

Challenges and prospects of integrating generative AI in constructivist learning environments in higher education: perspectives of faculty and students

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Abstract

Purpose – Constructivist learning focuses on active, student-centered engagement with content, promoting critical thinking and problem-solving skills. GenAI technologies help to transform teaching methods, learning experiences and the overall educational landscape in higher education. Yet, limited research remains about the challenges and prospects of integrating GenAI in constructivist learning in higher education. Further, few studies have explored the experiences of faculty and students using GenAI in teaching and learning environments. Therefore, this qualitative study explored the challenges and prospects of integrating Generative AI (GenAI) in constructivist learning environments within higher education. Data were collected following a qualitative research design via in-depth semi-structured interviews with 30 faculty (16 female and 14 male) and 20 students (12 female and 8 male) in four programs. Data analyses were done via a constant comparative approach. Findings indicated that faculty and students faced challenges in integrating GenAI, including concerns about technological readiness, ethical considerations, a lack of quality training and information and data security and privacy issues. Faculty and students stated the potential benefits of GenAI to include enhanced personalized learning, improved access to resources, support for special needs students, adaptive learning platforms and content creation and generation. The findings suggest that while there are significant challenges, the effective integration of GenAI can align with constructivist principles, offering new opportunities for collaborative, interactive and learner-driven educational experiences.

Design/methodology/approach – A qualitative research approach was chosen to thoroughly explore the challenges and opportunities of incorporating Generative AI (GenAI) into constructivist learning environments in higher education. Semi-structured interviews were used because their flexible structure enables a deep exploration of students' personal experiences with AI and reveals the nuanced, individual aspects of their learning processes (Christodoulou *et al.*, 2024). This study recruited 30 faculty (16 female and 14 male) and 20 students (12 female and 8 male, aged between 24 and 40 for students and 36 and 60 years above for faculty) in four programs.



Findings – An analysis of 12 semi-structured interviews identified several key themes: concerns about technological readiness, insufficient attention to ethical issues, a lack of quality training and information and concerns regarding data security and privacy. Both faculty and students highlighted potential advantages of generative AI, such as enhanced personalized learning, support for special needs students and adaptive learning platforms.

Research limitations/implications – This study is not without limitations, as the results could be more meaningful if a larger sample size were involved, with larger samples of faculty and students conducted through quantitative methods. Therefore, as the use of AI continues to increase in higher education, institutions must enact policies and guidelines regarding the application of AI tools for academic research work. Furthermore, the study primarily focused on the voices and experiences of faculty and students at the graduate level regarding the application and use of Gen AI tools in higher education. Thus, a larger representation of faculty, leadership, staff and students at all levels could have helped to make a generalized data decision.

Practical implications – The findings reveal that successful GenAI integration requires careful attention to maintaining constructivist principles while leveraging technological capabilities. This means ensuring that AI tools enhance rather than replace the human interaction, collaborative inquiry and reflective practice that define effective constructivist learning environments. The study suggests that GenAI is most effective when it supports the active knowledge construction that constructivism demands rather than providing ready-made answers that circumvent the learning process. This requires faculty to develop a sophisticated understanding of how to use AI as a mediating tool that facilitates student engagement with content rather than replacing that engagement.

Social implications – The interconnected nature of the challenges identified (technological readiness, ethical considerations, training needs and privacy concerns) suggests that successful implementation requires comprehensive, systematic approaches rather than piecemeal solutions. Institutions must address these challenges holistically while maintaining focus on the pedagogical principles that define effective constructivist education.

Originality/value – The findings illuminate how GenAI technologies intersect with constructivist pedagogical principles, offering insights into the nuanced realities of AI adoption in higher education settings that prioritize active, collaborative and student-centered learning. The analysis surfaced seven interconnected themes that capture the current state of GenAI integration: technological readiness concerns, insufficient attention to ethical issues, lack of quality training and information, data security and privacy concerns, enhanced personalized learning opportunities, support for special needs students and the emergence of adaptive learning platforms.

Keywords Generative AI, Constructivist learning and AI, Higher education, AI ethics, Data privacy, Personalized learning, Adaptive education

Paper type Research article

Introduction

The incorporation of Generative Artificial Intelligence (GenAI) into higher education is transforming traditional educational settings, especially through the perspective of constructivist learning theory (Pavlik, 2023; Noroozi *et al.*, 2024). This emerging technology presents considerable promise to improve constructivist learning experiences through individualized assistance, innovative assessments and active participation (Grubaugh *et al.*, 2023; Salinas-Navarro *et al.*, 2024). GenAI can cultivate creativity, critical thinking and problem-solving abilities vital for effective learning across diverse disciplines and contexts. A primary benefit of incorporating GenAI into higher education is its capacity to produce unique learning experiences. Studies demonstrate that instructors who hold constructivist ideas are more likely to utilize artificial intelligence (AI)-driven educational technologies, as these systems promote active involvement and address individual learning requirements (Cabero-Almenara, 2024).

AI programs can assess student performance data to customize instructional content, ultimately improving the learning experience (Alshehri, 2023). Furthermore, GenAI can promote collaborative learning settings by allowing students to critically interact with AI-generated content, essential for cultivating higher-order thinking skills (Simms, 2024). This corresponds with the constructivist paradigm, which promotes the development of knowledge through interaction and collaboration (Baskara, 2023). Despite the growing presence of GenAI in educational settings, its effects within constructivist learning contexts remain inadequately examined, particularly from the perspectives of faculty members and students who engage with these technologies directly (Bennett, 2023; Grubaugh *et al.*, 2023). This significant research gap limits our understanding of how to effectively integrate these AI technological

tools within pedagogical frameworks that prioritize active knowledge construction and collaborative learning experiences among students in higher education. However, the deployment of GenAI presents considerable challenges. Issues about data privacy, academic integrity and the risk of algorithmic bias must be resolved to guarantee the ethical and successful utilization of AI tools in educational settings (Wu, 2024). Dependence on AI-generated content may result in a shallow comprehension of complex topics if students fail to interact thoroughly with the material (Saad *et al.*, 2024). The tendency of AI to generate “pseudo-vignettes” emphasizes a disparity between AI outputs and the detailed comprehension necessary in domains like medical education (Saad *et al.*, 2024). This highlights the necessity for educators to assist students in critically assessing AI-generated information, hence strengthening the constructivist focus on critical thinking and the practical application of knowledge (Simms, 2024).

Moreover, the effective incorporation of GenAI into higher education necessitates a thorough comprehension of its advantages and constraints. Educators must possess the knowledge and abilities to properly integrate AI tools into their teaching methodologies while prioritizing the cultivation of self-sufficient thought and creativity in students (Anthony and Jennifer, 2024). This equilibrium is vital, as excessive dependence on AI may jeopardize the cultivation of fundamental cognitive abilities (Grubaugh *et al.*, 2023). Consequently, professional development for educators is essential for managing the complex issues of AI integration in educational environments (Anthony and Jennifer, 2024).

The incorporation of Generative Artificial Intelligence (GenAI) into higher education offers a revolutionary opportunity; yet its effects inside constructivist learning contexts are still inadequately examined, especially from the viewpoints of faculty members and students. Constructivist learning prioritizes active participation, collaboration and knowledge production through experience, necessitating an understanding of how GenAI might connect with these educational concepts. Studies demonstrate that students prefer adaptable teaching methods that encourage constructivist methodologies, including active and collaborative learning (Noguera *et al.*, 2022). This inclination indicates that GenAI tools, which promote individualized and interactive learning experiences, could augment student involvement and support constructivist approaches. GenAI is adaptable to individual approaches to learning, offering personalized feedback and tools that promote in-depth engagement with knowledge. This adaptability corresponds with the constructivist perspective that learning is most effective when students integrate new information with their pre-existing knowledge (Chen and Lertamornsak, 2023).

Yet, the existing research mostly emphasizes the technological potential of AI rather than its educational consequences. This gap highlights the necessity for more thorough investigations into the appropriate integration of GenAI within constructivist frameworks. Although several studies highlight the advantages of technology-enhanced active learning environments, they frequently neglect the problems and techniques necessary for the implementation of these tools within a constructivist framework (Kesler *et al.*, 2021; Shah, 2019).

While prior research has predominantly focused on technology-enhanced constructivist learning or AI adoption in isolation (Cress and Kimmerle, 2023; Pallant *et al.*, 2025), fewer studies examine how generative AI supports knowledge construction through the lived experiences of both faculty and students. Moreover, the ways in which GenAI-mediated learning mirrors experiential and work-based learning practices remain underexplored. By integrating these perspectives, the current study advances understanding of how GenAI can foster active, collaborative and reflective learning that aligns with the skills and problem-solving approaches required in contemporary AI-augmented professional environments. Comprehending these characteristics is essential for educators aiming to utilize GenAI in methods that authentically improve learning results.

Further, the incorporation of GenAI into constructivist learning settings presents significant ethical implications. Concerns include data privacy, algorithmic bias and the risk

of excessive dependence on AI-generated information, which must be resolved to safeguard the integrity of the learning experience (Cabero-Almenara, 2024). Both faculty and students must be adept at critically assessing AI results, promoting a culture of inquiry and reflection that is fundamental to constructivist teaching (Grubaugh *et al.*, 2023). This critical involvement is vital to prevent shallow understanding and to foster the development of higher-order thinking skills. Professional development for educators is essential for effectively integrating GenAI into their teaching methodologies. Educators must receive training in the technical facets of AI technologies and educational practices that correspond with constructivist concepts (Anthony and Jennifer, 2024). This dual emphasis will enable educators to establish learning environments that are both innovative and rooted in strong educational theory.

This study examines the challenges and possibilities associated with the incorporation of GenAI into constructivist learning contexts within higher education. By focusing simultaneously on faculty and student perspectives, this study contributes new insights into how constructivist learning principles interact with GenAI in authentic educational contexts. Unlike previous work that emphasizes technical affordances or ethical considerations alone, this research illuminates the ways in which AI-mediated learning mirrors experiential problem-solving and prepares students for AI-integrated professional settings.

This study addresses three primary research questions:

- RQ1. What challenges do faculty and students encounter when integrating GenAI in constructivist learning environments?
- RQ2. What potential benefits do stakeholders identify in using GenAI to support constructivist learning approaches? and
- RQ3. How can higher education institutions effectively balance technological innovation with sound pedagogical principles in GenAI implementation?

This qualitative study explores the challenges and opportunities associated with integrating GenAI into constructivist learning contexts within higher education through in-depth semi-structured interviews with 30 faculty members and 20 students across five academic programs.

Our findings reveal that while stakeholders identify significant challenges including technological readiness concerns, ethical considerations and data privacy issues, they also recognize substantial benefits such as enhanced personalized learning, improved resource access and support for diverse learner needs. The results of this study will enrich the dialogue on AI-augmented education, offering evidence-based insights for educators, policymakers and researchers working to align GenAI capabilities with constructivist principles that foster collaborative, interactive and learner-driven educational experiences.

Literature review

Constructivist learning in education

Constructivism asserts that learners actively generate knowledge through engagement with experiences and prior understanding rather than passively receiving information (Chand, 2024; Mugambi, 2018). The theoretical architecture rests on complementary frameworks explaining how learning occurs. Piaget (1970) demonstrated through observational studies with children that learners construct knowledge through environmental interaction across distinct developmental stages. Vygotsky (1978) extended this through sociocultural theory, introducing the Zone of Proximal Development to show how social interaction and scaffolding from more knowledgeable others enable higher learning. Bruner (1974) synthesized these perspectives into spiral curriculum design, where concepts are revisited with increasing complexity. However, these foundational theories focused primarily on children, creating uncertainty about their translation to adult learners in higher education, where disciplinary knowledge is more specialized and learner populations are more diverse.

Large-scale meta-analyses validate constructivist approaches across disciplines. [Freeman et al. \(2014\)](#) analyzed 225 studies, finding examination scores improved 6% under active learning, with students in passive formats 1.5 times more likely to fail. [Johnson and Johnson \(2002\)](#) synthesized over 900 studies showing social interaction enhances learning, while [Zhang and Ma \(2023\)](#) meta-analyzed 66 studies revealing significant effects from project-based learning. [Zimmerman \(2002\)](#) developed a cyclical model of self-regulated learning emphasizing metacognitive monitoring. Yet this evidence base reveals a critical gap: while confirming that constructivist approaches improve outcomes, research provides limited insight into mechanisms of effectiveness or how these principles scale across diverse institutional contexts, resource constraints and student populations. This gap between knowing constructivism works and understanding how to implement it effectively creates the central challenge for higher education.

Constructivist learning in higher education

Implementation research reveals systematic tensions between constructivist theory and institutional practice. Studies examining project-based learning ([Almulla, 2020](#); [Zhang and Ma, 2023](#)), flipped classrooms ([Baig and Yadegaridehkordi, 2023](#); [Bishop and Verleger, 2013](#)) and collaborative approaches document a consistent pattern: demonstrated learning benefits accompanied by faculty reporting increased preparation time, students expressing workload frustration and uncertainty about content coverage. [Holly et al. \(2008\)](#) found the lecturer-to-facilitator transition professionally demanding, while [O'Connor \(2020\)](#) argued that constructivist advocacy oversimplifies how knowledge structures vary across disciplines and lacks specificity for resource-constrained settings with large enrollments.

More troubling, [Krahenbuhl \(2016\)](#) demonstrated that student-centered approaches may advantage already advantaged students who possess self-regulation skills and cultural capital to navigate loosely structured environments. Without deliberate scaffolding, discovery-oriented pedagogy risks widening rather than narrowing achievement gaps. These findings suggest that constructivist effectiveness depends less on pedagogical techniques themselves than on the implementation of quality and institutional capacity to support both students and faculty through the transition. The core challenge becomes how to provide individualized scaffolding, immediate feedback and adaptive support that constructivist learning demands at the scale required in contemporary higher education.

Generative AI and constructivism

Technology and constructivism share a mutually beneficial connection in contemporary education, as digital tools augment the basic principles of constructivist learning. Digital platforms offer collaborative environments that facilitate knowledge building among students via discussion forums and peer review systems, consistent with the constructivist focus on social learning ([Feyzi Behnagh and Yasrebi, 2020](#); [Chuaungo et al., 2022](#); [Shadiev et al., 2024](#)). These instruments enable the development of personal learning environments (PLEs) and networks (PLNs), hence enhancing lifelong learning techniques ([Mohammed and Kinyo, 2020](#); [Grubaugh et al., 2023](#); [Imran et al., 2024](#)).

Informed by constructivist principles, adaptive learning technologies employ artificial intelligence to facilitate students' comprehension by generating personalized learning pathways that align with their advancement and requirements ([Grubaugh et al., 2023](#); [Onesi-Ozigagun et al., 2024](#)). This method corresponds with constructivism's emphasis on personal knowledge creation and experiential learning ([Singh and Kaunert, 2024](#)). Consistent with constructivist theory, AI-driven feedback tools provide students with prompt and tailored responses to their assignments, enabling them to assume responsibility for their learning, reflect on their progress and cultivate a deeper understanding through experiential engagement ([Gligorea et al., 2023](#); [Onesi-Ozigagun et al., 2024](#); [Nagy et al., 2024](#)).

Challenges in constructivist learning environments

While technology provides significant advantages for constructivist learning in higher education, problems persist. Challenges like the digital gap and the necessity for digital skills training for educators and learners must be resolved to guarantee fair access and successful execution (Kori, 2021; Solano-Gutiérrez, 2024). These strategies necessitate substantial transformations in conventional teaching roles while advocating for active learning and student-centered pedagogy (Holly *et al.*, 2008; O'Connor, 2020). Faculty must transition to the role of facilitators instead of lecturers, which might be demanding (Holly *et al.*, 2008; O'Connor, 2020). Students may encounter difficulties with the independence necessitated in self-directed learning contexts (Krahenbuhl, 2016; O'Connor, 2020). Again, the implementation of constructivist techniques frequently requires significant institutional support and resources (Kori, 2021; Shaki and Shakil, 2024). Evaluating learning outcomes in constructivist environments can be difficult, since traditional assessment techniques may be insufficient to reflect the broadness of student comprehension (Krahenbuhl, 2016; Pedersen and Hoby, 2020; Boud and Bearman, 2022). Furthermore, the advocacy for constructivist pedagogies may neglect significant disciplinary differences and simplify the transfer of curricular information across instructional modalities (O'Connor, 2020; Pedersen and Hoby, 2020; Boud and Bearman, 2022). Notwithstanding these limitations, constructivist methodologies provide advantages like enhanced engagement, critical thinking and knowledge retention when executed proficiently (Kori, 2021; Do *et al.*, 2023; Zhang and Ma, 2023; Shaki and Shakil, 2024). The incorporation of technology in education, when informed by constructivist ideas, can transform learning experiences, elevate student involvement and boost academic results (Garcia *et al.*, 2024; Kalyani, 2024). The integration of GenAI with broader institutional objectives for transforming education and preparing the future workforce has positioned GenAI as a catalyst for pedagogical renewal. The inclusion of constructivist AI practices in strategic plans, curriculum frameworks and assessment policies has led several studies to perceive GenAI as a catalyst for pedagogical renewal rather than a disruptive risk. Holmes *et al.* (2025) revealed that the alignment of GenAI use with institutional broader missions reinforces the relevance of constructivist pedagogy in ensuring ethical, reflective and collaborative engagements in educated graduates and AI-mediated societies.

Generative AI in education

The novel class of AI technologies known as “generative artificial intelligence” (GenAI) produces new content in various modalities, such as text, images, audio and code, in response to user inputs (Brown *et al.*, 2020; Ramesh *et al.*, 2022). Unlike traditional AI systems that mainly analyze existing data, GenAI creates original content by discovering patterns in large training datasets (Radford *et al.*, 2019; Vaswani *et al.*, 2023). These systems are based on large language models (LLMs) with billions of parameters trained on human-generated content (Achiam *et al.*, 2024; Devlin *et al.*, 2019). Leading GenAI technologies in education include OpenAI's GPT series, Google's Gemini, Anthropic's Claude, Microsoft's Copilot and image generators like DALL-E, Midjourney and Stable Diffusion (Kasneci *et al.*, 2023; Mittal *et al.*, 2024). These systems demonstrate unprecedented capabilities in producing human-like content that reflects creative and intellectual processes (Bubeck *et al.*, 2023).

In educational settings, GenAI provides functionalities fundamentally different from earlier technologies (Holmes *et al.*, 2019; Kasneci *et al.*, 2023). These systems generate lesson plans, assessments and practice exercises tailored to specific learning objectives (Rivera Muñoz *et al.*, 2022), enabling unprecedented personalization of learning materials (Karpouzis *et al.*, 2024). With human-like conversational abilities, GenAI applications serve as responsive learning partners that converse with students and direct learning processes (Mollick and Mollick, 2023). Advanced GenAI tools assess student work, provide formative feedback, identify misconceptions and create tailored learning recommendations (Denny *et al.*, 2023).

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Moreover, GenAI produces complex simulations and virtual environments that enable students to practice skills in safe settings and develop sophisticated reasoning through experiential learning (Wu, 2023).

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Current applications in higher education

The novel class of AI technologies known as “generative artificial intelligence” (GenAI) produces new content in various modalities, such as text, images, audio and code, in response to user inputs (Brown *et al.*, 2020; Ramesh *et al.*, 2022). Unlike traditional AI systems that mainly analyze existing data, GenAI creates original content by discovering patterns in large training datasets (Radford *et al.*, 2019; Vaswani *et al.*, 2023). These systems are based on large language models (LLMs) with billions of parameters trained on human-generated content (Achiam *et al.*, 2024; Devlin *et al.*, 2019).

In higher education, GenAI supports constructivist learning approaches across disciplines, developing adaptive learning experiences that respond to individual knowledge levels and learning styles (Rivera Muñoz *et al.*, 2022; Zawacki-Richter *et al.*, 2019). This approach shows special promise for meeting diverse student populations’ needs (Luckin and Cukurova, 2019). According to constructivist theories, social interaction is crucial to knowledge creation (Dewey, 1938; Vygotsky, 1978). GenAI facilitates group interactions by generating discussion prompts, moderating dialogues and synthesizing diverse contributions (Belkina *et al.*, 2025; Rivera Muñoz *et al.*, 2022). More sophisticated systems present varied theoretical perspectives and promote critical evaluation of information – core elements of constructivist pedagogy (Mollick and Mollick, 2023). Following Vygotsky’s framework of scaffolding (Wood *et al.*, 1976), modern GenAI systems provide dynamic support that adjusts based on learner progress (Leelawong, 2008). GenAI is also transforming assessment practices through authentic evaluation techniques (Kasneci *et al.*, 2023; Zawacki-Richter *et al.*, 2019), offering insightful feedback while maintaining academic integrity (Olga *et al.*, 2023; Perkins *et al.*, 2024).

Theoretical framework

This study is based on constructivist theories that highlight the active participation of learners in knowledge construction through experience and social interaction. Jean Piaget’s Developmental Theory (1970) asserts that learning is a gradual restructuring of cognitive processes influenced by biological maturation and experiential factors. Piaget emphasizes that learners actively construct meaning through cognitive development stages, indicating that educational technologies, such as Generative AI, should correspond with learners’ cognitive preparedness and encourage active inquiry.

Building on Piaget’s theory, Lev Vygotsky’s Social Constructivism (1978) emphasizes the significance of social interaction and cultural instruments in cognitive development. Vygotsky presents the concept of the Zone of Proximal Development (ZPD), highlighting that learners attain advanced cognitive abilities through collaborative endeavors facilitated by more educated individuals. When properly developed, generative AI can function as a scaffolding tool inside the Zone of Proximal Development, enhancing communication, cooperation and individualized learning experiences.

Jerome Bruner’s Constructivist Approach (1974) further enhances this foundation by promoting discovery learning, wherein learners construct new concepts based on their existing and prior knowledge. Bruner underscores the significance of spiral curriculum, scaffolding and the active involvement of learners in meaning construction. In higher education, Generative AI can increase discovery learning by providing dynamic, responsive and personalized teaching resources that adapt to individual learning pathways. Collectively, these constructivist viewpoints offer a framework to analyze the obstacles and opportunities of incorporating Generative AI into higher education, highlighting the necessity for technologies that facilitate active, socially mediated and developmentally suitable learning experiences. Figure 1 shows the framework of the constructivist theory.

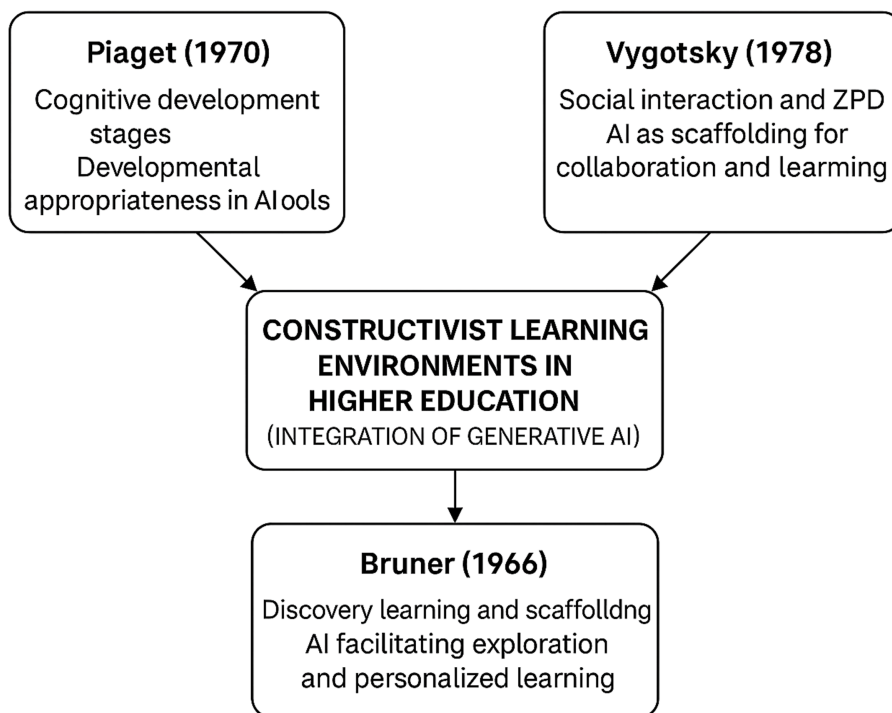


Figure 1. Conceptual framework of the constructivist theory

This study's theoretical framework is visually depicted through the convergence of three principal constructivist perspectives about the integration of Generative AI in higher education learning environments. [Piaget's \(1970\)](#) theory highlights the stages of cognitive development and the necessity of aligning AI tools with learners' developmental preparedness. [Vygotsky's \(1978\)](#) Social Constructivism emphasizes the role of Generative AI as a scaffold within the Zone of Proximal Development, promoting collaboration and facilitating learning. [Bruner's \(1974\)](#) Constructivist Approach emphasizes discovery learning and the function of AI in enabling exploration and individualized learning pathways. Collectively, these ideas offer a unified perspective for comprehending how Generative AI can both disrupt and augment constructivist learning in higher education.

Research method and approach

A qualitative research approach was chosen to thoroughly explore the challenges and opportunities of incorporating Generative AI (GenAI) into constructivist learning environments in higher education. Qualitative methods offer a way to examine the complex, context-dependent factors influencing students' use of these technologies ([Creswell, 2013a](#)). Semi-structured interviews were used because their flexible structure enables a deep exploration of students' personal experiences with AI and reveals the nuanced, individual aspects of their learning processes ([Christodoulou and Zembylas, 2025](#)). This approach was selected because there is limited research on faculty perspectives regarding the challenges and opportunities of integrating Generative AI (GenAI) in constructivist learning environments within higher education ([Creswell, 2013b](#)). Additionally, this study aligns with our theoretical framework of constructivist theory in higher education.

Sample and methods. This study recruited 30 faculty (16 female and 14 male) and 20 students (12 female and 8 male, aged between 24 and 40 years for students and 36 and 60 years plus for faculty) in four programs. The participants were selected from five public institutions and two private universities following a convenience sampling process in the USA. Participants were full-time teaching faculty in the colleges of arts and sciences, education, social sciences and public health (including 10 full professors, 10 associate professors and 10 assistant professors). All faculty have earned their Doctor of Philosophy in their respective fields of study. Student participants were all graduate students in the Colleges of Education, Arts and Sciences, Social Sciences and Public Health. Semi-structured interviews were conducted via Zoom at the convenience of participants. All interviews were recorded, transcribed and anonymized to protect participants' identities. The interviews were conducted between June and December 2024, with each interview lasting approximately 40–60 min.

Data collection. Data collection was carried out using 12 semi-structured interviews conducted on a secure online platform, with measures in place to maintain participant anonymity and confidentiality. First, through a convenience sampling procedure, we recruited a total of 45 faculty members from eight public and four private universities in the Northeastern part of the USA. The convenience sampling technique was used because of the availability and accessibility of the participants in universities/colleges. Following approval from the Institutional Review Board (IRB), we then contacted participants regarding the study's objectives and selected participants were assured of their confidentiality and anonymity. In total, 30 participants responded and agreed to participate in the study. To ensure the credibility of the data collection process, the study's theoretical framework – *Constructivist Theory* – and research questions were used to shape the initial interview guide. A qualitative approach guided the process, involving detailed semi-structured interviews with 30 faculty members (16 women and 14 men) and 20 students (12 women and 8 men) across five academic programs (namely, School of Education, College of Public and Health Sciences, College of Business, School of Engineering and Sciences and College of Sciences). Further, the interview questions were reviewed by four experts in the fields of online learning and cybersecurity. Based on their feedback, we revised it to finalize the interview guide. Interviews were then scheduled according to participant availability and conducted via Zoom. Data collection and interviews took place between June and December 2024. All interviews lasted between 40 and 60 min individually. All interviews were audio-recorded with permission and later transcribed into Word documents for analysis. To maintain participant anonymity, pseudonyms were used throughout the process.

Data analysis. This study employed constant comparative analysis, incorporating open, axial and selective coding methods as outlined by [Strauss and Corbin \(1998\)](#). We used constructivist theories that highlight the active participation of learners in knowledge construction through experience and social interaction, and the research questions to guide the coding process. To gain a thorough understanding of the data's content and context, the research team conducted an in-depth review of the interview transcripts. Using a qualitative constant comparative approach, the data were segmented into categories to identify recurring patterns and themes. NVivo 14 software was used to code the transcripts, breaking the data into smaller units and organizing them into preliminary categories. The software allowed us to leverage audit trail data and analysis comments. The audit trail consisted of all coded interview transcripts and other relevant comments made during the data analysis process (i.e. memos, categories, sub-categories and themes). Our analysis led to the following initial categories: "AI and challenges," "digital technology and AI," understanding of AI ethics and bias," "how to prevent data privacy and security using AI technologies," "AI and data breach," "AI and personalization of learning," "professional development for faculty and students on AI use" and AI tools and learning engagement."

In the second phase of coding – axial coding – the data were reorganized to reflect participants' perspectives on generative AI and its impact on teaching and learning in higher education. Similar codes were grouped across participant subgroups, and relationships among

these codes were analyzed to uncover broader thematic trends (Seidman, 2013). The researchers then refined and consolidated the codes, reducing redundancy and merging related categories into larger, more coherent groupings. The emerged categories from our analysis included: “knowledge of AI skills,” “navigating data privacy and breaches using AI in learning,” “knowledge and training of AI,” “AI and learning in higher education,” “challenges of using AI in higher education,” “addressing issues of ethics and bias of AI in education” and “providing support for special needs students on how to use AI tools for learning.”

During the final stage – selective coding – researchers addressed inconsistencies and finalized theme development. Nonessential categories were removed, and the remaining data were structured to enhance the reliability of the findings. Triangulation was used to validate the themes by comparing evidence across all three sources of data (interview transcripts). To ensure accuracy, a draft of the transcripts and preliminary findings was shared with participants for member-checking (Yin, 2013). In this case, codes were clearly defined and consistently applied to interview and observational transcripts organized in tables. The data were then revisited to identify and resolve any inconsistencies, thereby strengthening the credibility of the research. Trustworthiness and credibility in the data analysis were further strengthened through triangulation, whereby themes were validated across three sources of evidence: interview transcripts and field notes (Merriam, 2009). To promote accuracy of data, participants were provided with draft interview transcripts and preliminary findings as part of a member-checking process, allowing them to verify and confirm the emerging themes (Creswell and Plano Clark, 2011). Furthermore, we consolidated codes and categories suggested by reviewers and integrated them into our own coding framework derived from the dataset. Categories were then developed by grouping comparable codes across different participant subgroups. We also developed categories by aggregating related codes across participant subgroups. In addition, connections among these categories were examined to derive overarching themes from the data (Seidman, 2013). Interview recordings and transcripts were securely stored, and no information was disclosed to external researchers. Lastly, the researchers incorporated reviewer feedback into the dataset and maintained a detailed audit trail documenting each stage of data collection, coding and analysis. To safeguard participant privacy, all data were de-identified, and transcripts contained no personal information that could reveal identities. The final process of analysis resulted in the following themes, which are presented in the findings.

Findings

An analysis of semi-structured interviews identified several key themes: concerns about technological readiness, insufficient attention to ethical issues, a lack of quality training and information and concerns regarding data security and privacy. Both faculty and students highlighted potential advantages of generative AI, such as enhanced personalized learning, support for special needs students and adaptive learning platforms.

Theme 1: Concerns about technological readiness

The 21st-century teaching and learning in higher education witnessed the rapid use of Gen AI tools in teaching and learning in higher education. Most participants (20 of 30) reported that AI tools such as Gemini, OpenAI, ChatGPT and Grammarly helped them with their writing. For example, a faculty member in the college of education said:

Everyone will agree that Gen AI tools are good, and I use them to promote student engagement. However, there are concerns regarding my tech readiness, or let's say preparedness, that's lacking. I have no less skills in integrating generative tools into my online course to facilitate student engagement. This has been one of the challenges I face as a faculty.

A notable distinction emerged between faculty and student perspectives on technological readiness. Faculty participants primarily framed readiness as a pedagogical challenge,

expressing uncertainty about instructional integration and course design, whereas students more often described readiness in functional terms, emphasizing difficulty navigating AI tools efficiently within online learning environments. This divergence suggests that while faculty struggle with instructional application, students face challenges related to usability and self-regulation.

Participants' reflections showed that they were excited about how generative AI could help with schoolwork. The participants said that tools like ChatGPT, Grammarly, Gemini and others helped write and get students involved in their work. But there was a skills gap that made this enthusiasm less strong. For instance, 17 of the 30 faculty participants said they were frustrated with how little technical knowledge they had when it came to using and integrating these technologies into their courses. Five student participants honestly said they couldn't efficiently use generative AI in online learning environments.

This means that even though AI technologies are becoming easier to use, gaps in professional growth and digital literacy still make it hard to exploit them to their full potential. These results are in line with the research of [Kori \(2021\)](#) and [Solano-Gutiérrez \(2024\)](#), which shows that staff and students require specific training and assistance from their schools to become more confident and skilled with technology.

Theme 2: Insufficient attention to ethical issues

Another prominent theme from the interviews was the insufficient attention being paid to the ethical implications of Gen AI use in higher education. Most participants raised concerns about academic integrity, digital equity, critical thinking and the absence of clear institutional guidelines or policies regulating the responsible use of AI technologies in educational settings.

A participant from the College of Public Health illustrated this:

I think we are not paying much attention to the ethical concerns of using Gen AI tools in online learning and education in general, as you are aware, the rapid use of AI tools such as ChatGPT, Claude AI, Gemini, Open AI, and others by students, faculty and staff for research, essay and access information has led to an increase of plagiarism. A lot of students use these AI tools to write or draft their essays, complete assignments without any citations or references. We are experiencing the fact that most students lack knowledge about the proper usage of these AI tools.

Another faculty member from the College of Social Sciences stated:

I feel like the emergence of Gen AI in online learning has created lots of challenges for us regarding concerns of ethical considerations, faculty, and we have to now deal with students' lack of creativity and critical thinking – increasing use of Gen AI tools is making students do independent critical thinking and often depend on misinformation and disinformation of ideas or knowledge.

A faculty in the colleges of arts and sciences enumerated:

Currently, I'm dealing with students' work that I believe is generated by Gen AI tools; however, there are no policies and guidelines on the use of AI tools for academic or school-related work. We are experiencing an increase or widening of the digital divide in access to information; students from high-income homes who can afford digital tech tools to access information, and those who can't afford them, remain limited in information and knowledge resources.

Further, most participants also reported on the many challenges of the digital divide, where students from low-income and diverse backgrounds lack access to digital technologies. Hence, it affects access and use of AI tools for academic research and school work. For example, a faculty member in public health reiterated:

Access to digital devices has been a persistent issue because, like I said earlier, not all students can purchase these digital devices and Internet broadband, making it difficult to access information. And lots of these issues are not being resolved in connection with the rise and use of AI. We also deal with the issues of bias and discrimination regarding the use of AI in higher education because of the information.

Many participants expressed significant concern about the ethical challenges posed by the widespread use of generative AI tools such as ChatGPT, Claude AI and Gemini. A common issue was that students frequently relied on these technologies to complete assignments and write essays without proper attribution, resulting in a rise in plagiarism. Faculty members were frustrated by the difficulty in distinguishing AI-generated content from student work and the lack of clear institutional policies to address the situation. Faculty and students also differed in how ethical concerns were experienced. Faculty focused on academic integrity, creativity and policy gaps, reflecting their evaluative and instructional responsibilities. In contrast, students' ethical challenges were more implicitly tied to uncertainty about expectations and appropriate use, indicating a lack of shared ethical frameworks across institutional roles.

The result aligns with Wu's (2024) study, which said that the problem of algorithmic bias needs to be fixed to make sure that AI tools are used within educational institutions ethically and effectively. Participants stated that students are losing their ability to think for themselves and be creative because they rely too much on AI. This is because some students don't think critically about what they're learning in class. The literature supports these findings by saying that students may not fully understand complicated concepts if they rely too much on AI-generated content (Saad *et al.*, 2024). Issues of equity also emerged, with participants pointing out that students from lower-income backgrounds face disadvantages due to limited access to digital devices and reliable Internet, thereby widening the digital divide. Bias and discrimination in AI outputs were additional concerns, particularly regarding the representation and treatment of marginalized groups.

Theme 3: A lack of quality training and information

Most participants expressed concern over the lack of adequate training and accessible information about how to effectively use generative AI in academic settings. Despite frequent personal or professional use of AI tools, both faculty and students acknowledged gaps in their knowledge and skills, especially regarding best practices, ethical usage and educational applications. For instance, one student from the college of education shared his experiences, stating:

Though I use Gen AI for my school and social media engagements daily, I have no clue about proper guidelines on the best ways to use or the application of Gen AI for my school work and other social media interactions because I have had no formal training or education – I hear there are opportunities on campus to attend training on AI.

A faculty of the college of education described:

As a faculty, I have little or less practical understanding or knowledge of AI literacy. Especially, how to apply skills and understanding of AI to enhance students' educational practice, and again, how to provide support to students in understanding AI literacy. For instance, best practices and the appropriate use of the different types of AI tools in higher education.

Generative AI tools are increasingly integrated into both academic settings and social media use, but many participants reported using them without proper guidance or instruction. Several students admitted to frequently relying on AI without fully understanding what educators expected or what was considered appropriate use. This highlights a lack of structured education around AI literacy. Faculty members shared similar concerns, noting their own limited knowledge of how to effectively incorporate AI into teaching and learning. Without adequate training, they felt unprepared to support students in using AI responsibly.

Although both groups reported insufficient training, faculty emphasized the absence of pedagogically oriented AI literacy, while students highlighted the lack of explicit instruction regarding acceptable academic use. This suggests a misalignment between institutional professional development efforts and student-facing guidance.

Theme 4: Concerns regarding data security and privacy

Concerns surrounding data security and privacy emerged as a significant theme in participants' responses, especially from faculty. While many participants acknowledged the growing use and potential benefits of Gen AI, they also warned of the associated risks, particularly the misuse of personal data and the lack of adequate protection for users. Two faculty in the College of Arts and Sciences noted:

I stand to be corrected by the fact that Gen AI usage is rising among students and faculty – we all know the importance of AI. But it also brings some risks for student data security and privacy issues. The more students use generative AI, the more their data is exposed, and offering protection of data has been a challenge because students and faculty are using data without consent, as AI tools give most information without consent.

A student in the College of Social Sciences also shared her experiences, saying:

Generative AI tools have led to challenges such as loss of trust and data privacy. We are now experiencing automated hacking because the personal information of students is not protected.

A majority of faculty participants (19 of 30) consistently raised concerns about the potential risks to user data associated with generative AI technologies. As both students and instructors make greater use of AI platforms, worries about issues like informed consent, data privacy and the risk of personal information being exposed have grown. Some faculty members admitted that protecting student data is challenging and expressed unease about the possibility of data being misused without permission, which could lead to a decline in trust. Most participants talked about the escalating danger of automated hacking and the inadequate protections established to safeguard sensitive data. The findings highlight an urgent need for institutions to implement robust data governance frameworks, ensure that AI use is based on informed consent and strengthen cybersecurity measures to protect users in the academic environment.

Theme 5: Enhanced personalized learning

Despite concerns about ethics, training and data security, participants highlighted the transformative potential of Gen AI in enhancing personalized learning. Faculty and students alike noted that AI tools are increasingly being used to tailor educational experiences, provide timely feedback and support diverse learners. A participant from the college of education had this to say:

Gen AI took us by storm – it took us by surprise, and almost every faculty and student use of Gen AI is rapidly growing among faculty, staff, and students. I know students are gradually using Gen AI tools for their essays, research papers, and other projects, assignments, and final exams. I have also been using generative AI to create learning resources, assessments for my online courses, as well as timely feedback to students. For example, I use AI tools to create images for students with diverse backgrounds and special needs – the purpose is to enhance their academic and social engagement in class.

A student in the College of Arts and Sciences described her experience, saying:

I leverage AI tools to guide my work and interact with my peers in an online environment. I use it to track my progress, to automate responses for data analysis, and generative AI helps me to create learning platforms to enhance personalized needs and skills.

Further, findings showed that participants agreed that Gen AI has markedly enhanced their capacity to tailor learning for students. Faculty reported utilizing AI to create exams, provide personalized feedback and produce resources that align with students' backgrounds and learning requirements. Three instructors indicated the utilization of AI-generated visuals and resources to assist students with special needs and improve classroom inclusion. Likewise, students explored the application of AI for real-time progress monitoring, peer engagement and automated feedback, all of which enhance adaptive and student-centered learning

environments. The findings are consistent with the literature that Gen AI incorporated with constructivist methodologies provides advantages like enhanced engagement, critical thinking and knowledge retention when executed proficiently (Kori, 2021; Do *et al.*, 2023; Zhang and Ma, 2023; Shaki and Shakil, 2024).

These insights illustrate that AI, when employed judiciously, can enhance differentiated learning and promote deeper engagement, particularly when aligned with pedagogical objectives that prioritize students' distinct strengths and needs. The findings also agree with existing work that showed that Gen AI systems produce lesson plans, evaluations and practice exercises customized to learning objectives (Rivera Muñoz *et al.*, 2023), facilitating exceptional adaptation of educational resources (Weng *et al.*, 2024; Hwang and Chen, 2023).

Theme 6: Support for special needs students

Participants highlighted the positive role of GenAI in promoting inclusive education, particularly in supporting students with special needs. AI was seen as a valuable tool for enhancing accessibility, customizing content delivery and fostering equitable learning environments. For example, a faculty member in the College of Education shared:

I think AI expands more equitable access to educational resources for students with special needs, and AI tools like Astica.ai can help you create images or use images to create identification and automate scans of images to facilitate the learning needs of special needs students.

Student participants also shared similar positive experiences using AI tools to augment their academic work. Student participants discussed that AI tools helped them access resources. For example, students indicated that AI tools allow them to structure their learning easily or make the workload easier for them. A student in the College of Public Health stated:

I have been using generative AI tools to caption video lectures and create course resources for special needs students. AI tools make my course materials more accessible and create an equitable learning environment for me – just to let you know, I have a learning disability and need extra time and support to complete my class work, assignments, or projects. AI tools help me to structure learning content, and the difficulty of learning materials to meet the learning needs.

Faculty participants articulated pragmatic methods via which they are employing AI to assist students with disabilities. Astica.ai and similar tools were highlighted as essential for generating or analyzing photos to facilitate identification and content engagement. Others described their utilization of AI to generate captions for video lectures or modify the complexity of course materials to correspond with the capabilities of individual students. These initiatives seek to eliminate obstacles to education and guarantee that students with special needs may access and engage with academic material more equally.

The insights indicate that the application of generative AI possesses significant potential to promote inclusive education by personalizing instruction and improving accessibility. This aligns with the literature that the incorporation of technology in education, when informed by constructivist ideas, can transform learning experiences, elevate student involvement and boost academic results among all categories of students (Garcia *et al.*, 2024; Kalyani, 2024).

Theme 7: Adaptive learning platforms

Another key theme was the use of AI-driven adaptive learning platforms to support engagement and personalize educational experiences. Participants noted how these platforms enable dynamic, student-centered learning tailored to individual needs and learning approaches. For example, a student at the College of Public Health shared this experience:

I'm in the sciences, and we have been using AI adaptive platforms to help personalize our learning – I mean, interact and engage with our learning. For me, AI adaptive platforms help to actively engage in the learning process. AI tools provide platforms that are an opportunity to create content as a student.

Participants, especially in the sciences, reported favorable experiences with AI-driven adaptive learning platforms, characterizing them as instruments that augment engagement, creativity and individualized learning. These views correspond closely with the constructivist ideas articulated by Jean Piaget, Lev Vygotsky and Jerome Bruner, who emphasized that learning constitutes an active, contextualized process of knowledge construction rather than a passive reception of information.

According to Piaget, adaptable learning platforms facilitate individual cognitive growth by enabling learners to engage with knowledge at their own pace, according to their developmental stage. Vygotsky's concept of the Zone of Proximal Development (ZPD) is similarly evident in the application of AI tools. Adaptive platforms function as scaffolding, offering timely reminders, feedback and resources that assist students in closing the gap between their autonomous capabilities and their potential with support. AI platforms enhance motivation and learning efficiency by providing appropriately challenging tasks, maintaining learners within their ZPD.

Jerome Bruner's concept of discovery learning and spiral curriculum is reflected in the manner adaptive platforms enable students to review and enhance their understanding of concepts systematically. These platforms frequently promote student engagement in problem-solving, hypothesis testing and reflection, fundamental principles of Bruner's perspective that learners develop new concepts based on pre-existing knowledge frameworks. The interactive and personalized characteristics of these platforms reflect Bruner's conviction regarding the significance of actively involving students in their own learning journey.

Across opportunity-oriented themes, faculty tended to conceptualize GenAI as a design and facilitation tool for learning environments, whereas students experienced it more as a cognitive and organizational support system. This contrast highlights how GenAI mediates learning differently depending on one's role within the educational ecosystem.

GenAI as a mediating tool in constructivist knowledge construction. Beyond supporting personalization and accessibility, the findings suggest that GenAI functions as a mediating artifact in the constructivist learning process. Unlike static educational technologies, GenAI actively participates in knowledge construction by responding to learner input, generating feedback and adapting content in real time. This dynamic interaction enables learners to externalize thinking, test hypotheses and refine understanding, processes central to constructivist learning theory. Across themes related to adaptive platforms, personalized learning and support for special needs students, GenAI was shown to scaffold learning in ways that align with Vygotsky's concept of the ZPD, while also supporting Piagetian self-paced cognitive growth and Bruner's emphasis on discovery and reflection. In this sense, GenAI does not merely support learning outcomes but reshapes the conditions under which knowledge is constructed, positioning learners as active co-creators rather than passive recipients of information.

Discussion

This study's exploration of generative AI integration in constructivist learning environments through interviews with 30 faculty and 20 students across four academic programs reveals a complex landscape marked by both transformative potential and significant implementation challenges. The findings illuminate how GenAI technologies intersect with constructivist pedagogical principles, offering insights into the nuanced realities of AI adoption in higher education settings that prioritize active, collaborative and student-centered learning.

The analysis surfaced seven interconnected themes that capture the current state of GenAI integration: technological readiness concerns, insufficient attention to ethical issues, lack of quality training and information, data security and privacy concerns, enhanced personalized learning opportunities, support for special needs students and the emergence of adaptive learning platforms. These themes reflect the complex negotiation between technological innovation and pedagogical integrity that characterizes contemporary higher education.

Technological readiness: bridging the skills gap in constructivist settings

The disconnect between enthusiasm for GenAI tools and actual technological preparedness emerged as a fundamental challenge across both faculty and student participants. Despite widespread recognition of tools like ChatGPT, Gemini and Grammarly as valuable for promoting student engagement and supporting writing, 17 of 30 faculty members expressed frustration with their limited technical knowledge for integrating these technologies into constructivist learning environments. This skills gap is particularly significant in constructivist contexts, where technology should serve as a mediating tool that facilitates knowledge construction rather than simply delivering content. When faculty lack confidence in their technological capabilities, they struggle to design learning experiences that leverage GenAI to support collaborative inquiry, peer interaction and reflective practice: core elements of constructivist pedagogy. The challenge extends beyond basic tool competency to encompass understanding how AI can enhance rather than replace the human facilitation essential to constructivist learning. Students similarly acknowledged difficulties in using GenAI effectively within digital learning environments, often lacking awareness of how these tools might support their active engagement with course material. This finding aligns with research emphasizing urgent institutional needs for comprehensive digital literacy initiatives that address both technical skills and pedagogical integration strategies (Kori, 2021; Solano-Gutiérrez, 2024).

Ethical complexities: maintaining constructivist integrity

The insufficient attention to ethical considerations represents perhaps the most pressing challenge identified in this study. Participants consistently raised concerns about academic integrity, with faculty noting increased incidents of plagiarism as students use AI tools without proper attribution. This challenge is particularly acute in constructivist learning environments, where authentic assessment of student thinking and knowledge construction is essential. The concern extends beyond plagiarism to fundamental questions about learning authenticity. As one faculty member noted, students' declining critical thinking and creativity due to over-reliance on AI threatens the very foundation of constructivist education, which depends on students actively engaging with material, questioning assumptions and building understanding through experience and reflection. This echoes research suggesting that over-dependence on AI may impede students' ability to engage independently with complex concepts (Saad et al., 2024).

Digital equity emerged as another critical ethical dimension, with participants highlighting how students from lower-income backgrounds face barriers in accessing AI tools, potentially widening educational disparities. Research on algorithmic bias in educational systems found similar concerns about how AI implementation can perpetuate or exacerbate existing inequalities, particularly affecting students from marginalized communities (Wu, 2024). The absence of clear institutional policies governing GenAI use in educational settings compounds these ethical challenges, leaving both faculty and students without guidance for responsible implementation that preserves the integrity of constructivist learning experiences.

Training deficits: the need for constructivist-informed AI literacy

The lack of quality training and information represents a significant barrier to effective GenAI integration in constructivist contexts. Both faculty and students reported using AI tools regularly but without clear guidance on best practices, ethical boundaries or pedagogical applications that align with constructivist principles. Faculty expressed particular concern about their inability to support students in developing AI literacy while maintaining focus on constructivist learning objectives. This reflects a broader challenge in higher education where technological innovation often outpaces institutional capacity to provide appropriate professional development.

Effective integration requires understanding not only how to use AI tools but how to employ them in ways that enhance rather than undermine active learning, collaboration and reflective practice. The absence of structured AI literacy education leaves students to develop their own approaches, often without understanding how these tools might support or hinder their learning processes. This gap highlights the need for comprehensive training programs that address both technical competencies and pedagogical considerations within constructivist frameworks.

Data security and privacy: protecting the learning environment

Concerns about data security and privacy emerged as significant barriers to GenAI adoption, particularly among faculty participants. Nineteen out of 30 faculty members raised concerns about potential risks to user data, emphasizing challenges in protecting student information and ensuring informed consent when using AI platforms. These concerns are especially relevant in constructivist learning environments, where students often share personal reflections, collaborative work and learning artifacts that require careful protection.

Faculty worried about the exposure of student data without consent and the potential for automated security threats, highlighting the need for robust institutional frameworks to govern AI use while preserving the trust essential to effective constructivist pedagogy. The findings underscore an urgent need for higher education institutions to implement comprehensive data governance frameworks, ensure transparent consent processes and establish cybersecurity measures that protect both student privacy and the collaborative nature of constructivist learning environments.

Enhanced personalized learning: aligning AI with constructivist principles

Despite significant challenges, participants consistently highlighted GenAI's transformative potential for enhancing personalized learning experiences that align with constructivist principles. Faculty described using AI tools to create tailored feedback, develop customized assessments and adapt resources to individual student needs. These practices support the constructivist emphasis on meeting learners where they are and building on their existing knowledge.

The findings suggest that when implemented thoughtfully, GenAI can enhance the individualized attention that constructivist pedagogy demands while maintaining focus on active knowledge construction and collaborative learning. Students appreciated AI's capacity for real-time progress tracking and responsive support, enabling them to engage more actively in their learning processes. Recent research with international students supports these findings, demonstrating how AI tools can make learning more interactive by providing immediate responses to questions and enabling deeper engagement with course materials (Francis *et al.*, 2025).

Supporting inclusive education: AI as an equity tool

Participants highlighted GenAI's significant potential for supporting students with special needs and promoting inclusive education – a finding particularly relevant to constructivist environments that emphasize meeting diverse learner needs. Faculty described using AI tools like Astica.ai to create accessible materials, generate captions for video lectures and adapt content difficulty to match individual capabilities. These applications demonstrate how AI can serve constructivist principles by removing barriers to participation and ensuring that all students can engage actively in collaborative learning experiences. The technology's ability to provide multiple modes of content delivery and support various learning styles aligns with constructivist emphases on multiple pathways to understanding and the importance of connecting new learning to students' existing knowledge and experience. Students with

disabilities specifically noted how AI tools helped them structure learning content and manage the difficulty of materials, enabling more effective participation in constructivist learning activities. This finding is consistent with research demonstrating AI's potential to bridge learning gaps and create more inclusive educational environments when applied thoughtfully (Garcia *et al.*, 2024; Kalyani, 2024).

Adaptive learning platforms: technology-enhanced constructivism

The emergence of AI-driven adaptive learning platforms represents a particularly promising application for constructivist education. Participants, especially in the sciences, described how these platforms promote active engagement, creativity and personalized learning pathways that align with constructivist principles. These platforms embody key constructivist concepts by enabling students to engage actively in their learning process, receive immediate feedback and construct understanding through guided exploration.

The technology supports Piaget's emphasis on individual cognitive development by allowing learners to progress at their own pace according to their developmental readiness.

The scaffolding provided by adaptive platforms reflects Vygotsky's ZPD, offering timely support that helps students bridge gaps in their understanding. Similarly, the platforms' emphasis on discovery learning and student-generated content aligns with Bruner's constructivist approach, which emphasizes building new concepts on existing knowledge frameworks. Research confirms the effectiveness of adaptive learning platforms in higher education, showing significant improvements in academic performance and student engagement when these technologies are properly implemented (Do *et al.*, 2023; Zhang and Ma, 2023).

Implications for constructivist pedagogy

The findings reveal that successful GenAI integration requires careful attention to maintaining constructivist principles while leveraging technological capabilities. This means ensuring that AI tools enhance rather than replace the human interaction, collaborative inquiry and reflective practice that define effective constructivist learning environments. The study suggests that GenAI is most effective when it supports the active knowledge construction that constructivism demands rather than providing ready-made answers that circumvent the learning process. This requires faculty to develop a sophisticated understanding of how to use AI as a mediating tool that facilitates student engagement with content rather than replacing that engagement. Past studies indicate that Gen AI may augment constructivist learning through a cognitive and dialogue framework, while its uses are guided by pedagogical intent; but weak designed applications may minimize critical thinking and learner agency by encouraging overreliance on automated responses (Crompton and Burke, 2025).

The interconnected nature of the challenges identified (technological readiness, ethical considerations, training needs and privacy concerns) suggests that successful implementation requires comprehensive, systematic approaches rather than piecemeal solutions. Institutions must address these challenges holistically while maintaining focus on the pedagogical principles that define effective constructivist education.

Beyond pedagogical effectiveness, these findings carry important implications for the future-oriented mission of higher education. Constructivist uses of GenAI mirror the kinds of cognitive, collaborative and adaptive skills increasingly demanded in AI-mediated workplaces. When students learn to engage with AI as a tool for inquiry, reflection and problem-solving rather than as a shortcut for answers, they develop competencies such as critical evaluation of information, metacognitive awareness and collaborative knowledge construction. These skills are central to future employability in environments where human judgment must complement automated systems.

Recommendations for practice

Based on these findings, higher education institutions should prioritize several key areas for supporting GenAI integration in constructivist learning environments. First, comprehensive professional development programs must address both technical skills and pedagogical integration strategies that align with constructivist principles. Faculty need support in reimagining their teaching practices to leverage AI effectively while maintaining focus on active learning, collaboration and reflection. Such professional development should also emphasize how constructivist AI practices cultivate transferable skills such as critical thinking, ethical judgment, collaboration and adaptability that are increasingly valued in AI-enhanced professional environments. In this way, faculty development becomes not only a teaching improvement strategy but also a mechanism for aligning curricula with evolving workforce demands.

Second, institutional policies governing GenAI use must balance innovation with preservation of constructivist learning integrity. These policies should provide specific guidance for using AI in ways that enhance rather than undermine student engagement, critical thinking and collaborative knowledge construction. Clear institutional guidelines also serve a broader purpose by socializing students into the ethical norms and accountability structures they will encounter in AI-mediated workplaces. By embedding responsible AI use within constructivist learning experiences, higher education can prepare students to navigate professional contexts where transparency, data ethics and human oversight are essential.

Furthermore, robust data governance frameworks must protect student privacy while enabling collaborative sharing and reflection essential to constructivist pedagogy. This includes implementing transparent consent processes and secure data handling protocols that build trust in educational technologies. Finally, equity considerations must be central to GenAI implementation strategies. Institutions should ensure that AI adoption reduces rather than amplifies existing educational disparities while supporting the diverse learning needs that constructivist pedagogy seeks to address. Therefore, addressing equity and data governance in GenAI adoption is not only a matter of educational fairness but also of workforce inclusion. Graduates who lack access to AI-supported learning environments risk being underprepared for labor markets where digital fluency and AI collaboration are increasingly assumed.

Taken together, these recommendations position higher education as a critical bridge between constructivist learning principles and the realities of AI-mediated work. Rather than treating GenAI as a discrete instructional tool, institutions must recognize it as a socio-technical force shaping how knowledge is produced, evaluated and applied. Preparing students to learn with AI critically, ethically and collaboratively extends the significance of constructivist pedagogy beyond academic success to lifelong learning and professional resilience.

Limitations

This study is not without limitations, as the results could be more meaningful if a larger sample size were involved, with larger samples of faculty and students conducted through quantitative methods. Therefore, as the use of AI continues to increase in higher education, institutions must enact policies and guidelines regarding the application of AI tools for academic research work. Furthermore, the study primarily focused on the voices and experiences of faculty and students at the graduate level regarding the application and use of Gen AI tools in higher education. Thus, a larger representation of faculty, leadership, staff and students at all levels could have helped to make a generalized data decision.

Conclusion

This study explored the challenges and prospects of integrating Generative AI (GenAI) in constructivist learning environments within higher education. Results showed that faculty and students faced challenges in integrating GenAI, including concerns about technological

readiness, ethical considerations, a lack of quality training and information, as well as data security and privacy issues. Faculty and students stated the potential benefits of GenAI to include enhanced personalized learning, improved access to resources, support for special needs students, adaptive learning platforms and content creation and generation. Findings indicated that while GenAI presents significant opportunities for enhancing constructivist learning in higher education, successful integration requires thoughtful attention to both technological capabilities and pedagogical principles. The challenges identified, from technological readiness to ethical considerations, are substantial but not insurmountable when addressed through comprehensive institutional approaches that prioritize the active, collaborative and reflective learning that defines constructivist education. The findings suggest that GenAI's greatest potential lies not in replacing human facilitation or circumventing learning processes, but in providing sophisticated tools that support the kind of personalized, responsive and inclusive learning experiences that constructivist pedagogy envisions.

By addressing the identified challenges while leveraging these opportunities, higher education institutions can harness GenAI's capabilities to create more effective, equitable and engaging learning environments that truly serve all students. Future research should continue exploring how specific GenAI applications can be designed and implemented to support constructivist principles while addressing the ethical, technical and pedagogical challenges this study has identified. Only through such continued investigation can the field develop evidence-based approaches that realize AI's transformative potential while preserving the human-centered focus that makes constructivist education so powerful.

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