ORIGINAL RESEARCH ARTICLE

Students' perspectives on AI conversations in brainstorming within learning management systems in higher education

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This article explores students' perspectives on how AI conversations can enhance brainstorming within the Learning Management System (LMS), specifically Blackboard (BB). By analysing students' feedback, the study investigates how students are familiar with AI conversation, benefits, challenges, and future possibilities of this approach. The sample was selected to reflect a variety of learning backgrounds, featuring brainstorming sessions with participants of different ages and academic disciplines. The research utilises both qualitative and quantitative techniques, including an electronic survey distributed to a group of 103 students (78 males and 25 females) enrolled in the Leadership, Entrepreneurship, and Innovation course as well as the University Success course. The average age of the participants is 29, with most being in their first or second year of study. The findings highlight the significant role of AI conversations in boosting brainstorming skills (60.19%). In addition, notable variations in the perceived advantages of AI conversation in brainstorming were ($\chi^2 = 11.4$, $P < 0.01$). χ^2 = Correlation coefficient and P = Percentage. It is proposed to enhance e-learning systems by integrating AI. Universities should integrate AI conversational tools into their e-learning platforms to enhance student engagement. This can be achieved by developing AI platforms and providing comprehensive training for students and faculty on how to utilise these tools effectively. These platforms should also be integrated into assignments, group activities, and brainstorming sessions to encourage individual and group collaboration.

Keywords: students' perspective; AI conversation; brainstorming; learning management system blackboard

Introduction

Artificial Intelligence (AI) is significantly impacting higher education by transforming the methods of knowledge delivery, access, and construction. Recent advancements in AI technologies have allowed universities to improve learning personalisation, optimise administrative processes, and facilitate students' academic engagement through intelligent systems integrated into digital learning environments (Dogan et al., 2023; Kamalov et al., 2023; Luo et al., 2025). As higher education institutions increasingly implement AI-driven tools, the focus has transitioned from applications aimed at

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efficiency to exploring how AI can effectively enhance students' cognitive and learning processes (Ruano-Borbalan, 2025).

One of the most prominent contexts for AI integration is the Learning Management System (LMS), which serves as the central digital infrastructure for course delivery, communication, and assessment (Cabrera et al., 2025). AI-enhanced LMS platforms provide adaptive learning pathways, intelligent recommendations, and automated feedback, which facilitate self-regulated learning and enhance student autonomy (Tan et al., 2025; Vergara et al., 2024; Gligorea et al., 2023). Although these advancements have enhanced accessibility and instructional efficiency, the majority of AI applications in LMS environments are predominantly focused on content delivery or analytics, with insufficient attention given to promoting higher-order cognitive processes such as creative thinking and collaborative ideation (Rajabi, 2025).

Brainstorming is an essential cognitive and pedagogical approach in higher education, especially in courses focused on innovation, problem-solving, and leadership (Telychko et al., 2025). Brainstorming is defined as a systematic method for generating a variety of ideas through open exploration, associative thinking, and iterative questioning (Al-Samarraie & Hurmuzan, 2018). In contrast, creative thinking encompasses originality, flexibility, and fluency in the generation of ideas (Weiss & Wilhelm, 2022). Recent studies indicate that conversational AI tools can facilitate these processes by serving as interactive cognitive partners encouraging reflection, maintaining ideation, and providing alternative perspectives without the social pressures typically linked to peer-based brainstorming (Baidoo-Anu & Ansah, 2023; Chan & Hu, 2023; Sankar & Sen, 2025). In contrast to static digital resources, AI conversations facilitate dialogic interaction, which can enhance students' cognitive processes and sustain engagement in idea-generation tasks (Muzumdar & Cheemalapati, 2025).

Student engagement plays a central role in determining the effectiveness of such learning experiences. Engagement includes behavioural participation, emotional involvement, and cognitive investment in learning activities (Reeve et al., 2025). AI conversational tools can enhance engagement through immediate feedback, personalised prompts, and continuous interaction, which support motivation and independent learning. The effectiveness of these tools is significantly influenced by students' AI literacy, which encompasses their capacity to comprehend, critically assess, and responsibly utilise AI systems in academic settings (Bognar & Khine, 2025).

Despite the growing body of research on AI in higher education, several challenges remain unresolved. Ethical concerns related to data privacy, algorithmic bias, overreliance on AI, and reduced human interaction have been widely documented (Ferrara, 2024; Michel-Villarreal et al., 2023; Sebastian, 2023). Moreover, technical constraints and varying levels of student preparedness may affect the perception and utilisation of AI tools. The existing literature predominantly analyses AI through institutional or instructional lenses, with insufficient empirical attention given to students' lived experiences of AI interactions as brainstorming tools within LMS environments.

The gap is particularly evident in research examining the role of AI conversational tools integrated within LMS platforms, such as Blackboard, in facilitating brainstorming, creative thinking, and independent learning from the students' perspective. It is crucial to comprehend students' perceptions regarding the advantages, challenges, and future implications of AI conversations to ensure the ethical, pedagogical, and effective integration of these tools into higher education curricula.

Accordingly, this study aims to explore university students' perspectives on the use of AI conversations for brainstorming within LMSs. This study aims to provide empirical evidence regarding students' familiarity with AI conversations, their perceived benefits and challenges, and their future expectations, thereby addressing an underexplored area of AI-supported learning. The findings aim to guide educators, curriculum designers, and policymakers on the strategic integration of AI conversational tools within LMS environments to improve student engagement, creativity, and learning outcomes, while also considering ethical and pedagogical factors.

Study problem

The incorporation of AI in higher education has been extensively studied (Vieriu & Petrea, 2025), with previous research indicating its ability to improve personalisation (McCarthy et al., 2025), administrative efficiency, and learning support in LMS (Schmidt et al., 2025). This research predominantly examines AI-driven analytics, adaptive learning systems, automated feedback, and overall student engagement outcomes (Afolabi et al., 2025). Although these contributions are significant, they primarily frame AI as a supportive or managerial instrument rather than as an interactive cognitive collaborator in learning processes.

Previous research has investigated the application of AI in LMS environments (e.g. Ikhsan et al., 2025); however, there is a lack of studies focusing on AI conversational tools as enablers of brainstorming and creative thinking activities. There is a scarcity of studies examining students' experiences and perceptions of AI conversations utilised for idea generation, reflection, and independent learning within formal LMS platforms such as Blackboard. Recent studies predominantly highlight institutional or instructional viewpoints, resulting in a lack of representation of students' voices and lived experiences, especially concerning creativity-oriented learning tasks.

Furthermore, while brainstorming and creative thinking are critical skills in higher education, particularly in leadership, innovation, and problem-solving courses, there is a deficiency of empirical research investigating the impact of AI conversations on these cognitive processes within structured academic environments. The relationship among AI conversations, student engagement, AI literacy, and ethical considerations is inadequately examined, leading to ambiguity regarding the responsible design and implementation of these tools in university curricula.

This study aims to systematically examine university students' perspectives on the use of AI conversational tools for brainstorming within LMSs, thereby addressing existing gaps in the literature. This research investigates students' familiarity with AI conversations, their perceived benefits and challenges, and future expectations. The goal is to provide empirical evidence that supports the pedagogical, ethical, and student-centred integration of AI conversations in higher education.

Study's objectives

This study builds on previous research regarding AI in higher education and LMSs, aiming to achieve the following objectives:

(1) To investigate university students' awareness of AI interactions in brainstorming tasks.

This objective is based on prior research demonstrating disparities in exposure to and utilisation of AI tools among university students, especially within formal educational settings (Chan & Hu, 2023; Labadze et al., 2023).

(2) This study aims to analyse the perceived advantages and obstacles associated with the utilisation of AI conversational tools in brainstorming activities. Previous studies emphasise the capacity of AI to enhance creative thinking and engagement, while also addressing issues of overreliance, accuracy, and ethical considerations (Baidoo-Anu & Ansah, 2023; Michel-Villarreal et al., 2023; Sebastian, 2023).

(3) This study aims to examine the relationship between the utilisation of AI conversation tools and significant learning-related variables. This objective is based on empirical evidence showing correlations between AI-supported learning tools and student engagement, comprehension, motivation, and creative performance (Bozkurt et al., 2021; Giannakos et al., 2024).

(4) This study aims to examine the future implications of AI conversational tools on curriculum design and practices in higher education. Current studies indicate that AI technologies have the potential to transform pedagogical methods and curriculum frameworks; nonetheless, evidence centred on students is scarce, especially concerning AI interactions within LMS environments (Gligorea et al., 2023; Vergara et al., 2024).

Study hypotheses

This study proposes the following hypotheses based on the existing literature regarding AI utilisation in higher education, student engagement, and creative learning:

H1. A considerable number of university students exhibit knowledge of AI conversational tools utilised for brainstorming purposes.

This hypothesis is based on previous evidence indicating a rise in exposure to AI chatbots and generative AI tools among students in higher education (Chan & Hu, 2023; Javaid et al., 2023).

H2. The utilisation of AI conversational tools for brainstorming presents both perceived advantages and perceived obstacles among students.

Prior research illustrates the dual aspects of AI tools, emphasising improvements in efficiency and creativity while also addressing issues of distraction, dependence, and ethical considerations (Baidoo-Anu & Ansah, 2023; Michel-Villarreal et al., 2023).

H3. A statistically significant relationship exists between the use of AI conversation tools and various learning-related variables, such as student engagement, comprehension of academic material, motivation, and creative thinking.

This hypothesis is based on research showing positive correlations between AI-supported learning environments and both cognitive and affective learning outcomes (Bozkurt et al., 2021; Giannakos et al., 2024).

H4. Students recognise that AI conversational tools may significantly impact future curriculum design and teaching methodologies in higher education.

This hypothesis is corroborated by existing literature highlighting the transformative potential of AI technologies in influencing instructional models and curriculum innovation (Gligorea et al., 2023; Vergara et al., 2024).

The design of the study

Methods of research

With the use of a closed and open-ended questions survey questionnaire, this study applied a mixed-method research design to gather both quantitative and qualitative data. The study's scope and results were improved by the mixed-method approach, which provided a thorough framework for examining and exploring a variety of research questions while making up for the inherent drawbacks of a single-method design.

The survey was developed to capture participants' perspectives of AI conversation, their experiences with the online components, and their suggestions for improvement. The survey items were developed based on insights from the literature, including studies by Baidoo-Anu and Ansah (2023) and Chan and Hu (2023).

Study sample

In this study, we conducted our research in a classroom filled with university students enrolled in courses such as 'Leadership, Entrepreneurship, and Innovation' and 'University Success'. Initially, we had a sample of 235 students, but after some dropouts, we ended up with 103 participants, aged between 18 and 26 years, with an average age of 29. Our participants came from a variety of academic backgrounds, including Law, Education and Arts, and Business. To ensure a diverse representation, we used a non-random stratified sampling method, selecting students based on their enrollment in the specified courses. This approach helped us to capture a range of students' perspectives and kept our results from being skewed by any one discipline.

Study procedure

Our study centred on evaluating the students' perspectives on integrating AI conversations within the LMS to boost student engagement and cognitive skills. We designed the AI conversations with several key components: Role-Play Scenario: We incorporated AI conversation pages into the LMS, featuring role-play scenarios that were tailored to the course content. For instance, we used an AI persona of Elon Musk in the 'Leadership, Entrepreneurship, and Innovation' course, while Dr. Cornel West was featured in the 'University Success' course. These characters were chosen to provide thematic and content-related support that aligned perfectly with each course's objectives.

The lecturer and students were prepared through a presentation explaining the AI conversation tool and how it could be used for brainstorming. Students began by answering the first question posed in the AI conversation, followed by up to four additional AI-generated questions related to the main topic. They were given 15 minutes to brainstorm and respond.

To measure the students' perspectives, an electronic survey was distributed to the study sample. The questionnaire contained nine questions, which were developed and verified by the Author. The survey was divided into four main sections to give holistic data: Demographics, benefits, challenges, and future recommendations.

Discussion

Students' acquaintance with AI conversation in brainstorming sessions

The results demonstrate that 60.19% of students reported previous use of AI conversational tools, indicating an increasing familiarity with AI technologies in higher education settings (see Figure 1). This finding is consistent with the research conducted by Chan and Hu (2023), which indicates that university students are increasingly utilising generative AI tools for educational purposes. Javaid et al. (2023) observed that the swift proliferation of conversational AI has led to increased student awareness and informal adoption. The significant percentage of students who had not previously engaged with AI conversations (39.8%) indicates an inconsistent incorporation of these tools within formal LMS settings, corroborating Labadze et al.'s (2023) claim that institutional adoption of AI frequently trails behind students' informal experiences.

Artificial intelligence dialogues, ideation, and innovative thought processes

The favourable assessments of AI conversations regarding response speed, creativity, and idea generation indicate that these tools serve effectively as cognitive scaffolds in brainstorming activities (see Figure 2). The findings align with Baidoo-Anu and Ansah (2023), who indicated that AI chatbots can improve creative thinking by facilitating ideation and minimising cognitive load. Vergara et al. (2024) highlighted that AI-supported LMS environments promote higher-order thinking when tools are utilised interactively instead of passively. This study contributes to the existing literature
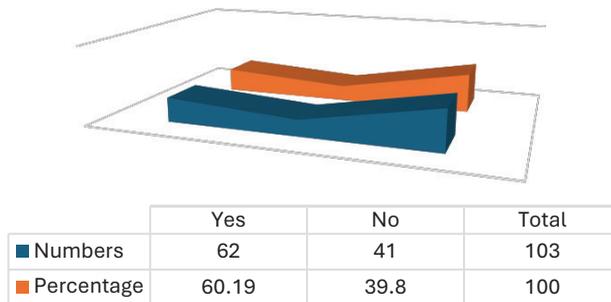

	Yes	No	Total
■ Numbers	62	41	103
■ Percentage	60.19	39.8	100

Figure 1. Prior use of AI conversation.

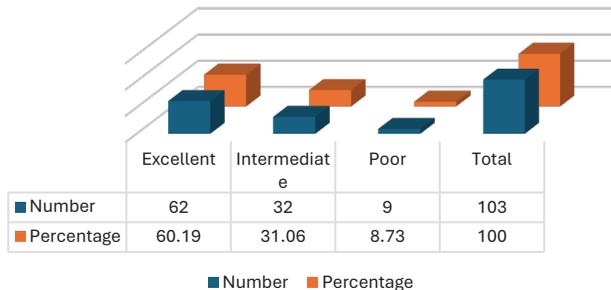|	Excellent	Intermediate	Poor	Total
■ Number	62	32	9	103
■ Percentage	60.19	31.06	8.73	100

■ Number ■ Percentage

Figure 2. Use and speed, creativity, and innovation.

by showing that AI conversations integrated into Blackboard can effectively facilitate brainstorming as a structured creative process.

Comprehending academic content and the process of knowledge formation

Students perceive that AI conversations enhance their understanding of academic materials, consistent with previous research indicating that AI tools improve comprehension via guided questioning and immediate feedback (see Figure 3) (Giannakos et al., 2024). These findings indicate that dialogic interaction, rather than personalisation alone, is crucial for supporting conceptual understanding during pre-learning and revision phases, in contrast to studies that primarily emphasise adaptive content delivery (Gligorea et al., 2023).

Motivation and autonomous learning

The significant correlation between the use of AI in conversations and heightened motivation and independent learning (see Figure 4) supports previous findings that AI-enhanced learning environments foster learner autonomy (Bozkurt et al., 2021). In alignment with the findings of Chan and Hu (2023), participants in this study indicated that interactions with AI facilitated self-directed inquiry. In contrast to Labadze et al. (2023), who warned that overdependence on AI could diminish critical engagement, the current findings suggest that AI conversations, when utilised as a supplementary tool, can enhance active learning rather than supplant it.
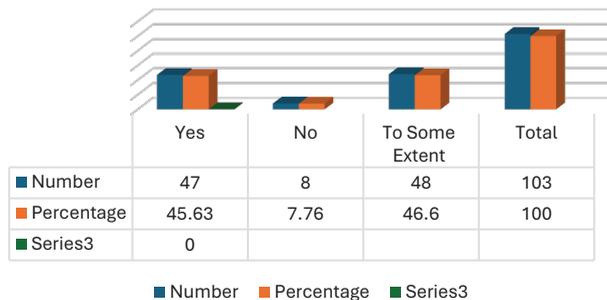
	Yes	No	To Some Extent	Total
■ Number	47	8	48	103
■ Percentage	45.63	7.76	46.6	100
■ Series3	0			

■ Number ■ Percentage ■ Series3

Figure 3. The use and understanding study materials.

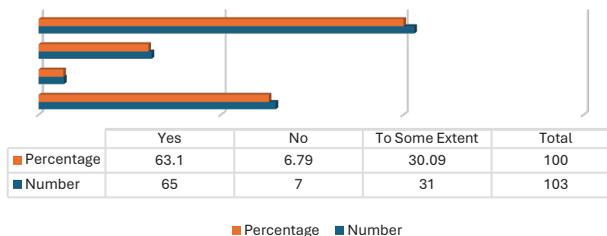|	Yes	No	To Some Extent	Total
■ Percentage	63.1	6.79	30.09	100
■ Number	65	7	31	103

■ Percentage ■ Number

Figure 4. Use and motivation and independent learning.

Integration of curriculum and implications for pedagogy

Support from students for the integration of AI conversations into higher education curricula indicates (see Figure 5) a wider demand for curriculum innovation in the context of the AI era (Vergara et al., 2024). The findings are consistent with Gligorea et al. (2023), who contend that AI ought to be integrated into pedagogical design instead of being regarded as an external supplement. This study provides evidence indicating that AI conversations are regarded as especially beneficial for brainstorming, discussion, and idea exploration in LMS platforms.

Challenges and ethical considerations in research

In alignment with previous studies, students indicated difficulties concerning distraction, accuracy, overreliance, and diminished human interaction. The concerns reflect the ethical and pedagogical risks identified by Michel-Villarreal et al. (2023) and Sebastian (2023), especially in relation to AI literacy and responsible usage. This study highlights that beyond technical critiques, students underscored the necessity of human oversight and instructional guidance. This supports Ferrara's (2024) assertion that ethical AI implementation demands institutional governance rather than relying solely on technological solutions.

Demographic factors influencing AI utilisation

The lack of notable differences among age, faculty, and academic year aligns with the findings of Vergara et al. (2024), which indicate that AI adoption is becoming increasingly normalised across various disciplines. The observed gender difference contrasts with previous studies indicating minimal demographic variation (Labadze et al., 2023), suggesting that contextual or cultural factors may influence AI engagement and require further investigation.

Results

Demographic data

Gender does not significantly affect the usage; rather, it is more influenced by technological development and the adoption of AI conversation, especially in university

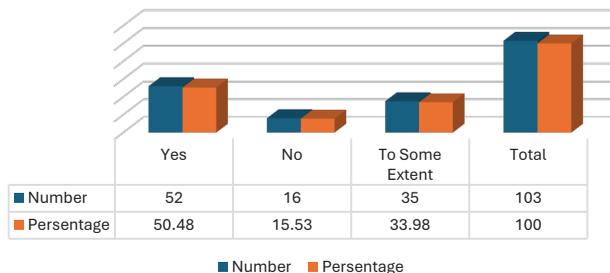|	Yes	No	To Some Extent	Total
Number	52	16	35	103
Persentage	50.48	15.53	33.98	100

Figure 5. AI conversation and integration them into higher education curriculum.

education (Male: (75.72%), Female: (24.27%). According to study statistics, the age group most engaged and interactive, is (18–21) the age group most enrolled in university is (63.1%).

Students are familiar with AI conversation

The use of AI conversation is not limited to a specific academic year, college, or course, but rather is linked to some extent to technological development and the use of AI to attract students to the educational process. The study shows that students at the university level keep up with and are informed about the technological innovations that have shaped the revolution of the era in terms of the pre-use of AI conversation (60.19%). The detailed sociodemographic characteristics and their association with AI usage are presented in Table 1.

Advantages of AI conversation in brainstorming

A lack of integration of AI conversation into e-learning systems adopted in university education (39.8%). Students interacted with AI conversation and used various skills, especially creative thinking skills, which helped them to innovate and answer questions, which contributed to the brainstorming technique among students (60.19%). The interaction helps to prepare the student for studying, facilitating the understanding of academic materials and their chapters by raising questions related to the general topic of the chapter being studied (60.19%). The use of AI conversation helped to build students' initial knowledge and then understand and comprehend the materials after

Table 1. Sociodemographic characteristics of the groups and their association with using AI educational settings.

Variables		$n = 103$ (%)	χ^2	P
Age	18 – 21	66 (63.5)	0.66	.71
	22 – 26	21 (20.2)		
	26+	17 (16.3)		
Sex	Male	78 (75)	6.44	.01
	Female	26 (25)		
Faculty	Education and Arts	17 (16.5)	2.1	.3
	Law	21 (20.3)		
	Business	65 (63.1)		
Academic year	1	63 (61.2)	1.9	.5
	2	27 (26.2)		
	3	9 (8.7)		
	4	4 (3.9)		

explanation and clarification by the teacher (92.23%). The students were able to explain that these AI conversations help to encourage them to self-learn by asking questions and answering through previous knowledge and knowledge that was gained through unlimited communication of questions asked, which enhances the user experience (63.1%). The students emphasised the importance of using AI conversation in higher education curricula as an auxiliary tool in brainstorming and thus lead to knowledge, understanding, and self-learning (50.48%) (33.98%). AI conversations have been able to have positive aspects that contribute to helping the student to access and understand information appropriately, ease of access, and use. The positive aspect of using AI conversation is the ability to retrieve previous knowledge through brainstorming, which contributes to finding answers that enhance students' creative thinking.

The challenges of using AI conversation

Increasing interaction and communication between AI conversations and students requires structured guidance and institutional monitoring to ensure effective and responsible use. AI conversations need to be followed up by specialists and the sources from which they are read so that they are tools that can clarify and display the required information. It is an important and interactive tool within university education that facilitates the process of brainstorming for students as one of the students' creative thinking tools, but by certain controls and laws imposed by the nature of the university environment and e-learning.

The relationship between AI conversation tool usage and demographic data

There were no statistically significant differences between students who used AI in their educational settings and those who didn't, except with respect to sex ($\chi^2 = 6.44$, $P < 0.01$).

The assessment of AI experience and its correlation with the use of AI in educational contexts

Significant variations were identified between individuals who use AI in educational environments and those who were not, concerning the advantages of AI ($\chi^2 = 11.4$, $P < 0.01$) and its role in enhancing the understanding of academic subjects ($\chi^2 = 6.2$, $P < 0.05$). The statistical associations between AI usage and learning-related variables are summarized in Table 2.

Conclusion

This research investigated university students' views on the application of AI conversational tools for brainstorming in LMSs. Previous studies have thoroughly examined AI applications in higher education, focusing on personalisation, analytics, and instructional support. However, there has been insufficient exploration of AI conversations as interactive cognitive tools that facilitate brainstorming, creative thinking, and idea generation within formal LMS environments. This study addresses the gap in the literature by concentrating on students' lived experiences.

Table 2. Questions related to the assessment of AI experience and its correlation with the use of AI in educational contexts.

Variables		$n = 103$ (%)	χ^2	P
Rate your experience with AI conversations in terms of speed of response, creativity, and innovation?	Poor	9 (8.7)	11.4	0.003
	Average	32 (31.1)		
	Good	62 (60.2)		
Do you agree that using AI conversation helps in understanding academic subjects better?	No	8 (7.7)	6.2	.04
	Sometimes	49 (47.1)		
	Yes	47 (45.2)		
Do you agree that using AI conversation helps motivate you to research and learn independently?	No	7 (6.8)	3.1	0.2
	Sometimes	31 (30.1)		
	Yes	65 (63.1)		
Do you agree that using AI conversation is a useful tool but needs improvement?	No	15 (14.6)	0.53	0.76
	Sometimes	23 (22.3)		
	Yes	65 (63.1)		
Do you agree that using AI conversation can cause distraction during learning?	No	41 (39.8)	0.81	0.66
	Sometimes	38 (36.9)		
	Yes	24 (23.3)		

The findings indicate that students typically view AI conversations as beneficial tools for brainstorming, fostering creativity, engagement, and independent learning, while also acknowledging significant challenges concerning accuracy, dependence, and ethical considerations. The findings support previous recommendations for the responsible and pedagogical integration of AI in higher education (Baidoo-Anu & Ansah, 2023), while contributing empirical, studeSnt-centred evidence regarding the functionality of AI conversational tools in LMS-based academic activities.

This study enhances the understanding of AI's role by explicitly situating AI conversations within the contexts of brainstorming and curriculum design, moving beyond efficiency-driven applications. The results indicate that AI conversational tools, utilised as supplementary and guided learning resources, can enhance higher-order cognitive processes while not substituting human instruction. Students' perspectives underscore the significance of AI literacy and institutional oversight for the ethical and effective implementation of AI.

This research contributes to the literature by addressing a significant gap between theoretical discussions of AI in education and practical, learner-centred applications in LMS platforms. This work offers evidence-based insights for educators, curriculum designers, and policymakers aiming to integrate AI conversational tools to enhance creativity, engagement, and learning outcomes, while adhering to ethical and pedagogical standards.

Recommendations

Enhance E-Learning Systems with AI Integration: Universities should incorporate AI conversation tools into their e-learning platforms to foster student engagement. This can be achieved by developing AI-powered brainstorming platforms and offering comprehensive training for both students and faculty on how to effectively utilise these tools.

Raise Awareness through Workshops: Universities should organise workshops to raise awareness of the benefits of AI conversations. In addition, mandatory introductory AI workshops for new students could highlight the role of AI in enhancing creative thinking and supporting academic success.

Develop AI-Supported Platforms for Independent Thinking: Universities should create AI platforms that simulate discussions and debates, promoting independent thinking and improving comprehension. These platforms should be integrated into assignments, group activities, and brainstorming sessions to encourage both individual and group collaboration.

Ensure Accurate and Fact-Checked Information: It is essential for universities to establish teams of subject-matter experts to monitor AI platforms regularly. This will ensure that students receive accurate and reliable information, fostering trust in the AI tools used in the learning process.

Invest in AI and Virtual Reality Integration: Universities should consider investing in the development of AI systems that integrate with Virtual Reality (VR) and other collaborative tools. This will create immersive and interactive brainstorming environments that enhance the students' learning experience.

Implement Data Privacy and Ethical Policies: Universities must establish clear policies to safeguard data privacy and address any ethical concerns related to AI use. These policies should ensure that students' personal data and intellectual property are protected while using AI-powered learning tools.

Limitations

While the study showed some promising results about the role of AI conversations in higher education, there are a few limitations worth mentioning:

Limited Sample Size and Academic Context: The research involved a small group of students from a specific academic environment, which might make it hard to apply the findings to larger or more varied populations.

Geographic Limitations: This study took place at a private university in Qatar, which means the results may not be relevant to other countries or educational settings that have different cultural, technological, or institutional dynamics.

Variation in Student Readiness: The success of AI conversation tools can vary depending on how ready individual students are and how comfortable they are with using such technologies, which could affect their engagement and learning results.

Need for Broader Research: To make the findings more applicable, it would be beneficial to conduct further studies with larger, more diverse groups and using different research methods.

Statements and declarations

Availability of data and materials

Data sources: we got our data from AI Conversation created on Blackboard.

Data availability: Data used is restricted to this research.

Materials: we used Blackboard as a software tool to keep all students' responses on AI Conversation.

Conflict of interest and funding

Authors' contributions

The authors confirm their contribution to the paper as follows: study conception and design: Triza Mohareb (1), Author. Data collection: Triza Mohareb (1), Author. analysis and interpretation of results: Triza Mohareb (1). Author, and Amani Elbarazi (3) Author; draft manuscript preparation: Triza Mohareb (1) Author, Rania Al-Qayyem (2) Author, and Amani Elbarazi. (3) Author. All authors reviewed the results and approved the final version of the manuscript.

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