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Students' Engagement with Generative AI in Higher Education: A Mixed-Methods Study

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Abstract

Generative AI (GenAI) is reshaping tertiary education by facilitating personalized learning, enhancing engagement and improving academic outcomes. However, it simultaneously raises ethical concerns regarding data privacy, academic integrity, and prospective erosion of teacher-student interaction. This study examines students' engagement toward GenAI in higher education through a mixed-methods case study at the Institute of Education and Research (IER), University of Dhaka, involving a survey (N=166) and focus group discussions (n=18). Findings reveal a state of informed ambivalence: students consistently use GenAI for complex academic tasks yet acutely perceive a productivity-skill trade-off, weighing immediate efficiency against long-term erosion of critical thinking, creativity, and independent problem-solving. This ambivalence is conditioned by infrastructural constraints, policy ambiguities and pedagogical traditions configuring a distinctive adoption context where functional reliance precedes philosophical acceptance. Theoretically, this study extends the Technology Acceptance Model (TAM) by incorporating "Concerns" as a moderating construct and identifying a "productivity-skill trade-off" as an evaluative dimension influencing attitudes and behavioral intention. This study provides a policy-relevant case from the Global South and insights on the need for guided and context-sensitive integration of GenAI in higher education, contributing to the broader discourse on bridging the gap between current reality and transformative ambition

Keywords: *Generative AI, Tertiary Education, Student Engagement, AI in Education.*

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1. Introduction

Generative artificial intelligence (GenAI) is rapidly shaping pedagogical practices by supporting personalized learning, strengthening teacher–student interactions and enhancing student engagement and academic performance (Zhang et al., 2024; Ifenthaler et al., 2024). While previous educational technologies mainly supplemented existing pedagogical practices, modern GenAI tools such as ChatGPT, Gemini, DeepSeek, Grok and Claude assist in multidimensional cognitive tasks, including content generation, problem-solving, brainstorming, research, summarization, personalized feedback, and critical evaluation of arguments (Jayavardhini et al., 2024; Segura Altamirano et al., 2026; Ejjami, 2024; Vallis et al., 2024; Zhang et al., 2024). This shift has created a state of 'pedagogical flux', challenging conventional understandings of learning, originality, and the respective roles of teachers and students (Chan & Hu, 2023). However, increasing integrity concerns, information privacy, algorithmic bias, and students' dependence on AI-generated content are accompanied by educational advantages of AI (Holmes et al., 2019; Akgün & Greenhow, 2022; Hutson, 2024; Eager, 2023; Altinay et al., 2024). Collectively, these developments raise critical questions about whether GenAI enhances learning or merely improves academic efficiency at the expense of deeper cognitive engagement.

While research on AI in education has grown rapidly, non-Western contexts have been overlooked, resulting in a "AI generation gap". Consequently, the unique experiences, engagements and challenges of the students in Global South remain underrepresented. In Bangladesh, the integration of AI in improving learning is shaped by infrastructural constraints, policy ambiguities, conventional pedagogical practices that emphasize teacher-centric and examination-oriented learning (Begum, 2025; Jamila & Zubairi, 2022). Similar contextual challenges have been reported in other Global South settings, where inadequate digital infrastructure, institutional capacity limitations, digital proficiency challenges, and financial constraints continue to influence the adoption of GenAI in teaching and learning (Danquah et al., 2024; Zondi et al., 2024; Owusu-Ansah et al., 2025). These conditions create a unique adoption context in which the potential advantages of GenAI may be particularly valuable, while barriers including western-centric training data, limited digital literacy, and contextual challenges may be more pronounced (Chan & Hu, 2023; UNESCO, 2023). Despite these contextual realities, evidence remains limited emphasizing how Bangladeshi tertiary students perceive and negotiate the opportunities and challenges of GenAI.

Against this backdrop, the present study investigates tertiary students' perception, engagement and challenges of using GenAI in learning. This study was situated within

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the framework of the National Education Policy 2010 of Bangladesh, which emphasizes learning autonomy, development of higher order thinking (analysis, synthesis, creativity and critical thinking), and teacher facilitation. Rather than viewing AI adoption solely through the lens of technological acceptance, the study investigates the negotiation of students with the educational benefits of GenAI alongside concerns related to privacy, ethics, and higher-order cognitive development. In doing so, it contributes to the growing literature on AI in education by proposing the concepts of productivity-skill trade-off and informed ambivalence to explain how students balance immediate academic efficiency with longer-term learning and intellectual development. These insights provide a contextually grounded perspective on GenAI adoption in the Global South and offer implications for the responsible integration of AI into higher education.

1.1 Research Questions

This study addresses the following research questions:

1. How do the students perceive the role of GenAI in tertiary education?
2. How do the students use GenAI in tertiary education?
3. What concerns do the students have regarding the use of GenAI in tertiary education?

2. Review of Related Literature

2.1 The Evolution of AI and GenAI in Education

The term "Artificial Intelligence" has been used since 1956 (Cristianini, 2016; Hamet & Tremblay, 2017), though its definition has evolved with technological advancements (Crompton & Burke, 2023). Currently, AI refers to technologies or systems that can engage in problem-solving, data analysis, interpreting, synthesizing, and self-learning like human beings (Chan & Tsi, 2024; Popenici et. al., 2017). Generative AI (GenAI) differs from traditional AI by generating original content, including text, images, and code, in response to various complex prompts rather than merely analyzing existing data (Chan & Hu, 2023; Lim et. al., 2023; Peres et al., 2023).

GenAI has gained considerable popularity because of its multifaceted educational benefits. Studies consistently show that it supports personalizing learning, adaptive feedback, academic writing and research, learner motivation, and language and problem-solving development (Bahroun et al., 2023; Brynjolfsson & McAfee, 2014; Holmes et al., 2019; Michel-Villarreal et al., 2023; Nikolopoulou et al., 2024; Segura Altamirano et

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al., 2026; Lye & Lim, 2024; Ejjami, 2024; Ba et al., 2025; Zhang et al., 2024). Collectively, these capabilities position GenAI as an interactive learning partner rather than merely an instructional technology.

2.2 Theorizing the Productivity-Skill Trade-off in AI-Assisted Learning

Previous studies point to a fundamental concern in AI-assisted learning: the trade-off between short-term productivity gains and long-term cognitive development. While GenAI tools enhance efficiency in task completion, content generation, and information retrieval (Michel-Villarreal et al., 2023; Lye & Lim, 2024), they also raise concerns regarding overreliance, diminished critical thinking, creativity, and independent problem-solving alongside unequal access across contexts (Aghaee et al., 2024; Shishavan, 2024).

This study conceptualizes the productivity-skill trade-off as a reflection of competing epistemological perspectives on learning in AI-mediated environments. From a cognitive learning perspective, effective learning involves effortful processing and internalization of knowledge structures (Sweller, 1988), implying that outsourcing cognitive tasks to AI might hinder in-depth understanding. By contrast, if learning is perceived as the capacity to efficiently cooperate with intelligent systems, the trade-off shifts: rather than skill erosion, what emerges is skill transformation, in which new forms of human-AI collaboration become educationally relevant (Luckin et al., 2016; Kasneci et al., 2023).

2.3 Concerns and Ethical Challenges

Technological developments rais ethical issues including data security, privacy, as well as the possible replacement of human educators (Selwyn, 2019). Primary concerns include academic integrity, as students may utilize AI-generated content without intellectual and reflective engagement (Hutson, 2024; Eager, 2023). Additionally, AI-generated information can be inaccurate and biased (Lodge et al., 2023; Bower et al., 2024), emphasizing the need for AI-resistant tasks that promote critical thinking (Shishavan, 2024).

Furthermore, AI solutions heavily depend on vast user data, raising security and confidentiality issues for users (Altinay et al., 2024; Akgün & Greenhow, 2022). The acquisition, handling, and retention of user data by AI systems require the safeguarding of student confidentiality (Altinay et al., 2024; Akgün & Greenhow, 2022; Baskara,

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2023). Moreover, biased algorithms may reinforce unequal learning experiences, particularly for marginalized groups, underscoring the need for transparent and accountable AI systems (Seo et al., 2021; Jobin & Ienca, 2019; Al-Zahrani et al., 2024).

The absence of standardized policies governing AI use limits the development of effective institutional (Atkinson-Toal & Guo, 2024; Batista et al., 2024; Lodge et al., 2023). Furthermore, concerns regarding excessive GenAI continue to raise questions about students' critical thinking, creativity and problem-solving abilities (Aghaee et al., 2024). While AI presents considerable potential for personalized learning experiences, and improved academic performance, many scholars argue that concerns over the potential decline of teacher-student interactions are becoming more frequent (Selwyn, 2019.)

2.4 The Ambition for AI in Education

Beyond the current applications AI, it is increasingly viewed as a catalyst for educational transformation. Emerging developments include adaptive learning systems, AI-enhanced virtual mentors, and immersive AI-enabled learning environments that respond dynamically to learners' needs (Jayavardhini et al., 2024; Ahmad et al., 2023; Ejjami, 2024). Within the Education 5.0 paradigm, AI is positioned as an enabler of personalized, adaptive, and experiential learning while redefining educators' competencies (Ahmad et al., 2023). Nevertheless, addressing issues of equity, pedagogical appropriateness, and contextual feasibility, particularly in resource-constrained settings, is necessary for achieving this vision.

2.5 Global South Perspectives on AI in Education

Global South presents distinctive conditions for GenAI adoption that are often overlooked in the predominantly Western literature on AI in education. GenAI adoption in the Global South is shaped by institutional capacity, sociocultural contexts, and infrastructure limitations, in contrast to many Western technology adoption models that mainly explain adoption in terms of users' willingness to accept new technologies. Evidence from Ghana, South Africa and India shows a consistent pattern of positive perceptions of GenAI coexist with concerns over academic integrity and a range of infrastructural, technical, institutional and financial barriers to its adoption (Zondi et al., 2024; Danquah et al., 2024; Adjei & Agyeman, 2024; Owusu-Ansah et al., 2025). Collectively, these studies suggest that GenAI adoption in the Global South is shaped by perceptions of the technology, as well as the institutional, infrastructural, and socio-cultural contexts within which it is implemented.

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Bangladesh reflects many of these contextual challenges. Although technology integration to enhance learning is a national educational policy priority, its implementation is hindered by persistent infrastructural constraints, inadequate teacher training, limited digital literacy, and resource limitations (Begum, 2025; Jamila & Zubairi, 2022). GenAI adoption in tertiary education in Bangladesh is therefore likely to be influenced by these broader systemic challenges rather than by individual perceptions alone.

2.6 Theoretical Framework

This study draws its theoretical basis from Davis's (1989) Technology Acceptance Model (TAM). The model is considered appropriate for examining users' perception of new technology. According to the model, an individual's attitude toward technology is based on two perceptions: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of the technology (Davis, 1989; Venkatesh et al., 2003).

In the present study, PU refers to Students' perception of GenAI as a tool to enhance academic performance, research support, and access to information. PEOU reflects the extent to which students perceive GenAI tools as easy to use for academic purposes. Together, these perceptions influence students' attitudes toward GenAI and their intention to incorporate it into academic practice.

Although the Technology Acceptance Model (TAM) offers a robust framework, its shortcomings become apparent in educational settings where social, ethical, and cognitive aspects substantially influence technology use. Previous research has therefore extended TAM by adding contrasts such as trust (Gefen et al., 2003), social impact (Venkatesh et al., 2003), and perceived risk and ethical considerations (Pavlou, 2003). However, the integration of GenAI in higher education introduces additional complexities that extend beyond these extensions.

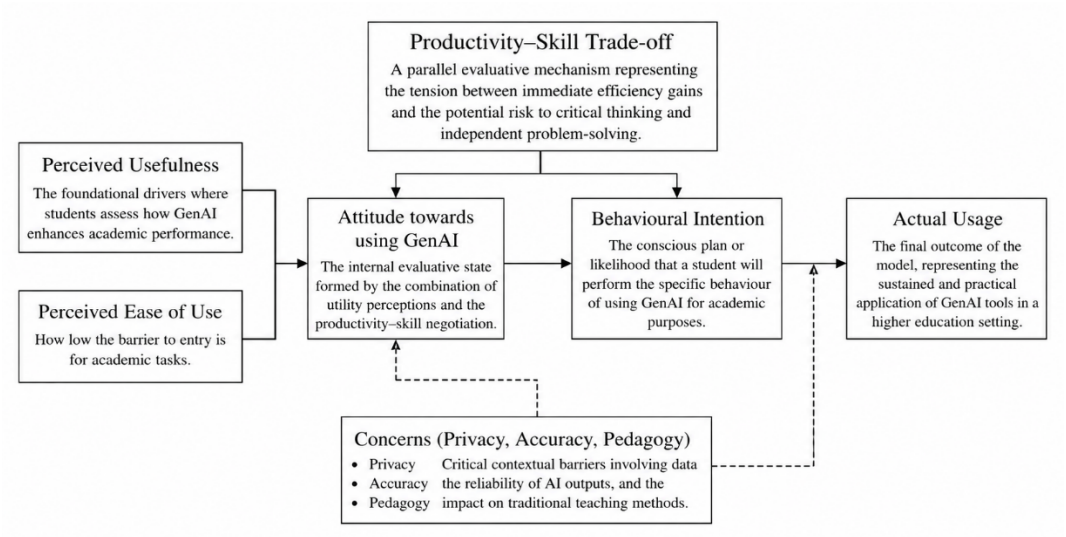
The present study extends TAM in three ways. First, it views the concerns as moderating factors which influence the interconnection among attitudes, behavioral intentions and actual use rather than viewing concerns as merely obstacles to technology adoption. Second, it incorporates the productivity-skill trade-off as an additional assessment mechanism that captures the balance between short-term efficiency gains with long-term cognitive growth and how this balance shapes the students' attitudes and behavioral intents. Third, it situates these theoretical extensions within the Global South context, recognizing that technology adoption is shaped not only by individual

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perceptions but also by broader systemic challenges such as infrastructural constraints, institutional capacity, and socio-cultural contexts.

As illustrated in Figure 1, the framework follows the core TAM structure, whereby Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) shape students' attitudes, behavioral intention and actual use. However, these relationships are moderated by students concerns regarding GenAI, while the productivity-skill trade-off operates as a parallel evaluative mechanism, reflecting students' ongoing negotiation between short-term efficiency and long-term cognitive development.

Figure 1
Improvised Adaptation of TAM Framework



3. Methodology

This study employed a convergent mixed-methods case study to investigate students' attitudes toward the use of generative artificial intelligence (GenAI) in tertiary education. Employing a convergent mixed-methods design (Creswell & Plano Clark, 2018), quantitative and qualitative data were collected concurrently, analyzed separately, and then integrated to identify convergence, divergence, and complementarity. This approach allowed for an exploration of the phenomenon under consideration in its real-world setting (Yin, 2018) and for obtaining comprehensive information from different sources (Creswell & Poth, 2018).

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3.1 Participants and Sampling

Participants were undergraduate and postgraduate students at the Institute of Education and Research (IER), University of Dhaka. Quantitative data was collected through an online survey, whereas qualitative data were obtained through Focus Group Discussions (FGDs). The survey was distributed via email and social media platforms using a convenience sampling approach from 2 to 25 February 2025. The survey employed broad participant recruitment to capture diverse student perspectives (Bell, 2010), yielding 166 valid responses from 300 students, with a response rate of 55.3%. Subsequently, 18 students were purposively selected to participate in three FGDs with six participants per group. The FGDs included both undergraduate and postgraduate students. The FGDs were conducted online via Zoom during the same data-collection period. Table 1 presents the characteristics of the survey and FGD participants.

Table 1
Participant Characteristics

Characteristics	Survey (n=166)	FGD (n=18)
Gender	Male= 76 (45.8%) Female= 90 (54.2%)	Male= 9 (50%) Female= 9 (50%)
Age	20-24 years	20-24 years
Academic level	Undergraduate and Postgraduate	Undergraduate and Postgraduate
Discipline	Institute of Education and Research, University of Dhaka	Institute of Education and Research, University of Dhaka
Year of study	Mixed years of study	Mixed years of study

3.2 Data Collection Instruments

3.2.1 Survey Questionnaire: The survey questionnaire consisted of two parts. The first part collected participants' demographic and academic data, such as gender, age, academic level, and discipline/department. The second part consisted of 24 items divided into three sections: (a) perceptions of GenAI (11 items); (b) usage of GenAI (4 items); and (c) concerns regarding GenAI (9 items). The items were developed based on the literature review and adapted to the local context, employing a 4-point forced-choice

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Likert scale (Strongly Agree = +2, Agree = +1, Disagree = -1, Strongly Disagree = -2). The exclusion of a neutral option was intended to minimize central tendency bias and encourage respondents to express either agreement or disagreement (Garland, 1991; Tourangeau et al., 2000; Kulas & Stachowski, 2009; Revilla & Ochoa, 2020; Weijters, et. al., 2010).

3.2.2 Focus Group Discussions: The Focus Group Discussions (FGD) followed a semi-structured protocol organized around three themes: (a) experiences with and perceptions of GenAI tools; (b) usage patterns and purposes; and (c) concerns and future expectations regarding AI in education. FGD sessions were audio-recorded, transcribed verbatim, and translated into English prior to analysis. This approach facilitated an in-depth exploration of students' collective experiences and perspectives regarding the use of GenAI in tertiary education (Krueger & Casey, 2015).

3.3 Data Analysis

3.3.1 Quantitative Analysis: The survey data were analyzed using descriptive statistics (mean, standard deviation) to identify patterns of agreement and variability. Standard Deviation (SD) values were categorized as: < 0.60= Strong consensus; 0.60–0.90= Moderate consensus; 0.90–1.20= Noticeable variability; 1.20–1.40= High variability / divided tendency; and 1.40= Strong polarization. Because negatively worded items were not reverse-coded, findings were interpreted at the individual item level rather than as a composite attitude score.

3.3.2 Qualitative Analysis: Qualitative data were analyzed using Braun and Clarke's (2006) six-phase approach: (a) familiarization with the data; (b) generating initial codes; (c) searching for themes; (d) reviewing themes; (e) defining and naming themes; and (f) producing the report.

3.3.3 Data Integration: Quantitative and qualitative findings were integrated following the convergent mixed-methods approach (Creswell & Plano Clark, 2018). The two datasets were compared to identify convergence, divergence, and complementarity, thereby strengthening the interpretation of findings through methodological triangulation.

3.4 Ethical Considerations

Informed consent was obtained electronically from all participants, and participation was voluntary, with the right to withdraw at any stage. Anonymity and

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confidentiality were maintained. Data were password-protected with access limited to researchers. The study posed no physical or psychological risks to the participants and ethical principles have been followed throughout the data collection and reporting process.

4. Findings

This section presents the findings from both the survey and focus group discussions organized according to the three research questions. Within each section, quantitative and qualitative findings are presented side-by-side, with interpretive commentary that highlights the key insights emerging from the data.

4.1 Perception of GenAI

Eleven statements regarding different aspects of using GenAI have been formulated to record the level of agreement and disagreement of the students, so that their perception can be outlined. Table 2 represents the findings from the survey regarding students' perception.

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Table 2
Perception of Students Regarding GenAI

Statements	Strongly Agree (+2)	Agree (+1)	Disagree (-1)	Strongly Disagree (-2)	Std	Mean
AI significantly improves the overall quality of education in universities	24	105	26	11	1.113	0.633
GenAI offers a personalized learning experience that adapts to individual needs	40	109	10	7	0.928	0.994
AI will be an integral part of tertiary education in the near future	87	65	8	6	0.970	1.319
GenAI is capable of offering tailored learning experiences that better suit my academic needs	30	107	26	3	0.967	0.813
AI based tools help in research tasks, such as literature review or data analysis	56	88	17	5	1.008	1.042
GenAI based tools have improved my academic performance by offering personalized support	27	99	30	10	1.133	0.621
AI powered systems make it easier to access academic resources and materials online	49	100	12	5	0.923	1.060
The use of GenAI in education could help democratize access to quality learning resources globally	36	104	21	5	0.988	0.873
GenAI will create new opportunities for more flexible, remote learning experiences	49	99	14	4	0.920	1.054
In the future, GenAI will be able to replace most traditional educational methods, such as face-to-face teaching	23	72	47	24	1.353	0.139
AI-based tools help students work more efficiently, allowing them to spend more time on critical thinking and creativity	31	67	52	16	1.333	0.271

The results indicate an overall positive orientation toward GenAI among the participants (Table 1), although agreement varied across different aspects of AI use. Most respondents agreed that AI enhances educational quality, supports personalized learning, facilitates research activities, and will play an important role in future education. AI-based tools were also seen as highly beneficial for accessing academic resources. However, the standard deviation for educational quality (1.113) suggests despite overall agreement, participants' views were not uniformly shared.

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These findings were consistent with the focus group discussions, in which participants described GenAI as a useful tool for providing personalized learning experience. One participant explained, *"Though GenAI didn't give me a personalized answer at the beginning, but when I used proper prompts, it gave me a proper personalized answer with relevant examples."*

Although respondents mostly held positive perceptions, there was skepticism about AI replacing the traditional teaching-learning methods. The statement relating to replacement of traditional teaching-learning methods recorded the lowest mean score (M = 0.139) and the highest standard deviations (SD = 1.353), with 95 respondents agreeing (23 strongly agree; 72 agree) and 71 disagreeing (47 disagree; 24 strongly disagree). These findings suggest that although students recognize the educational value of GenAI, they remain uncertain about its role in replacing face-to-face teaching, contextual instruction, and classroom interaction.

The qualitative findings echoed these concerns. Participants from FGDs consistently opined that GenAI should be used "*side-by-side with the traditional method*" to complement rather than replace teachers. As one participant stated:

> *AI gives content from collected sources. It can't change the constant concepts but can make it more understandable, modified, well explained. So, I think, this will aid the traditional teaching-learning methods by making learning more convenient and helping the teachers but won't replace the teacher or face-to-face teaching-learning.*

Participants also expressed mixed perceptions regarding the influence of GenAI on critical thinking and creativity. Survey responses were almost evenly divided, with 98 respondents agreeing (31 strongly agree; 67 agree) and 68 disagreeing (52 disagree; 16 strongly disagree), resulting in a relatively high standard deviation (SD = 1.333). This variability indicates considerable differences in students' views regarding whether GenAI enhances or limits higher-order thinking.

The qualitative findings provided additional insights to these concerns, as most of the respondents believed that excessive reliance on GenAI could reduce opportunities to develop critical thinking, creativity, and independent problem-solving. One of the respondents described feeling uncomfortable after using GenAI to get instant solutions: "*I shouldn't have done that [use GenAI to generate a lesson plan]. It was not right. But I needed the work done instantly and I could not think clearly at that time*."

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Overall, while results indicated a positive perception of incorporating GenAI in education, certain aspects, for instance the transformation of conventional teaching approaches, over-reliance on AI on innovation, creativity, problem-solving skills, critical thinking, emotional intelligence, etc., are still debatable.

4.2 Use of GenAI

Four survey items examined students' use of GenAI for academic purposes. The quantitative findings are summarized in Table 3.

Table 3
Students' Overall Use of GenAI

Statements	Strongly Agree (+2)	Agree (+1)	Disagree (-1)	Strongly Disagree (-2)	Std	Mean
I actively use different GenAI tools in my academic work	44	91	24	7	1.095	0.849
I use AI-based learning platforms to understand difficult concepts or topics more easily	65	80	14	7	1.049	1.096
I use GenAI technologies to assist with writing assignments or improving my writing skills	46	85	24	11	1.186	0.789
I use GenAI to identify my academic barriers and to get personalized support	33	103	25	5	1.017	0.807

Survey findings demonstrate that GenAI has become widely integrated into students' academic activities, particularly in cognitively demanding tasks. The highest mean score (M = 1.096) was recorded for using AI to understand difficult concepts, suggesting that GenAI is primarily used to support learning and comprehension. In addition to the survey, the respondents from the FGD highlighted the use of GenAI to improve academic writing, personalized learning support, and identifying learning barriers, although these activities received relatively low mean scores (M = 0.789 and M = 0.807). The standard deviation for (SD= 1.017) using GenAI in identifying academic barriers indicated noticeable variability in responses, possibly reflecting differences among the participants' familiarity or trust in GenAI tools for analyzing academic barriers and providing personalized assistance.

Focus group participants highlighted the use of GenAI for a wide range of academic activities, including understanding theoretical concepts, brainstorming ideas,

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lesson planning, assignment preparation, academic writing, curriculum vitae preparation, statement of purpose writing, debate preparation, and cross-checking information. Participants also valued the immediate feedback and personalized support provided by these tools.

Although most participants expressed strong support for continued use of GenAI in future academic work because of its convenience and efficiency, some highlighted the need for institutional guidelines to ensure responsible academic use. Overall, both datasets indicate that GenAI has become an important component of students' academic practices, particularly for supporting learning, research, and academic productivity.

4.3 Concerns regarding the use of GenAI

Students' concerns regarding the use of GenAI were examined using nine survey items. The results are presented in Table 4.

Table 4
Concerns of Students Regarding the Use of GenAI

Statements	Strongly Agree (+2)	Agree (+1)	Disagree (-1)	Strongly Disagree (-2)	Std	Mean
AI-generated information and output can be inaccurate	53	93	14	6	0.990	1.042
Using AI in education can raise data breaching and misuse of personal information	38	99	22	7	1.055	0.838
AI leads to the loss of personal interaction between students and teachers, which is essential for learning	37	84	35	10	1.210	0.620
GenAI encourages students to engage in academic dishonesty (e.g., plagiarism, cheating)	54	80	27	5	1.113	0.910
GenAI technologies hinder development of generic or transferable skills such as teamwork, problem solving and leadership	43	77	37	9	1.231	0.650
AI leads to an invasion of privacy through surveillance and tracking	29	101	29	7	1.078	0.699
GenAI in education should be carefully regulated to ensure it does not infringe on students' privacy or rights	68	80	13	5	0.984	1.163
Using GenAI technologies to complete assignments undermines the value of university education	36	87	30	13	1.225	0.620
GenAI has a limitation in context based complex problem solving	50	95	14	7	1.009	1.006

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Although participants generally viewed GenAI positively, both the survey and FGDs revealed several concerns regarding its educational use. The highest level of agreement was recorded for the need to regulate GenAI to protect students' privacy and rights (M = 1.163). Most respondents (148 out of 166; 68 strongly agree and 80 agree) supported stronger regulation. Responses also indicated concerns regarding inaccurate information, data privacy, academic dishonesty, reduced teacher-student interaction, and the possible effects of excessive dependence GenAI.

Considerable variability was observed for several items, including GenAI's ability to solve context-specific problems (SD = 1.009), its influence on the achievement of 21st century skills (SD = 1.231), the perceived impact of AI-generated assignments (SD = 1.225) and reduced teacher-student interaction (SD = 1.210). These findings indicate that students' concerns are shared but vary in intensity across different issues.

The FGDs reinforced these findings. Participants most frequently discussed inaccuracies in AI-generated information, privacy and security risks, and limitations in responding to context-specific questions. One of the respondents stated, "*GenAI collects data from numerous websites and still can't categorize the information properly. Sometimes these GenAI tools fail to differentiate among various ideas or contents and provide very generic answers to my specific context-based query*". Another respondent added, "*It's very common for ChatGPT or Gemini to not get what I am actually looking for and so they provide wrong and somewhat funny answers.*" Respondents also remarked that they had to change prompts several times to get what they really want from GenAI as these tools "*fail to understand context properly*" and "*can't relate the output with context norms and values*."

Besides providing inaccurate information, respondents further expressed concerns that excessive dependence on GenAI could reduce critical thinking, creativity, and independent problem-solving while increasing opportunities for academic dishonesty. Consequently, many argued that proper regulations and guidelines are necessary to support the responsible utilization of GenAI in higher education.

On the concern of privacy and security breach, the qualitative data provided more diverse responses. While many felt *uncomfortable* about the collection and use of personal data, others expressed little concern. One participant stated:

> "*I don't mind if it [GenAI] is using my information if it is providing me with customized and personalized results according to my search history. I am no celebrity and I don't have any secrets that the GenAI can reveal.*"

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Another participant believed that using premium versions of GenAI tools would adequately protect personal information. Overall, both the survey and FGDs indicate that students recognize the substantial educational value of GenAI while simultaneously expressing concerns regarding privacy, information accuracy, academic integrity, and excessive dependence. These findings suggest that students' support for GenAI is accompanied by expectations for responsible use and appropriate institutional regulation.

Table 5
Integrated Mixed-Methods Findings in Relation to the Extended Technology Acceptance Model

Extended TAM Construct	Survey (Quantitative)	FGDs (Qualitative)	Integrated Interpretation
Perceived Usefulness (PU)	High agreement that GenAI improves learning, research, and access to academic resources.	GenAI was valued for concept clarification, idea generation, writing support, and personalised explanations.	GenAI is perceived as a useful academic learning partner.
Perceived Ease of Use (PEOU)	Frequent use across academic tasks, particularly for understanding complex concepts.	Students highlighted rapid feedback, accessibility, and ease of prompting.	Ease of use supports widespread academic adoption.
Concerns (Moderator)	Concerns centred on privacy, accuracy, academic integrity, and regulation, with moderate variability.	Participants reported hallucinations, privacy risks, contextual inaccuracies, and overdependence.	Ethical and trust-related concerns moderate technology acceptance.
Productivity-Skill Trade-off	Mixed views on critical thinking and teacher replacement.	Students valued efficiency but worried about reduced creativity, critical thinking, and independence.	Students balance productivity gains against long-term cognitive development.
Overall Engagement	Positive perceptions and widespread use despite concerns.	Participants favoured AI as a complement-not a replacement-for teachers.	GenAI is accepted conditionally rather than uncritically.

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Table 5 integrates the quantitative and qualitative findings according to the extended TAM framework, illustrating how the two datasets converge to explain students' engagement toward GenAI.

5. Discussion

The findings demonstrate that tertiary students in Bangladesh usually hold positive attitudes toward the use of generative artificial intelligence (GenAI); nevertheless, this acceptance is conditional. While participants acknowledged GenAI as a useful academic partner that improves learning quality, facilitates research, and supports personalized learning, they also expressed concerns about privacy, academic integrity, critical thinking, and trust. These results imply that students constantly weigh the educational advantages of GenAI against its perceived ethical, cognitive, and contextual hazards rather than showing a simple process of technology acceptance. Multiple research strands have established that artificial intelligence supports complex cognitive processes, including problem-solving, data analysis, adaptive learning (Cristianini, 2016; Hamet & Tremblay, 2017), as well as enhances human reasoning and enables personalized learning pathways (Chan & Tsi, 2024; Popenici et al., 2017).

Furthermore, the study revealed that GenAI has become functionally integrated into students' academic practices. Participants reported utilizing GenAI to comprehend complex concepts, brainstorming, problem solving, support research activities, organize ideas, and complete academic tasks more efficiently, corresponding with previous studies highlighting the increasing integration of GenAI as a cognitive partner (Michel-Villarreal et al., 2023; Lye & Lim, 2024; Lo, 2023). However, persistent concerns regarding information accuracy, contextual relevance privacy, and academic integrity coexisted with these perceived advantages. This combination suggests that students adopt GenAI pragmatically, recognizing its usefulness while remaining aware of its limitations.

One of the key insights emerging from this study is the identification of a productivity-skill trade-off. Participants valued the immediate efficiency, accessibility and convenience offered by GenAI, particularly in tasks requiring quick comprehension or output generation. However, many questioned whether continued reliance on these tools could weaken critical thinking, creativity, and independent problem-solving. Similar concerns have also surfaced in current literature highlighting the potential harm of GenAI in higher-order thinking and learner autonomy (Kasneci et al., 2023; Tlili et al., 2023). The present study moves beyond identifying this tension by conceptualizing it as a productivity-skill trade-off which encompasses the continuous conflict that students

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face between immediate academic productivity and longer-term intellectual development. Such concerns are not fully explained by traditional technology adoption models, indicating a gap in existing theoretical frameworks. The findings suggest that cognitive and ethical considerations are integral to students' decisions about how and when to engage with GenAI, pointing to the need for more contextually sensitive perspectives on educational technology adoption.

The findings also contribute to theory by extending the Technology Acceptance Model (TAM). Although most students perceived GenAI as practical and simple to use, their attitudes toward adoption could not be explained by these impressions alone. Concerns regarding data privacy concerns, information accuracy, contextual relevance, academic integrity, and responsible AI use consistently influenced how participants translated positive perceptions into sustained acceptance. The qualitative results further revealed misconceptions about data privacy, particularly the belief that premium versions of AI tools may offer better user data protection. These misconceptions point to significant gaps in students' digital literacy and demonstrate that trust-related issues are integral to technology acceptance in educational contexts. The findings suggest that applications of TAM in educational settings should incorporate ethical and trust-related dimensions alongside perceived usefulness and perceived ease of use to offer a more comprehensive explanation of GenAI adoption in higher education.

Despite recognizing the capabilities of GenAI in supporting learning, the participants consistently resisted the notion of replacing human educators. Instead, teachers were viewed as indispensable for providing emotional support, contextual understanding, mentorship, meaningful human interaction and professional judgement. This aligns with previous claims that AI should complement rather than substitute human teaching (Selwyn, 2019; Holmes et al., 2019). Together, these findings advocate for a complementary model of AI integration in which GenAI enhances educational processes while preserving the central pedagogical role of teachers.

Finally, the Bangladeshi context adds another layer of interpretation to these findings. Persistent challenges related to digital literacy, policy ambiguity, infrastructural deficiencies, and ethical awareness influence students' perception and usage of GenAI. These contextual influences suggest that adoption in Global South settings cannot be adequately explained through technological characteristics alone but must also account for institutional capacity, educational traditions, and broader socio-cultural conditions.

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Overall, this study proposes that students' engagement with GenAI is characterized by a state of informed ambivalence- a condition where learners simultaneously recognize the substantial educational usefulness of GenAI while remaining critically aware of its ethical, cognitive, and practical limitations. GenAI adoption among Bangladeshi tertiary students emerged as a negotiated process shaped by the interaction of technological affordances, educational values, individual judgement, and contextual realities. By conceptualizing concerns as contextual influences on technology acceptance, introducing the productivity-skill trade-off as a complementary explanatory construct, and interpreting these findings through a Global South perspective, this study extends existing evidence of GenAI adoption in higher education and offers a more contextually grounded explanation of how students engage with emerging AI technologies.

5.1 Limitations and Future Research

This study has several limitations that should be noted. First, the single-institution design may limit the generalization of the results. Although students of IER form an important population (the next generation of educators), their views may differ from students in other disciplines and institutions. Second, the study focuses exclusively on students' perspectives and does not capture the views of faculty members or institutional leaders. Third, it examines attitudes towards GenAI rather than comprehensively focusing on how GenAI affects actual learning outcomes.

Future studies may extend this work across diverse institutions, disciplines, and Global South contexts; incorporate stakeholder perspectives; and investigate how GenAI use influences academic performance, critical thinking, and skill development. While investigating how infrastructure, policy, and cultural factors influence equitable GenAI adoption in higher education, longitudinal, comparative, and mixed-methods studies may also assess AI-integrated pedagogies and AI literacy initiatives.

6. Recommendations

The following recommendations have been developed based on the findings of this study:

***Strengthen AI literacy*:** Higher education institutions should collaboratively design AI literacy programs for both students and teachers to inform about GenAI's functionality, capabilities and ethics. Programs should address: (a) how GenAI works (basic technical understanding); (b) capabilities and limitations; (c) ethical implications (privacy

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academic integrity expectations, equity); (d) effective prompt engineering; (e) critical evaluation of AI-generated content; (f) the productivity-skill trade-off through structured reflection and self-assessment tools; and (g) privacy misconceptions.

***Promote responsible use*:** Students should integrate AI tools as cognitive partners in brainstorming, feedback, reflection and revision while safeguarding independent thinking. Learning experiences should balance efficiency with skill development through opportunities for independent work before AI engagement.

***Strengthen privacy and ethical governance*:** Strict data protection policies should be developed with student input to prevent security breaches and misuse of user data. In addition, academic institutions should ensure transparent communication about data collection, usage, and students' rights to address privacy concerns. Collaboration among universities, educators, developers, and policymakers is essential to improve the transparency, reliability, and contextual relevance of AI systems, while Students should participate in monitoring AI's impact on learning outcomes and equity**.**

7. Conclusion

This study examined students' attitudes towards generative AI (GenAI) in higher education, revealing a pattern of informed ambivalence that reflects both the opportunities and challenges of AI integration. While students have functionally integrated GenAI into their learning for concept clarification, academic planning, and personalized support, its adoption remains constrained by infrastructural limitations, policy ambiguities, and uneven digital literacy. The findings further indicate that students perceive GenAI as a complement too, rather than a replacement for educators, highlighting its potential to support more personalized and collaborative learning. The study advances the Technology Acceptance Model (TAM) by conceptualizing concerns as moderating factors shaping the relationships between attitudes, behavioral intentions, and actual use, while introducing the productivity–skill trade-off as a complementary mechanism through which students negotiate immediate efficiency and long-term cognitive development. Situated within a Global South context, the findings demonstrate that GenAI adoption is shaped not only by individual perceptions but also by infrastructural, institutional, policy, and socio-cultural conditions. Overall, the study contributes to a more context-sensitive understanding of AI adoption in higher education and highlights the importance of balancing technological innovation with ethical, pedagogical, and contextual considerations to support responsible and equitable AI integration.

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