioned agriculture, healthcare, finance, education, and governance concerns rather than focusing on general educational sectors. Therefore, the long-term impacts of AIED, especially on faculty, students and related stakeholders, have been less examined. Though Abu Sayed Sikder, (2023) AI education aims to empower Bangladesh's workforce and skill development, including agriculture, healthcare, finance, education, and governance, by leveraging AI for sustainable socio-economic development in Bangladesh.

Aim and Objectives

This paper explores the current use of AI tools to foster sustainable learning in Bangladeshi higher education institutions. Specifically, the study seeks the following objectives:

1. Explore potential AI tools and their applications to promote sustainable learning in BHEIs.
2. Identify the perceived benefits of AI integration.
3. Identify AI-driven sustainable learning barriers, their impacts and recommend strategies for overcoming them.

LITERATURE REVIEW

Artificial intelligence (AI) has gained global acceptance as a means of achieving sustainable education by decongesting, customising learning and relieving faculty from pressure on limited resources. Garzón et al. (2025) highlighted how Artificial Intelligence (AI) is becoming increasingly pervasive in the educational domain. It enables knowledge acquisition and algorithmic decision-making systems. As a subfield of computer science, it enables machines to perform tasks that require human intelligence, such as processing information, learning from experience and making decisions (Abulibdeh et al., 2024; Ertel, 2024; Yan et al., 2024). Sperling et al. (2024) write that AI can deeply change education by changing how teachers teach, students learn, and educators engage in professional development; thus, educators and learners must prepare for an automated future. The literature identifies many barriers to adoption. *(2024) lists several important challenges of the use of AI in education: ethical problems concerning data privacy, algorithmic fairness, maintenance challenges of academic integrity, cost issues or economic obstacles, as well as expensive infrastructure setup of AI.* Tackling these challenges is essential to ensure AI tools are adopted safely, equitably and effectively. These challenges are also pertinent globally; however, the impact of these on higher education in Bangladesh and ways to mitigate them have been relatively under-investigated. Universities have infrastructure shortages, uneven digital access and no formal policies for AI adoption. Filling these gaps is important to adapt AI tools in Bangladeshi higher education and unlock their potential to promote inclusive and sustainable learning. According to (2023), a lack of technological infrastructure, support for internet access and modern computing facilities compounds limitations to sustainable

learning; additionally, AI-related skills hamper students' and educators' digital learning processes.

Further Mahbub et al. (2024) This evidence supports the claim that inequalities in AI awareness, data privacy concerns, educational equity issues, and *cultural preservation* needs collectively hinder sustainable educational improvements. Islam, (2025) said insufficient *training programs* are a notable problem students face when preparing themselves for the future workforce using technology. They also noted incomplete policies and ethical quandaries, creating *governance vulnerabilities that complicate AI* integration. Similarly stated by Wafik et al. (2024) Ethical issues such as data privacy and algorithmic fairness are substantial concerns when implementing AI learning environments.

Administrative, assistant and developer support are essential to support integrated AI learning frameworks, and the demand for remote education also created openings for educators to think outside the box and trial different pedagogical methods with digital platforms and practices. Teachers had learned from experience, reflection and experimentation how to work around the constraints of a higher education system that simply doesn't deliver (Shohel et al., 2025). AI can promote sustainability in education through individualised learning experiences and evidence-based decision-making, but privacy and data protection issues must be considered. Lin et al. (2023) Identifies issues of AI integration in education for Bangladesh, namely teachers' attitudes, the absence of training and the need for *appropriate pedagogy*. These obstacles prevent AI from being effectively embedded in sustainable primary education teacher practices.

ITSs: Different AI systems will support faster learning and knowledge capturing from different sources. Carbonell (1970) noted that Intelligent Tutoring Systems (ITSs), adaptive learning systems and AI-based assessment systems have been found to increase student engagement and decrease dropout rates, which is tied to the sustainability of higher education. Infrastructural constraints are among the most commonly cited challenges. *Unstable Internet, insufficient computer resources and lack of technical support are key challenges that limit organisations from effectively deploying AI-powered systems* (Anwar & Adnan, 2020; Okonkwo & Ade-Ibijola, 2021). Budach et al. (2022) and Horton (2024) show how poor training data quality can cause generative AI models to underperform significantly and cast doubt on their suitability for resource-stressed settings. This is especially concerning in developing worlds, where quality datasets and computational resources are substandard.

Finally, large language models and generative technologies require significant investment in both infrastructure and expertise, which limited resources may find difficult to sustain (Ali et al., 2024). According to (2024), developing countries like India are revolutionising education and overcoming the challenges associated with poor infrastructure and teacher shortages. AI-powered solutions can improve access to education, enhance delivery, encourage creative learning models and spur better performance. Implementing AIOPS in HEIs in developing countries brings personalised education, administrative support and decision-making closer to home. Yet barriers such as data quality limitations, lack of resources and cultural reluctance highlight the need for strategic opportunities and training to support implementation (Funda & Francke, 2024). Ade Nandang Mustafa (2025) noted that AI adoption in education is challenging for developing countries for several reasons, including infrastructure constraints, teacher preparedness and ethical issues. The study highlights the requirement of policy guidelines for responsible and inclusive incorporation of AI into educational systems in these territories. AI applications in education in developing countries are attractive, such as personalised learning and intelligent administration. Nevertheless, issues such as biases, ethical concerns and the need to sustain critical thinking will all require strategic focus and collaboration among different stakeholders. The results reveal the successes of AI in serving individual learning needs, learning styles and learning abilities for students and moving them towards personalised learning paths in all three areas (the United States, China and India) (Bhutoria, 2022).

However, Barriers to AI-based education in developing countries include limited expertise (Hu, 2021), high costs associated with investment required for training data (Bogina et al., 2022), significant technical and data maintenance requirements (Baidoo-Anu & Owusu Ansah, 2023; Sigalov & Nachmias, 2023), and time consumption of user feedback integration processes (Bernius et al., 2022; Gao, 2021) as well as poor levels of personalization and interactivity sustainment concerns surrounding sustainability and privacy issues regarding data use (Kasneci et al., 2023). These difficulties frequently refer that when AI tools are available, their use is inconsistent and less effective. Artificial intelligence is also a potent accelerant of sustainable learning, delivering personalized instruction, school system effectiveness and expanded equity. But to fully unleash its potential, several ethical, environmental and infrastructural hurdles must be overcome. Present research focus on responsible, inclusive and AI energy efficient integration for education systems that genuinely contribute to a sustainable future. Strielkowski et al. (2025) researched to

understand the Trends in adaptive learning and AI research publication reveals that Adaptive learning technologies and AI are transforming education through personalized experiences, innovation, economic growth all towards a sustainable future. According to Albahli, (2025) application of artificial intelligence (AI) to the educational system can revolutionize educational practice and sustainability in education. This paper investigates the development and testing of machine learning (ML) models for predicting student performance, which leverage socio-demographic as well as academic features, with a special focus on behavioral data to improve overall accuracy while encouraging interpretation reveal that AI-based models such as the convolutional neural networks (CNNs) can predict student failure accurately which provides personalized learning strategies or equal opportunities. The CNN models performed better than the conventional ones, with prediction accuracy of 99.97% for all students. However, the authors noted that These results help develop personalized learning approaches, interventions on time and equitable educational practices that result in student retention and overall effectiveness of an institution. The focus of this study is consistent with the aims of sustainability education in prioritizing data-driven methods to improve learning achievement, equity and resource efficiencies. Moreover, the literature reviewed indicates that AI's potential for sustainable learning is significant, in terms of personalization, intelligent tutoring, adaptive assessments and data-supported academic choices all the ways through which it could help the aims we had set out to pinpoint specific areas in Bangladesh university sectors where AI tools are applicable.

Yet the literature also highlights crucial barriers -deficits in technology, lack of digital skills, infrastructural gaps, high costs of adoption, ethical and privacy dilemmas and asymmetries in awareness against which developing countries like Bangladesh are firmly pushed. These challenges constrain the sustainable and responsible incorporation of AI, thereby underscoring the need for strategic capacity development, governance structures and context-specific implementation routes.

METHODOLOGY

Research Design and Sampling

This paper utilised exploratory qualitative research to acquire comprehensive insights into the perceptions, experiences and challenges related to the adoption of Artificial Intelligence (AI) for sustainable learning in HEIs in Bangladesh. Qualitative analysis was chosen as it allows

for probing complex human experiences and contextually specific meanings that may not be revealed through quantitative investigations (Creswell & Poth, 2018).

The research was carried out with different faculty students in public university of Bangladesh from August to November 2025, which reflected good temporal diversity for collecting data as well as having participants. A purposive sample was selected to represent individuals with diversity in their academic qualification, professional experience as well as prior exposure to AI technology so that rich and diverse views pertaining the research question is achieved.

Data Collection

The study applied in-depth interviews (IDI) to deeply understand the participants emotion and insights. Through a combination of individual and interactive, collectively produced views, data were informed using the semi-structured interviews Semi-Structured Interviews. Semi-structured interviews permitted for flexible investigation of personal experiences and perceptions. Interview guides were developed with reference to the conceptual knowledge and literature review, Key thematic areas included benefits and limitations of AI in learning, experience with AI tools and platforms, institutional support and readiness, impact on learning sustainability, suggestions for improvement. All sessions were audio-recorded with participants' consent and verbatim transcribed to ensure data precision and transparency.

Data Analysis Procedures

We thematically analysed the data according to Braun and Clarke's (2006) six-step process. To increase the credibility of the research and methodological rigour, we used several strategies: member checking (providing preliminary results to a sample of participants for verification and further explanation) and peer debriefing with other academic colleagues to minimise researcher bias and enhance interpretative validity. The researcher maintained an audit trail through coding decisions, thematic development and analytical reflections.

Ethical Considerations

The Rajshahi University Education Club Review Board approved the study. Before participation, all participants were assured of confidentiality, anonymity and the right to withdraw from the study without prejudice. The research team securely stored all data in encrypted research databases and used them only for academic purposes.

Table 1: Analysis of Thematic Report

Participant ID (P)	Name Pseudonym /	Age / Age Range	Gender	Role	Institution	Field of Study / Department	Years of Higher Education Experience
P01	Zaman	Not specified	Male	Student	Rajshahi University (RU)	Accounting	4 years
P02	Haque	22	Male	Student	Rajshahi University (RU)	Material Science & Engineering	3 years
P03	Uthso	Not specified	Male	Student	Rajshahi University (RU)	Computer Science and Engineering (CSE)	Not specified
P04	Anina	25	Female	Student	Rajshahi University (RU)	Fine Arts & Crafts	4 years
P05	Jemima	22	Female	Student	Rajshahi University (RU)	Social Work	3 years

Participant Demographics

The study included five students from Rajshahi University (RU), Bangladesh. They were composed of four males (P01, P02, P03,) and one female (P05, P04). The participants were 22–25 years old; three participants had unspecified ages. In terms of academic background, they were majoring in Accounting (P01), Materials Science & Engineering (P02), Computer Science and Engineering (CSE) (P03), Fine Arts & Crafts (P04), and Social Work (P05). All participants had been in higher education for 3 or 4 years, making them either upper-level undergraduates or advanced students who were familiar with the university learning context. Overall, the sample is an adequate mixed-sex group from diverse academic fields, with exposure to post-secondary education, for analysing learning perceptions and experiences related to AI-assisted learning.

AI-as-Multipurpose Academic Assistant

Students use AI tools as adaptive learning companions. AI can help in many areas, from simplifying concepts and summarising texts to assisting with assignments, checking grammar and supporting note-taking and personal growth mentorship. Students can use AI to complete routine and complex academic tasks, serving as an inseparable assistant on the learning path. It showcases the diversity of AI applications in higher education, showing how technology

supplements traditional teaching methods and supports individualised learning. Our respondents said, respectively

“Mostly we use AI when something is too complicated to understand. Any chapter that is long or boring, I request AI to summarize it. – P01

“I use AI if I don’t understand something... I ask AI to provide a summary of it.” – P01

“If there are some lecturers or articles [I] could not understand, I ask AI to explain it in a simpler way.” – P03

“I mainly use AI tools to help me understand topics more, such as those that are confusing.” – P04

AI assists with assignments and academic writing; students and teachers use it for research purposes. Our two respondents mentioned, respectively

“ChatGPT is good with report and writing tasks; Perplexity can do math problems. I also used for my assignment and research” - P02

“I use ChatGPT and DeepSeek to complete my assignments, note making and getting guidance for life planning/ future requirement. P05

Students are not using AI as study aids alone, but also for advice on life, future and skills development, viewing it as a personal trainer for their growth. One respondent stated

“I employ the AI to receive recommendations or suggestions about life goals.” - P05

Students use multiple AI tools based on their academic and personal situation. Their tools include ChatGPT, DeepSeek, Gemini, Claude and Grammarly, used for everything from clarification to rapid research and analysis, or simply writing better. This indicates the resulting flexibility in tool use. But Bangladeshi universities are not aware of these AI factors.

“I usually use free version tools such as ChatGPT, Gemini, Claud, DeepSeek, and QuillBot also.” - P01

“I love ChatGPT for explaining ... Google Gemini for quick research... Grammarly to refine writing mistakes.” - P04

AI Improves Learning Effect and Educational Performance

This theme depicts how students use AI to learn faster, more productively and on their own. Smart AI supports and guides them through the learning process, tailoring sessions to their individual needs, whether they have just started school or are about to graduate.

Faster Learning

AI saves time and speeds comprehension by helping people find information quickly and get answers and examples immediately. Our respondents said, respectively:

AI tools support sustainable learning because it saves a lot of time... instead of spending hours on one topic, I can just get a quick explanation and move on. P 03

They have a positive effect such as completing the answers quickly by assisting with examples not found in textbooks. -P 02

Better Academic Results

There is better quality of homework, correct answers, and improved exam results through the use of AI.

It saves paper work, and also makes us to learn the lesson well. So generally, it makes learning more effective. - P01

Independent Learning and Self-Paced learning

Students can learn independently, follow a flexible schedule, and learn at their own pace without waiting for teachers.

Artificial intelligence means learning is more independent and flexible – I can learn at my own pace, quickly receive personalized responses to complex or simple questions without waiting for class materials or teacher feedback. - P 03

Barriers to Effective AI Adoption

AI integration in organisations or personal workflows is fraught with challenges. These obstacles are technological, human, organisational or ethical. Learning from them helps create stronger strategies for integrating AI in the future. Data accuracy and reliability are closely linked to AI integration. Our respondents stated

Sometimes it gives the wrong answer... like totally wrong sometimes. - P01

AI doesn't always give answers according to my wish or style... unreliable. - P05

Technological Constraints and Inaccessibility

Slow internet, limited devices, poor connectivity, offline predicaments and the high cost of advanced features are major hurdles to wider AI use in Bangladesh's education sector. Our respondents accordingly said

Slow Wi-Fi, limited device access ...makes it harder. - P04

If AI could function without internet (offline use) it would be better. - P05

Institutional support and optimisation are needed

Institutional Barriers are difficulties within schooling systems that hinder the effective implementation of AI. These concerns encompass the fact that AI tools have not been formalised in teaching practice, teachers may not encourage or even ban students from using AI for fear of lower creativity or critical thinking skills, and there is no degree of organised training for students on how to responsibly apply their use of AI. These barriers prevent students from taking advantage of AI-enabled learning. Our two respondents explain their concerns

*Teachers often forbid AI use, considering it harmful to creativity and learning.
- P01*

Teachers discourage using AI because it reduces creativity and thinking capacity. - P05

Privacy and Ethics Concerns include risks and mitigations regarding personal data and responsible AI use. Students are concerned about privacy, misuse of AI for instance, (harassment, for instance AI-morphed content), and fear that AI might decrease creativity or critical thinking. Especially for women, students are more suspicious. These worries emphasise the necessity of clear policies and processes so that ethical, safe and responsible application of AI in education can take place. Our respondents respectively express

AI knows all my information even the password of my email, social media account and personal interest If anything, happen bad, i will completely finish. - P02

AI collects all my information; there is no personal privacy... Policies to stop AI-related harassment, such as AI-morphed blackmail, are needed. - P05

Training and Awareness are described as the guidance, educational programs that help students to effectively work with AI in an accountable manner. As well as training and tutorials for appropriate use of AI, ethical considerations, and approaches to optimize learning results. These efforts give students the tools to take full advantage of AI and prevent its misuse. Respondents mentioned

They should provide proper AI training... support AI officially for students. - P01

Awareness-building about how to use AI, teaching proper usage... Encourage ethical AI use to enhance thinking. - P05

Infrastructure and Tool Access means access to essential technology that supports efficient AI use. This includes adequate internet, access to premium AI tools and resource support at the departmental level – this is required for students to leverage AI-based learning tools. Similarly, two respondents stated:

The university should provide workshops, better internet access and make more AI tools available for students. - P03

Better internet access and access to premium AI tools for students. - P04

Teaching and Learning Integration includes the use of AI tools in classroom activities and academic practices. This includes AI-driven assignments, personalised feedback, and teacher-facilitated use that improve learning results while promoting responsible student use of AI. Our participants address the following:

Teachers should use AI in class... study materials should include AI-based activities. - P01

Faculty awareness programs could encourage ethical and effective student use. - P02

Ethical and Safety Guidelines are guiding principles that support responsible, safe use of AI in education. That includes warding off abuse, protecting privacy and shielding students from risks such as AI-morphed harassment – ensuring that AI tools support learning without violating ethics or leading to harm. Our participants mentioned strongly

Policies to stop AI-related harassment, such as AI-morphed blackmail... are needed. - P05

Discussion and Conclusion

The thematic findings explore AI's usefulness in advancing sustainable learning among university students across diverse fields. Highlights different tools used as multipurpose academic assistance: students simplify complex concepts, refine academic writing, summarise lengthy materials and even pursue mentorship for personal development, which reflects the technological shift as an integrative learning partner in higher education; these behaviours are directly congruent with Vygotskian scaffolding theory (Cai et al., 2025a). Tools like ChatGPT, Grammarly, and others are utilised for various academic tasks (Aguilar

et al., 2025), with ChatGPT being the most popular among students (Vaněček et al., 2025). The proliferating use of ChatGPT, Gemini, Claude, DeepSeek and Quill Bot in higher-education settings illustrates frequent use of these tools, with 70% of undergraduates reporting extensive utilisation of ChatGPT, while demonstrating the performance differences between free and premium AI access (Cahill & McCabe, 2024; Monib et al., 2025). Meanwhile, our respondents demand access to premium tools and administrative support that can accelerate their effectiveness. Although free editions offer basic brainstorming and summarisation support, paid plans provide improved reasoning accuracy, contextual recall and multimodal processing that can affect outcomes on high-stakes academic assignments. This layered pattern of use both confirms student flexibility and describes emerging inequities. Technological constraints, inaccessibility, institutional supports, training and awareness programs are identified as major essentials for broad AI integration and for boosting student performance, as well as ensuring AI-based learning across developed geographies. This evidence supports Cai et al. (2025), who stated that access inequalities are not limited to subscription costs; insufficient infrastructure, restrictive institutional policies and limited AI literacy further limit equitable use. Teacher prohibition of AI use is a major obstacle, as Cahill & McCabe (2024) also note, with 68% of students citing these restrictions as a primary concern. Female students engage with AI activities less than males, often because of privacy concerns, and marginalised and economically disadvantaged learners rely on free-tier tools but have lower confidence in dissecting AI outputs, illustrating disparities in access and competencies. Privacy, misuse of data, and harassment related concerns are especially high for women students in higher education (the female gender is more concerned about ethical risks, data security, biased outcomes or personal information misuse than their male counterparts); this aligns with fears about AI, privacy and ethical standpoints (Asiksoy, 2024; Đerić et al., 2025; Kalim, 2025).

This research concludes that students in Bangladeshi HE use AI tools as multipurpose academic assistants for concept clarification, summarisation, writing and personal skill development. Tools such as ChatGPT, Gemini, DeepSeek, Claude and Grammarly show that personalised, efficient learning solutions are possible. However, Bangladeshi students have limited knowledge of several new AI tools and their usefulness, and many report no access to premium AI tools because of financial constraints. The university does not offer access to premium tools on campus. The results indicate clear advantages: faster understanding, increased student achievement, self-learning at their own pace, and less workload. According

to the students, AI improves learning quality and promotes sustainable learning, in tune with national aims for education sustainability. However, it also revealed several obstacles. Students encounter flaky AI outputs, fragile digital infrastructure, limited access to devices and premium tools, and a lack of institutional endorsement. Ethical considerations, particularly privacy risks and AI-driven harassment, also hamper safe integration. Resistance from teachers and lack of training also hinder integration. Students touched on the importance of AI literacy initiatives, ethical guidelines and structured classroom adoption. Overall, these thematic analyses indicate that although AI has significant potential for sustainable learning in Bangladesh, its success depends on responsible implementation, improved infrastructure, institutional readiness and a clear policy framework. Strengthening these will empower higher education institutions to harness AI more responsibly and sustainably while delivering students' long-term learning outcomes.

Implications for policies

The paper notes that AI is a multifunctional academic assistant that can improve learning efficiency, assignment quality, self-paced study, and personal development. For educators, the results highlight the need to integrate AI into pedagogy and research practices, offer scaffolded instruction, and design assignments that balance AI support with problem-solving. AI literacy training will ensure that students can evaluate these outputs critically, use tools strategically and work ethically while minimising the risks of privacy violations and misuse. At the policy level, institutions and national authorities need to ensure fair access to AI tools, reliable infrastructure and ethical protections, while faculty development and student training programs will help ensure AI-adaptive education works at its best. At the global level, best-practice sharing, cross-sector collaborations to promote AI literacy and open resources can increase responsible, inclusive and effective AI adoption across higher education systems while mitigating disparities and improving sustainable learning outcomes globally.

Limitations

Despite the study's valuable insights into AI adoption in Bangladeshi higher education, several limitations warrant attention. Student experiences may not fully capture faculty or administrative insights, which are essential for understanding institutional AI adoption. The results are also country-specific and may not apply to other countries or education systems.

Finally, rapidly evolving AI tools and individual experiences mean some observations on capabilities and challenges may become obsolete as technology progresses.

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APPENDIX

Participant	New Insights / Codes	Saturation Status
P01	Initial patterns emerge: AI for assignments, explanations, notes; benefits, barriers, recommendations	No saturation yet; first interview sets the baseline
P02	Reinforces same patterns; adds minor insight on AI helping English learning	Emerging saturation; most codes overlap with P01
P03	Adds sustainability perspective: AI reduces paper use and travel;	Themes largely repeated; saturation approaching

	reinforces independence and speed	
P04	Confirms patterns from previous participants; minor variations on organization, consistency	No new major theme; saturation increasingly evident
P05	Adds minor unique codes: life-goal planning, offline AI, privacy concerns, AI-morphed harassment	Saturation mostly reached; no major new theme emerges; only refinements of subthemes