JUTLP
Journal of University Teaching & Learning Practice

Agentic Engagement with Educational AI Chatbots Among Pre-service Teachers: A Mixed-Method Study in Qatar

Dr Youmen Chaaban[a], Research Associate Professor Soon-Gyo Jung[b] System Engineer, and Professor Bernard J. Jansen [b]
[a] Qatar University, Qatar; [b] Hamad bin Khalifa University, Qatar

Abstract

Agentic engagement captures students' intentional efforts to shape their learning environment and co-create their educational experiences. However, there is limited understanding of why engagement with educational artificial intelligence (AI) chatbots varies among students, particularly among pre-service teachers, and agentic engagement is often overlooked in AI-mediated instruction. This mixed-method study explored engagement with an AI chatbot among 33 pre-service teachers enrolled in a classroom management course at one university in Qatar. Guided by self-determination theory and agentic engagement, we analysed 2,189 chatbot messages and end-of-course interviews, and classified participants into high, medium, and low engagement groups. The findings showed that high-engagement students used the AI chatbot autonomously for clarification and assignments, although they expressed minimal ethical concerns. Medium-engagement students balanced selective use with collaboration and raised concerns about plagiarism. Low-engagement students engaged only sporadically, placed greater value on instructor guidance, and expressed mixed ethical views. Overall, the results highlighted the potential of AI chatbots to support autonomy and competence, while also revealing gaps in relatedness and risks of overreliance. This study contributes to engagement theory by showing that frequency of use can mask different forms of agentic engagement, including selective use and agentic refrain. It also underscores the need for thoughtful integration, supported by instructor guidance, to promote balanced, ethical and reflective engagement.

Editors

Section: Education Technology
Senior Editor: Rachel Fitzgerald
Associate Editor: Jeya Amantha Kumar

Publication

Submission: 28 Aug 2025
Revised: 03 May 2026
Accepted: 06 May 2026
Online First: 16 May 2026

Practitioner Notes

1. Use an innovative chatbot (e.g. Cipherbot) to explore and support different engagement levels among pre-service teachers.
2. Apply self-determination theory and agentic engagement to identify and understand high, medium and low engagement levels.
3. Leverage AI to support student autonomy and competence, while monitoring risks to relatedness and overreliance.
4. Accompany AI integration with instructor guidance to support ethical and reflective engagement.

Keywords

Pre-service teachers; teacher education; engagement; educational chatbots; artificial intelligence

Citation:

Chaaban, Y., Jung, S.-G., & Jansen, B. J. (2026). Agentic engagement with educational AI chatbots among pre-service teachers: A mixed-method study in Qatar. *Journal of University Teaching and Learning Practice*, 23(2). https://doi.org/10.53761/r4ttan25

Introduction

The integration of generative artificial intelligence (AI) into higher education is reshaping how university students' access, process and engage with course content (Almassaad et al., 2024; O'Dea et al., 2024). AI tools, like chatbots and advanced content management systems, promise personalised learning and instant feedback, offering students key affordances to provide just-in-time support (Chaaban et al., 2024). These tools enable students clarify concepts, explore ideas and deepen their understanding in a self-directed manner (Annamalai et al., 2023; Salminen et al., 2024a). Some research also shows AI-supported instruction enhances engagement through personalised, interactive experiences (Wang & Xue, 2024). However, despite these benefits, student engagement with AI can vary significantly. For instance, while some students integrate these tools deeply into their learning routines, others remain sceptical of their effectiveness and have lower emotional engagement or trust (Abbas et al., 2024). Understanding engagement disparities among students can help ensure that AI complements, rather than disrupts, traditional learning paradigms (Dunn & Kennedy, 2019).

Against a backdrop of uneven engagement, it is important to examine how future educators adopt and regulate their use of AI tools within contexts where AI-enabled education is being strategically advanced. In Qatar, initial teacher education is positioned as a lever for human capital development and the shift toward a knowledge-based, digitally enabled economy. National blueprints such as Qatar National Vision 2030 and the Digital Agenda 2030 prioritise digital capabilities, innovation, and technology-enabled public services, which have accelerated local investment in AI-focused education. This national direction is reflected in initiatives such as Cipherbot, developed in Qatar in response to these priorities. Cipherbot is a generative AI chatbot that provides students with course-specific information by retrieving and processing instructor-curated content. As AI tools like Cipherbot become more embedded in university classrooms (O'Dea et al., 2024), it is essential to investigate how pre-service teachers interact with them, what types of questions they ask, and how they perceive AI's role in learning (Lee & Bryan, 2025). These questions allude to what Reeve and Tseng (2011) have termed agentic engagement, defined as students' proactive contributions to shaping their learning environment. Agentic engagement represents an often-overlooked dimension of engagement that may be particularly relevant to AI-mediated instruction (Reeve & Tseng, 2011; Dunn & Kennedy, 2019), specifically in teacher education, which aims to prepare pre-service teachers for their future roles in AI supported learning environments (Lee & Bryan, 2025).

Building on prior research that classifies engagement into categories (Khalil et al., 2017), this mixed-method study explores the learning interactions and engagement of 33 pre-service teachers with Cipherbot within a teacher education program in Qatar. Drawing on Reeve and Tseng's (2011) framework, which extends engagement to include agentic dimensions, this study assesses how Cipherbot fosters proactive student involvement during the course. This study offers insight on pre-service teachers' engagement with AI in teacher education by showing that engagement is not only a matter of quantity of use, but of agentic choice and refrain, ethical stance and the conditions created by instructor guidance. Specifically, this study aims to respond to the following research questions (RQs):

RQ1: How do interactions differ among high, medium, and low frequency users of the AI chatbot?

RQ2: What types of questions are most common among high, medium, and low frequency users of the AI chatbot?

RQ3: How do participants' perspectives on using the AI chatbot for learning and instruction differ among high, medium, and low frequency users?

Literature

Student engagement has been considered a significant determinant of academic success and a cornerstone of effective learning environments (Wang & Xue, 2024). Broadly defined, engagement refers to the extent to which students actively participate in and commit to their educational experiences, which further encompasses their attention, effort and emotional investment in learning activities (Fredricks et al., 2004). Research consistently shows engagement as a multi-dimensional construct comprising three interrelated components: (a) behavioural engagement (e.g., participation, effort and attendance), (b) emotional engagement (e.g., interest, enthusiasm or anxiety), and (c) cognitive engagement (e.g., deep processing, self-regulation and use of learning strategies) (Fredricks et al., 2004; Skinner et al., 2008). These three dimensions reveal how students respond to and interact with learning opportunities and provide a theoretical framework for understanding their classroom engagement (Chaaban, 2025).

Despite the utility of this tripartite model, other scholarship has argued for an expanded conceptualisation to account for students' proactive roles in shaping their learning experiences. Reeve and Tseng (2011) propose agentic engagement as a fourth dimension, which they defined as "students’ constructive contribution to the flow of the instruction they receive" (p. 258). While behavioural, emotional and cognitive engagement may seem reactive in nature, as students respond to pre-structured activities, agentic engagement, by contrast, emphasises intentional actions, such as offering suggestions, asking questions or personalising learning tasks that influence the instructional process (Reeve et al., 2015). Reeve and Tseng's (2011) study grounds agentic engagement in self-determination theory (SDT) and suggests that it fosters autonomy, enhances motivation and correlates positively with academic achievement and psychological need satisfaction (Annamalai et al., 2023; Reeve et al., 2025).

High engagement levels are associated with improved grades, deeper conceptual understanding and persistence in challenging tasks (Appleton et al., 2008; Skinner et al., 2008). Conversely, low engagement levels, manifested as withdrawal, boredom, or superficial effort, are shown to predict lower achievement and higher dropout rates (Finn & Zimmer, 2012). However, engagement is not uniform across students or contexts. Variability arises from individual differences (e.g., motivation, prior knowledge), classroom dynamics (e.g., teacher support) and the nature of learning activities (Fredricks et al., 2004; Reeve et al., 2025). For instance, Skinner et al. (2008) found that engagement fluctuates over time, influenced by developmental changes and environmental factors, suggesting the need to explore how specific tools or pedagogies can enhance engagement and sustain it.

Agentic engagement may be particularly apparent in technology-rich teacher education, where pre-service teachers increasingly interact with tools that require active participation (Chaaban et al., 2025). For instance, in AI-mediated teacher education, pre-service teachers must navigate their engagement with AI and decide whether to treat it as a support tool or an alternative source of guidance (Guan et al., 2025). At the same time, their limited AI competencies may constrain agentic participation and increase the need for tangible instructor presence and direct guidance (Lee & Bryan, 2025). For example, Chaaban et al. (2025) found agentic engagement to vary according to pre-service teachers' intrapersonal, behavioural and environmental conditions, and revealed distinct viewpoints ranging from self-reliant users with limited ethical awareness, balanced ethical users, and uncritical users who suspended their agentic engagement.

However, teacher education presents a distinct adoption context. Pre-service teachers use AI in university as students, and must also interpret this use as a model for their future classroom practice (Guan et al., 2025; Lee et al., 2025). This dual role raises the stakes for ethical decision-making, because AI use can influence their beliefs about what good teaching looks like, what forms of assessment are available and useful, and what counts as evidence of learning. Therefore, understanding engagement becomes even more critical for pre-service teachers who will soon become responsible for their future K-12 students' engagement (Chaaban et al., 2024; Sun et al., 2024). Teacher education increasingly relies on innovative technologies, such as AI, to support pre-service teachers' learning, yet these are not neutral tools, and questions have been raised about how they intersect with engagement dimensions (Guan et al., 2025; Qiao et al., 2025; Wang & Xue, 2024). While traditional models emphasise pre-service teachers' reactions to certain tasks and assignments, the introduction of generative AI systems that can respond to student input and creating course material has amplified the need for agentic engagement, which presumably enables learners to co-create their educational experiences with AI systems (Chaaban, 2025). Without intentional learning experiences with AI that merge awareness and critical reflection (Guan et al., 2025), pre-service teachers may adopt a tool-centric stance that sidelines deeper pedagogical reasoning and ultimately diminishes their engagement with course material (Sun et al., 2024).

Theoretical framework

Two prominent frameworks, namely self-determination theory and agentic engagement, provide complementary lenses. Self-determination theory, developed by Deci and Ryan (1985), posits that human motivation and engagement emerge from the fulfillment of three basic psychological needs: autonomy (control over one's actions), competence (mastery and efficacy), and relatedness (connection with others). In educational contexts, self-determination theory (SDT) suggests that environments supporting these needs foster intrinsic motivation and lead to higher engagement and deeper learning (Ryan & Deci, 2020). SDT has been examined in the context of AI-supported instruction (Annamalai et al., 2023; Darvishi et al., 2024). AI systems are unique in their ability to provide just-in-time support and enable students to ask questions or explore content at their own pace, which may further support autonomy and competence (Annamalai et al., 2023). For instance, students using AI to clarify concepts or seek feedback could experience greater autonomy over their learning (Darvishi et al., 2024). However, SDT traditionally focuses on reactive engagement, that is, responses to external conditions, which leaves room for an expanded framework to address proactive student contributions, such as those facilitated by AI tools.

Building on SDT, Reeve and Tseng (2011) introduce agentic engagement as a fourth dimension of student engagement, distinct from the traditional behavioural, emotional and cognitive dimensions noted above. Unlike reactive dimensions, which reflect how students respond to pre-designed activities, agentic engagement captures their intentional efforts to shape the learning environment (Annamalai et al., 2023; Reeve, 2013). Rooted in SDT's autonomy construct, agentic engagement posits that students are not merely recipients of instruction but active agents who co-create their educational experiences (Darvishi et al., 2024). In their meta-analysis, Reeve et al. (2025) found that agentic engagement contributes to students' learning by enhancing psychological need satisfaction, improving motivation and promoting academic achievement. It also served as the strongest predictor of perceived teacher support among all engagement types. Moreover, agentic engagement emphasises autonomy and students' sense of ownership over their education.

Some researchers have proposed categorising engagement into multiple levels based on observable behaviours and self-reports to operationalise engagement for empirical analysis (Khalil et al., 2017). High engagement reflects consistent participation and enthusiasm, medium engagement indicates sporadic or moderate involvement, and low engagement signals disinterest or minimal effort. This framework, while pragmatic, often focuses on behavioural and emotional indicators, with less attention to agentic actions. Integrating Reeve and Tseng's (2011) concept, high engagement might involve frequent, proactive interactions with AI learning tools (e.g., Cipherbot), while low engagement might reflect passive or rare use. This categorisation provides a practical lens for this study and enables differentiation of AI chatbot users by frequency, question types and perceptions, as outlined in the RQs.

Method

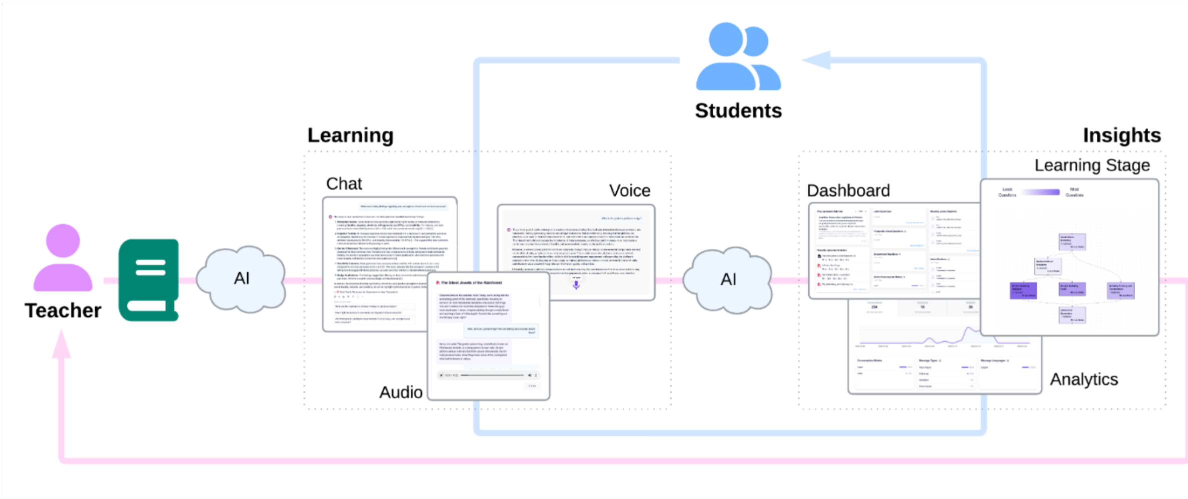
Educational AI chatbot - Cipherbot

Cipherbot is a state-of-the-art AI educational chatbot developed by the second and third authors (Aldous et al., 2025; Azem et al., 2025) that bases its answers to student questions on learning material uploaded by the instructor (see Figure 1). Cipherbot operates on OpenAI's ChatGPT 4o, and integrates other technologies, such as Redis Queue, Celery, Azure Storage, Azure Cognitive Search and Azure OpenAI Chat Completions. Cipherbot has multilingual capabilities (Medina et al., 2025), allowing students to interact in either English or Arabic, with automatic language detection and translation features that ensure comparable responses in both languages. This multilingual capability was particularly important in the present context, given that all participants were bilingual and the course was taught in English, as students could pose questions in Arabic for conceptual clarification. Additionally, Cipherbot supports learning through chat, voice, and audio interactions, providing students with real-time assistance.

Furthermore, unlike many commercial AI systems, Cipherbot grounds its responses in content curated by the course instructor to mitigate ethical concerns regarding accuracy and relevance (Salminen et al., 2024a). It also addresses the problem of hallucination, in which LLMs generate factually incorrect information, by identifying and revealing the resources in the chat as available references (Salminen et al., 2024b), where such reference features of the course content provide students with an avenue to conduct in-depth analyses of the chatbot's responses. Learning analytics dashboard enables instructors to assess students' engagement through frequency reports that document the number and modes of their conversations, as well as the types of questions and language used. Cipherbot's system overview is shown in Figure 1.

Figure 1

System overview of Cipherbot.



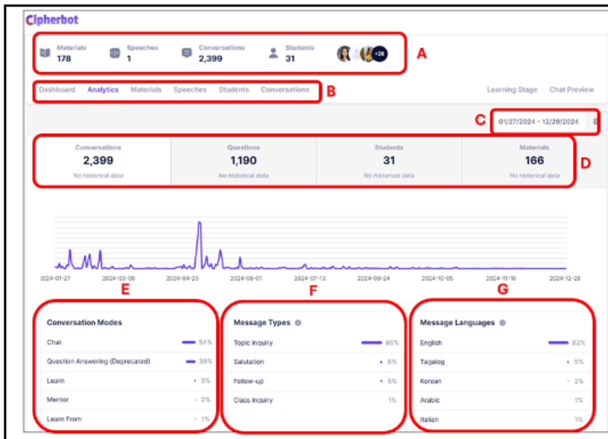
Research Design

Pedagogical intervention design and implementation

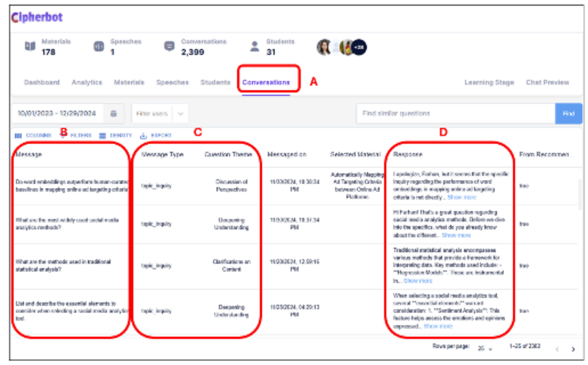
The first author uploaded required course material for the classroom management course, including PowerPoint presentations, articles, and textbooks to Cipherbot. Over the 14-week semester, students used Cipherbot to search for and clarify course concepts, engage in classroom discussions by comparing AI-generated responses with peer insights, prepare assignments and develop structured responses to course-related prompts. For example, students asked Cipherbot to generate classroom management scenarios, suggest disciplinary strategies, and role-play teacher-student interactions. Outside class, students independently used Cipherbot to deepen their understanding and prepare for assessments, and they could choose how often and what to ask based on their needs. The instructor remained responsive to students' real-time interactions, providing timely feedback and adjusting the pace of engagement or discussing ethical concerns such as accuracy and reliance on AI. Importantly, the chatbot was integrated into classroom activities but not imposed on pre-service teachers, thereby allowing them to engage voluntarily and at their own discretion (Chaaban, 2025; Chaaban et al., 2025). An example interaction and interface afforded by Cipherbot are shown in Figure 2.

Figure 2

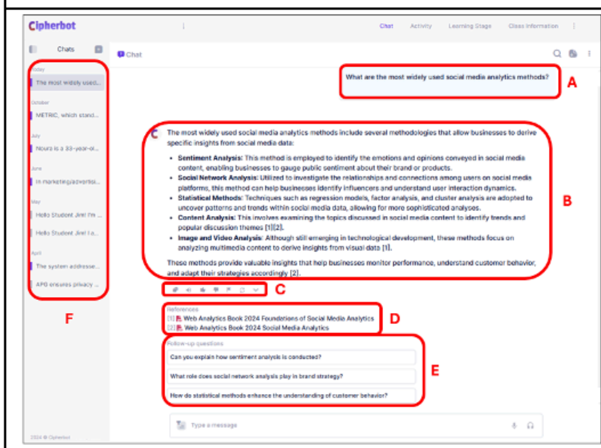
Screenshots of some of the interfaces afforded by Cipherbot



(a) Educators' interface where teachers can view existing class information, including A. course overview, B. instructor tab, C. reporting period, D. student engagement metrics, E. dialogue modes, F. message types, and G. language used, among many other instructor features and analytics.



(b) Conversations tab for educators A. where teachers can view conversations that have occurred within the course, including B. student questions, C. message types and themes, and D. Cipherbot responses, among many other conversation attributes, including questions not answered by the system.



(c) Student conversation interface. A. student query, B. Cipherbot response with citations to course material, C. student reactions, copy, etc., D. clickable course material, E. follow-up questions, and F. conversation history.

(d) Course material interface. A. material name, category, and theme, B. LLM generated title and summary based on the content, and C. LLM generated question and answer pairs. The Cipherbot responses are based on the course material vetted by the instructor.

Participants

Participants were 33 pre-service teachers taking a classroom management course as part of their teacher education program. The participants ranged in age from 20 to 29 years. Nationality data revealed a diverse group, including 21 (64%) Qatari and 12 (36%) expatriates. Academically, participants were in their third (N=14, 42%) or fourth (N=19, 58%) year of study, consistent with the course's placement in the teacher education program. All participants were bilingual in Arabic and English, with English as the primary language of instruction in this course. Participants interacted with Cipherbot and participated in post-course interviews conducted in their preferred language. They were informed of the study at the beginning of the semester and signed consent forms in compliance with the university's IRB committee approval (QU-IRB 198/2024-EA). The consent forms included details on voluntary participation and withdrawal. All students agreed to participate, and none withdrew from the study.

Procedure

Data collection and analysis

The quantitative component of this mixed method stud included learning analytics tracked and analysed through Cipherbot's interface, while the qualitative component consisted of individual interviews with participants. Participants' interactions included 2,189 generated messages recorded throughout the semester. These messages were categorised by engagement frequency, question type and actual use of Cipherbot. We analysed message length and question types to capture qualitative dimensions of engagement. Whereas engagement shows participation intensity, message length provides further insight into interaction, and question types indicate cognitive and agentic orientation, together enabling a multidimensional assessment of AI-mediated engagement (Fredricks et al., 2004; Chi & Wylie, 2014).

To systematically examine engagement levels, participants were divided into three groups: (1) high engagement users (120+ messages): Frequent users who relied on Cipherbot for clarification, extended learning, and iterative questioning, (2) medium engagement users (25-119 messages): Selective users who engaged with AI to support discussions and enhance coursework, and (3) low engagement users (≤24 messages): Infrequent users who primarily used AI for occasional fact-checking or complex queries. We use message frequency as an indicator of engagement, providing a metric of participation in AI learning environments; however, message frequency may not fully capture qualitative dimensions such as cognitive depth, motivation, or reflective learning (Fredricks et al., 2004; Gašević et al., 2015).

First, our analysis of message frequencies revealed clear natural breaks in the distribution at approximately 24 and 120 messages, which informed the group boundaries. This approach is consistent with prior learning analytics practices for identifying engagement segments (Kovanović et al., 2015; Gašević et al., 2015). Second, we calibrated the thresholds for comparative analysis, consistent with prior engagement classification research (Khalil et al., 2017). This classification enabled a structured analysis of how engagement levels varied across question patterns and perceptions of AI's role in education. The thresholds were further supported by a one-way ANOVA confirming statistically significant differences in message frequency between groups.

At the end of the course, participants took part in face-to-face individual interviews, conducted in English or Arabic and lasting 30-60 minutes each. Arabic transcripts were translated into English by the first author, who is a native Arabic-English bilingual. All interviews were first segmented into meaning units (coded comments) and analysed through a descriptive frequency count into topical categories, and then thematically analysed. This process entailed several systematic steps (Braun & Clarke, 2006). First, the first and third authors read and re-read the transcripts to record initial impressions and code recurring ideas related to engagement and perspectives on AI. They agreed on six topical categories aligned with participants' views of Cipherbot: uses, benefits, drawbacks, ethical considerations, suggestions for improvement, and instruction with AI. They then calculated the frequency of coded comments within each category for high, medium, and low engagement groups to support cross-group comparisons. In this frequency count, N represents the number of coded comments assigned to each topical category within each engagement group, and % represents the proportion of that group's total coded comments.

Throughout the analysis, the authors held deliberation sessions to discuss coding disagreements and refine code definitions and decision rules. They assessed intercoder agreement to confirm consistent coding and calculated intercoder reliability using Cohen's Kappa, yielding a coefficient of $\kappa = .83$, indicating strong agreement. They resolved discrepancies through consensus and documented all revisions to create an audit trail. For the thematic analysis, they divided participants' transcripts into three engagement levels to identify emerging categories and themes that differentiated them. Themes were developed inductively, allowing them to emerge from the data rather than imposing preexisting frameworks, though they were informed by theoretical lenses such as self-determination theory (Ryan & Deci, 2020) and agentic engagement (Reeve & Tseng, 2011; Reeve et al., 2025).

Analysis

The results of this study are presented in two parts: quantitative results include message frequency, message types, question themes, and interaction patterns across high-, medium-, and low-engagement groups. Following this, qualitative findings from individual interviews with participants are presented and analysed thematically to explore students' perceptions of their experiences and interactions with Cipherbot. Engagement with Cipherbot varied among participants: 7 (21.2%) were high-frequency users (120+ messages), 18 (54.5%) were medium-frequency users (25-119 messages), and 8 (24.2%) were low-frequency users (≤24 messages).

Quantitative results

Cipherbot automatically classifies questions into message types of *Class Inquiry* (i.e., questions about the course), salutation (i.e., greetings to Cipherbot), *Topic Inquiry* (i.e., the first question from a student about a topic), and *Follow up* (i.e., questions that follow the initial question by a student). The distribution of message type is shown in Table 1.

Table 1

Distribution of message type

Message Type	Count	Percentage
Topic Inquiry	1,930	88.17%
Follow up	171	7.81%
Class Inquiry	67	3.06%
Salutation	21	0.96%
	2,189	100%

A total of 2,178 chats were questions (12 messages were not classified by the system) and targeted the following themes: *Content clarifications* (36%), *Deepening understanding* (34%), *Discussion of perspectives* (10%), and *Application of knowledge* (7%), as shown in Table 2 and elaborated with examples in the Appendix. Cipherbot automatically generates these analytics and provides the instructor with just-in-time statistics on student engagement with the chatbot.

Table 2

Question types and count

Question Theme	Count	Percentage
Content clarifications	795	36.50%
Deepening understanding	762	34.99%
Discussion of perspectives	227	10.42%
Application of knowledge	162	7.44%
Assignment assistance	72	3.31%
Greetings	46	2.11%
Critical Thinking	31	1.42%
Group collaboration	30	1.38%
Making connections	19	0.87%
Practical challenges	10	0.46%
Potpourri	24	1.11%
Total	2,178	100%

Cipherbot derives the categories presented in Table 2 by integrating established frameworks on educational questioning, cognitive engagement and scaffolding in learning interactions. The categories draw on Dillon's (1981) research on classroom questioning to distinguish between factual, procedural and conceptual student inquiries. Chi and Wylie's (2014) ICAP framework for defining active student engagement serves as the foundation for linking to deeper learning outcomes. Bloom's revised taxonomy (Anderson & Krathwohl, 2001) informs the hierarchical differentiation between clarification, application and critical thinking questions. These classifications were generated automatically by Cipherbot's learning analytics system and reviewed by the first and third authors, who independently examined a random sample to confirm they accurately reflected the content of student messages.

Table 3 illustrates interaction patterns across engagement groups in response to RQ1.

Table 3

Interaction patterns among high, medium and low engagement users

Row labels	Average of count of message	Std dev of the count of message	Max of count of message	Min of count of message
High	176.17	46.63	254	121
Medium	59.39	27.63	118	25
Low	7.88	3.18	10	1
Overall	68.41	63.34	254	1

As shown in Table 3 the three groups differed substantially in both the frequency and variability of chatbot usage. High engagement users showed consistently intensive interaction, with their minimum message count still exceeding the maximum for the medium group, demonstrating a consistently intensive engagement with the chatbot. The relatively high standard deviation (46.63) indicates some variation in usage within this group but consistently high interaction overall. Medium engagement users exhibited moderate but more varied interaction, suggesting that some participants engaged regularly while others used the chatbot sporadically. Their maximum message count approaches the lower end of the high group, indicating some overlap in behaviour but a generally lower reliance on the tool. By contrast, low engagement users engaged infrequently with the chatbot. We conducted a one-way ANOVA of total message count and engagement group (high, medium, low). Results reveal a statistically significant difference in message frequency between groups, $F(2, 32) = 64.21$, $p < .001$. Post hoc comparisons using Tukey's HSD test indicated statistically significant differences among engagement groups, confirming that the three engagement categories represent statistically distinct usage patterns.

Table 4 shows the differences in message length across high, medium and low engagement users and sheds light on their distinct interaction styles with Cipherbot.

Table 4

Message length across engagement levels

Row labels	Average of message length (characters)	Average of message length (words)
High	185	28
Medium	117	17
Low	277	42
Overall	154	23

As shown in Table 4, high engagement users, who sent the most messages, had an average message length of 28 words, while medium engagement users had shorter messages, averaging 17 words. In contrast, low engagement users, despite sending the fewest messages overall, produced the longest messages, averaging 42 words.

In response to RQ2, the most common types of questions among high, medium, and low engagement users of the AI chatbot are presented in Table 5. Across users, topic-related inquiries were the dominant message type, indicating that participants primarily relied on the chatbot for subject-matter assistance. However, differences emerge in other message types. High engagement users sent the highest proportion of follow-up questions, suggesting deeper engagement and iterative learning. In contrast, medium users exhibited slightly lower follow-up rates. Still, they had a higher proportion of class-related inquiries, indicating that they also used the chatbot for administrative or course-related questions. Low engagement users, though, had a notably higher proportion of salutations, suggesting more infrequent but socially oriented interactions.

Table 5

Message types across high, medium, and low engagement users

Row labels	Count of message type (N)	Percentage
High	**1057**	
Class Inquiry	16	1.51%
Follow up	99	9.37%
Salutation	7	0.66%
Topic Inquiry	**935**	**88.46%**
Low	**63**	
Class Inquiry	2	3.17%
Follow up	1	1.59%
Salutation	6	9.52%
Topic Inquiry	**54**	**85.71%**
Medium	**1069**	
Class Inquiry	49	4.58%
Follow up	71	6.64%
Salutation	8	0.75%
Topic Inquiry	**941**	**88.03%**
Total	**2189**	

According to Table 6, high engagement users strongly emphasised content clarification and deepening understanding. They also engaged more in discussing perspectives and applying knowledge. Medium engagement users, following a similar pattern, placed a slightly greater emphasis on deepening understanding than on clarifications, indicating that they might have used the chatbot more selectively for in-depth learning rather than frequent quick clarifications. They also demonstrated a slightly higher application of knowledge, showing a practical engagement with the material. Low engagement users, in contrast, overwhelmingly sought deepening understanding, suggesting that when they did engage, they tended to use the chatbot for more complex or difficult concepts rather than routine clarifications.

Table 6

Question themes across high, medium and low engagement users

Question themes	High		Medium		Low	
	Count	**%**	**Count**	**%**	**Count**	**%**
Content Clarifications	**408**	**38.67%**	379	35.6%	10	16.95%
Deepening understanding	340	32.23%	**391**	**36.7%**	**31**	**52.54%**
Discussion of perspectives	114	10.81%	107	10.1%	8	13.56%
Application of knowledge	71	6.73%	89	8.4%	2	3.39%
Assignment assistance	37	3.51%	33	3.1%	2	3.39%
Group collaboration	23	2.18%	19	1.8%		
Critical thinking	20	1.90%				
Connections to other topics	15	1.42%	4	0.4%		
Greetings	12	1.14%	28	2.6%	6	10.17%
Exam preparation	7	0.66%				
Feedback and suggestions	4	0.38%	2	0.2%		
Practical challenges	3	0.28%	7	0.7%		
Potpourri	1	0.09%	5	0.5%		
	1055	100.00%	1064	100.0%	59	100.00%

Qualitative findings

In response to RQ3, this section reports on the thematic analysis of the qualitative data. Table 7 presents the frequency of comments made by high, medium and low engagement users about Cipherbot during interviews, organised into six topical categories. The table is provided to contextualise the thematic analysis by showing the relative salience of each topic across groups.

Table 7

Views on AI across high, medium and low engagement users

Views on AI	High	%	Medium	%	Low	%	Total	%
Uses	12	27.9%	43	22.9%	35	24.0%	90	23.9%
Benefits	14	32.6%	74	39.4%	52	35.6%	140	37.1%
Drawbacks	4	9.3%	13	6.9%	11	7.5%	28	7.4%
Ethical considerations	7	16.3%	31	16.5%	28	19.2%	66	17.5%
Suggestions for improvement	1	2.3%	4	2.1%	9	6.2%	14	3.7%
Instruction with AI	5	11.6%	23	12.2%	11	7.5%	39	10.3%
Total	43	100.0%	188	100.0%	146	100.0%	377	100.0%

Medium users were the most vocal, contributing the highest number of remarks across all categories, particularly in the benefits and uses of AI. Low users followed with a notable emphasis on benefits and uses, but also a higher relative focus on ethical considerations and suggestions for improvement. Despite their minimal interaction, they had significant concerns and ideas about AI's role in education, and reflected scepticism and a desire for enhancements to increase trust. High users, with the fewest comments, focused primarily on benefits and uses, with fewer remarks on drawbacks and suggestions for improvement. Their extensive use led to a more positive, yet less critical perspective, though they still noted some ethical considerations and instructional needs. Overall, students valued Cipherbot's utility but raised ethical and practical concerns, with medium and low users driving broader discourse. The medium users' dominance in feedback shows that moderate engagement is a bridge between high reliance and low scepticism. Because these figures reflect a descriptive count of coded interview comments, they are interpreted as indicators of what participants discussed most often, not as direct evidence of the depth or quality of viewpoints.

Each topic was then analysed thematically across engagement groups. Despite variations in the quantity of comments, the qualitative analysis revealed a consensus among the three engagement groups. The benefits noted by the three groups included: (1) ease and speed of access to information, (2) enhanced understanding and learning and (3) increased confidence. The drawbacks noted by the three groups included: (1) over-reliance leading to reduced independent thinking, (2) limited scope or depth of information, (3) inaccurate or conflicting responses and (4) difficulty in formulating effective questions.

Variation in uses of AI

High engagement users demonstrated intensive, proactive use, medium engagement users exhibited selective, balanced application, and low engagement users showed infrequent, instructor-prompted engagement. Two overarching themes emerged: (1) assignment support and concept clarification and (2) in-class engagement and group collaboration.

Assignment support and concept clarification

Across all three engagement groups, Cipherbot served as a critical tool for assignment support, though the depth and frequency of use varied significantly.

High users relied heavily on Cipherbot as a primary resource, with P2 using Cipherbot "with everything for this course" and commenting: "I actually cancelled ChatGPT, I kept using Cipherbot for every subject." Another difference across groups is that the high engagement group members extended their use of Cipherbot beyond the classroom management course. P3 explained how she expanded her uses of Cipherbot: "with other courses, especially with linguistic courses, it was so much easier, I created another chat, and then I attached the file, and I ask Cipherbot could you explain this chapter, and it was the actual stuff. I did this with two of my other courses"

Medium users applied Cipherbot more selectively and purposefully, as well as make use of the resources that appear at the end of the chat (e.g., course references, follow-up questions). For instance, P6 explained this process as follows: "I would chat with it, ask it some questions, ask it some more questions and look at the resources that it gives me for this answer so I can understand." P7 further elaborated: "Before asking Cipherbot about the questions I need, I actually researched about them. I go read the PowerPoints or the content on Blackboard. If I still didn't understand I will go and ask Cipherbot." P8 described a similar learning process with Cipherbot: "I start with myself and then I ask Cipherbot and then I get more ideas and then I start thinking and expanding on my understanding." P15's use was also strategic, as she explained: "If I have research and I believe that my point could be further explained or I should explore it more, then I go ask Cipherbot. And then if I'm not convinced with Cipherbot, then I would go through the material and try to pick what I want and then try to ask Cipherbot about it"

Low users used it sporadically and were often prompted by specific needs rather than routine integration, as P16 commented: "it depends if I needed it, like some weeks maybe I did go without using it." P18 also noted other AI tools, which she found more useful (e.g. Humata, ChatGPT and POE), and used Cipherbot "only once because there was the PowerPoint, there was information I didn't understand it clearly. So, I searched for it through Cipherbot."

Furthermore, consistently across the groups, participants used Cipherbot for concept clarification. High users like P1 used it "to simplify something that is hard to understand," and P3 to "break it down," so she did not "have to read the entire chapter." Medium users employed it selectively for clarification, with P5 typing questions "when I didn't understand something" in class, often supplementing with personal effort, such as reading course material and searching for other sources. Low users also sought clarification, with P16 using it for "a more detailed explanation" on misbehaviour examples yet remained sceptical toward the generated answers and sought other references or depended on their understanding of course material. These patterns reflect qualitatively distinct expressions of SDT's autonomy construct: high users appropriated the tool proactively, medium users integrated it selectively to preserve their own reasoning, and low users exercised autonomy through deliberate restraint.

In-class engagement and group collaboration

The second theme, which shows participants' use of Cipherbot for in-class engagement and group collaboration, revealed high users dismissing such use, while medium users commended in-class collaboration and low users depended on instructor-led group engagement. As high users focused on their individual uses of Cipherbot, medium users leveraged it for in-class group tasks. For example, P8, a high user, explained how her team integrated Cipherbot for their group presentation to engage other students:

> Instead of printing the materials, we can just assign for the classroom to just read from Cipherbot… we gave them four minutes to do the task and they finished it… it was really impressive, otherwise they would have gone to other resources, they could have taken ten minutes to research in the classic traditional way.

Low users also relied on it during instructor-prompted class activities. Low user P17 noted the way the instructor "would ask a question or she would ask us to search something that she has already talked about; we would later just put into a Cipherbot and come up with answers as groups." They further noted an instance where peers, during their presentation, directed the class to use Cipherbot to explore classroom behaviour models, showing its use in student-led in-class activities. Accordingly, their uses of Cipherbot were predominantly instructor or peer-prompted, where in-class use often supplemented limited out-of-class engagement. From an SDT perspective, low users' in-class engagement was mediated primarily by relatedness, through a dependence on instructor and peer scaffolding, rather than the autonomous, self-initiated use characteristic of higher engagement groups.

Variations in perspectives on ethical considerations

The high engagement users generally expressed minimal ethical concerns about using Cipherbot in their coursework, and reflected trust in its instructor-curated design. When ethical concerns were absent, they attributed this to responsible usage practices and Cipherbot's reliability compared to other AI tools like ChatGPT. When concerns emerged, they were conditional, tied to misuse (e.g., copy-pasting) rather than inherent flaws in the tool itself. For example, P1 (a high engaged student) explicitly stated she had no ethical concerns about using Cipherbot in the classroom, saying, "I know my instructors knows that if I'm copy pasting, then it's called cheating. But like, if I'm taking inspiration, then it's not." P2, another high engaged student, also expressed no ethical concerns about Cipherbot, asserting, "I stopped using ChatGPT because I feel their information is not accurate, aside from Cipherbot it has references that you apply them… it tells you where it got them from." Her lack of concern is rooted in Cipherbot's reliability and transparency, contrasting it with ChatGPT's inaccuracies and concerns of lack of underlying references.

The medium users exhibited a range of ethical concerns about using Cipherbot, with most participants expressing some level of worry, though often mitigated by responsible usage or trust in its design. Their concerns were primarily centred on plagiarism risks from copy-pasting, loss of originality or personal voice, and over-reliance impacting learning integrity. For instance, P4 stated: "I don't do copy and pasting. I am afraid that it will show plagiarism… In our university it shows if you use it. The doctors have AI detectors, and they can know when we have used AI." P5 and P6 agreed on the need to "rewrite the answers that it gives," suggesting this concern can be managed through responsible practice. P8's ethical concerns were conditional: "We were allowed to use it… as long as we're saying our own words… it should have some sense of originality… it depends on the subject because if we're allowed or not, that's the first ethical concern. Second of all, the originality." Trust in Cipherbot's sourcing and instructor approval of its use eliminated their ethical concerns.

The low users displayed a mixed stance on ethical concerns about using Cipherbot. When ethical concerns emerged, they focused mainly on the loss of personal voice and originality. P16 articulated a deep concern toward her struggle with over-reliance and its impact on her autonomy as follows:

> I'm looking back and comparing what I'm submitting now versus the quality and the depth of work that I used to submit. When I'm reading the documents I used to submit, I can see myself writing this. This is me. It does reflect me. It does represent me. Meanwhile, these other documents I'm submitting at the moment, it's just looking like what any generic AI tool could come up with. It does not reflect me. It does not represent me 100%.

She continues to struggle with the agency of AI tools, indicating: "I'm looking forward to completely eliminating it, because I really cannot sit on my own and think for my own. I can no longer think for my own." P16's account is theoretically insightful as her experience reflects a perceived erosion of autonomy, one of the Ryan and Deci's' (2020) three core psychological needs, manifested as a diminishing sense that her academic outputs originated from her own thinking and volition. Yet at the same time, she is agentic in the sense of recognising this erosion and deliberately choosing to withdraw from the tool as a self-protective act, reaffirming her ownership over her learning and her emerging professional voice. On the contrary, other participants in this group reported minimal or no concerns, attributing this to ethical usage practices and Cipherbot's instructor-curated framework. P18 expressed no concerns, commenting, "I don't have ethical concerns, because only getting information," while P19 similarly dismissed worries, saying, "I don't think so… It's like you are using technology to give you the information," seeing no difference between other digital research tools and the agentic AI tools.

Consensus on instruction with AI

Students across levels viewed Cipherbot as a valuable tool alongside classroom instruction and instructor guidance. The high users saw it as a practical tool that enhances instruction, with P1 noting, "When I ask you, my instructor, it's easier than Cipherbot, but if you're not there, then my second choice is Cipherbot," and P2 adding, "It's only supplementary to the instructor's explanation, I still want the doctor to explain things to me… So we're learning through discussion, through talking to our classmates, talking to the instructor. And Cipherbot play a role in these discussions." These participants also noted how other instructors were not open to the use of AI in their courses, and "they're following a tradition way to teach and they're not really open to AI, and they feel that it's not useful for the students because they are not learning from it."

The medium users, similarly, noted the need for pedagogical guidance with AI, emphasizing the importance of the instructor's role in amplifying the usefulness of Cipherbot. Similar to P5, P14 insisted on her preference for teacher-directed instruction and for "information coming from the instructor." Participants in this group also noted other professors not approving the "use AI because they think that the only way we will use it is to just give them our assignments. Make them do it for us and then just copy and paste," as explained by P6. This made them feel comfortable using Cipherbot in the presence of the instructor, "because she gave us the access to search. It feels different than sneaking trying to see the answer like in other courses," as P8 illustrated. On a final note, P11 showed the secondary role of Cipherbot for engagement, saying: "I feel like I would have engaged with the content just as much even without Cipherbot. I think it's more on like personal interest in the content and the instructor who utilised it in a really good way"

From the low users, similarly, P17 said, "When she tells us to use Cipherbot, it makes me like concentrate more, but it's not only because of Cipherbot, it's because of the professor," and P19 noted, "I like the way that it's discussion and getting the information by discussion. It's the instructor that manages the way the Cipherbot is being used anyway. So, it's all about the instructor their pedagogy and their instruction," viewing Cipherbot as enhancing participation when guided, but not replacing instruction.

Practical Implications

This mixed method study revealed distinct engagement patterns and perceptions of an AI chatbot among 33 pre-service teachers, which were categorised into high, medium, and low engagement users, based on a total of 2,189 messages over a 14-week semester in an undergraduate classroom management course. The variations in interaction style underscore that frequency alone is insufficient for understanding AI engagement, and that the depth of engagement, quality, purpose, and agentic orientation of interactions are equally important.

First, high engagement users sent frequent yet concise messages, which were dominated by topic inquiries and follow-ups, with question themes emphasizing clarifications and deepening understanding. Almassaad et al. (2024) similarly found that 78.7% of students frequently used AI tools like ChatGPT for tasks such as concept clarification and assignment support and cited benefits like timesaving and ease of access, yet their limited ethical concerns echo potential overreliance risks. Qualitatively, the highly engaged participants reported extensive reliance on Cipherbot for assignment support and concept clarification and extended their use of Cipherbot across courses. However, these contributed fewer comments relative to participants from other engagement groups, with these comments primarily focused on benefits and uses, with minimal ethical concerns (7) tied to misuse rather than flaws in the AI tool. The highly engaged participants adopted a proactive, individual approach, preferring self-directed learning over group dynamics. Their minimal reliance on instructor or peer interaction further suggests that relatedness needs were largely unmet or deprioritised in favour of autonomous use.

The profile of the high engagement group shows similarities to the experimental group in Wang and Xue's (2024) study, where English as a Foreign Language (EFL) students received AI-assisted instruction via chatbots (e.g., TalkAI, Wenxin Yiyan) and, similar to this group, demonstrated increased academic engagement, particularly in personalised learning contexts. The group's intensive autonomous use suggests high engagement may stem from AI's capacity to support self-directed learning. Their minimal ethical concerns, though, should be noted in reference to the oftentimes high academic workload and time pressures documented in Abbas et al. (2024), who revealed frequent use as a coping mechanism for such pressures. These uses may lead to negative engagement behaviours, such as procrastination (Abbas et al., 2024; Darvishi et al., 2024) and an overreliance on AI. They may further lead to concerns over cognitive offloading, where students delegate their reasoning to the AI and jeopardise their opportunities for independent thinking and pedagogical decision making. For pre-service teachers, the risks are more serious because routinised reliance can become a habit of practice that they later transfer to their own classrooms, which will affect the way they respond to their future students' uses of AI and their learning needs. These concerns call for further structured guidance to balance AI use with independent critical thinking. Instructors could integrate AI literacy training, as recommended by O'Dea et al. (2024), to focus explicitly on ethical use and awareness of risks, such as procrastination and dependency, to prevent long-term negative behaviours, especially for pre-service teachers who will model ethical and responsible uses for their future students (Lee & Bryan, 2025).

Second, medium engagement users showed the highest variation in interaction, as they balanced shorter messages with a mix of topic inquiries, follow-ups and class inquiries, which primarily targeted deepening understanding and clarifications. Their qualitative comments reflected selective use for assignments and clarification, alongside frequent in-class collaboration, which corroborated with the quantitative group collaboration. They voiced significant benefits but also ethical concerns about plagiarism and originality, which they believed could be mitigated by instructor trust. Their infrequent use of Cipherbot, as shown in the quantitative results, diverges from their broader critical discourse emerging from the qualitative findings. Almassaad et al. (2024) similarly found 21.3% of students avoided AI due to limited knowledge or concerns about autonomy and academic integrity, which aligns with this group's cautious stance and preference for instructor guidance. This dependence on instructor trust and peer collaboration reflects a stronger relatedness need, which, when fulfilled, enabled more open and ethical engagement.

The medium group's balanced use and critical reflection suggest a nuanced interplay of autonomy and relatedness, key dimensions in SDT (Ryan & Deci, 2020). Similarly, Yang et al. (2024) identify this behaviour in their "resourceful" learners, who were shown to actively use ChatGPT to meet complex learning needs, thus reflecting high agentic engagement (Reeve et al., 2025), yet their critical reflections align more with Yang et al.'s "reflective" learners, who scrutinised AI outputs for relevance and accuracy. This may also explain why the medium group provided the most interview comments despite moderate use. Their position between routinised reliance and deliberate non-use appeared to create the most evaluative work because they had enough exposure to notice affordances and limits and enough distance to question them. Unlike Wang and Xue's (2024) uniformly positive engagement, this group's ethical tensions highlight a shift from surface-level use to deeper engagement, as they leveraged instructor-guided collaboration with autonomous reflections and illustrated a dynamic that is less evident in controlled interventions. Almassaad et al. (2024) similarly noted students' concerns about academic integrity, indicating that instructor trust, as voiced as a mitigator by this group, could be formalised through clear guidelines and collaborative activities that integrate AI outputs with human oversight, leading to deeper levels of engagement.

Third, low engagement users showed infrequent and sporadic use with the fewest messages but the longest average length. Their messages predominantly targeted topic inquiries and salutations, as they focused primarily on deepening understanding over clarifications. Their qualitative comments emphasised benefits and uses and the importance of an instructor-guided approach. However, they diverged in regard to ethical concerns about losing voice on one hand and a complete dismissal of ethical concerns on the other. These observations were not fully captured in their sparse quantitative interactions, which only showed deeper queries and infrequent use. The longer average message length observed among low engagement users may reflect a compensatory interaction strategy rather than deeper, sustained engagement. Prior research reports that infrequent users of digital learning tools often consolidate multiple interactions into single extended queries, as they attempt to resolve complex learning challenges (Gašević et al., 2015; Kovanović et al., 2018). This low engagement motivation aligns with their qualitative accounts of cautious, needs-based use and limited integration. Their reliance on instructor and peer-prompted interactions suggests that relatedness was the primary psychological need mediating their engagement, rather than autonomy or competence.

These patterns parallel Yang et al.'s (2024) "resistive" and "receptive" learners: resistive students rejected ChatGPT due to scepticism about its utility, while receptive ones passively consumed outputs without critical engagement. Both these students belonged to the low engagement group, though we disagree with Yang et al. (2024) that such patterns reflect low agency, as students exhibit agency in their refraining decisions, especially in the presence of ethical considerations (Dunn & Kennedy, 2019), and apprehensions over losing authorial voice and originality (Abbas et al., 2024; Vetter et al., 2024). In such cases, it cannot be assumed that the low engagement group exhibited surface learning with AI, but ways to take a protective stance against some of the adverse outcomes, such as reduced independent thinking. Our findings, thus, extend and complicate these claims by showing how several low users made deliberate decisions to limit or avoid Cipherbot use in a clear show of self-regulation rather than passivity. Choices as these add agentic refrain as intentional non-use when it protects learning goals and personal values. Accordingly, this study extends agentic engagement theory (Reeve & Tseng, 2011) by showing that agency manifests not only through frequent AI use, but also through selective use and intentional non-use, or what we term agentic refrain. These students should be encouraged to maintain their voice, authorship, and criticality (Chaaban, 2025; Chaaban et al., 2025), while showing ways that AI can leverage other aspects of their learning that do not interfere with voice and originality, as a deliberate choice (Darvishi et al., 2024; Vetter et al., 2024).

As Qatar's education system continues to expand e-learning and digital solutions, there can be several implications for learning and teacher education based on this study's findings. Importantly, how pre-service teachers engage with AI now is likely to shape their emerging professional identities and future classroom practices. Teacher education programs can integrate opportunities for AI chatbot use within courses in ways that keep the focus on learning goals, such as concept clarification, lesson planning rehearsal, and reflective practice. Programs can also strengthen ethical and responsible use by embedding academic integrity practice that addresses common risks, including overreliance, shallow processing, and blurred boundaries around authorship and originality; for instance, through reflection tasks in which pre-service teachers document what they contributed independently versus what AI generated. In the Qatari context, these implications should be interpreted alongside cultural, institutional and linguistic conditions, including a bilingual student population and the way instructor guidance influence trust and use patterns. Finally, as AI tools become more available and nationally endorsed, programs can protect peer interaction and collaborative learning by designing assignments where dialogue, co-construction, and classroom-based practice remain central, with AI positioned as a supplement that supports preparation and refinement rather than replacing human feedback and social learning; for instance by having student groups discuss a concept first, then consult Cipherbot, and evaluate its response against their prior discussion.

Limitations and Future Research

This study provides valuable insights into pre-service teachers' engagement with AI chatbots in teacher education, yet some limitations must be acknowledged. First, the sample size of 33 pre-service teachers positions this study as theory-building rather than broadly generalisable, as the aim is to develop conceptual insights. Future research should examine larger and more diverse samples across multiple courses and institutions to enhance external validity. Second, while the study categorises participants into high, medium and low engagement users based on message frequency, it does not account for other contextual factors, such as prior AI experience, motivation or digital literacy, that may influence engagement levels. Future studies should integrate pre-course surveys or additional behavioural tracking to capture these factors. Third, engagement was measured primarily through chatbot interactions and self-reported experiences, which may not fully reflect actual learning outcomes. Future research could incorporate performance-based assessments or longitudinal tracking to examine the long-term impact of AI chatbot engagement on academic achievement. Fourth, Arabic interview transcripts were translated by the first author without a formal validation procedure, which may have introduced unintentional interpretive bias. Despite these limitations, the study offers several strengths, including its mixed-methods approach, which combines learning analytics with in-depth qualitative insights to provide a nuanced understanding of AI-assisted learning. Additionally, the focus on agentic engagement extends traditional engagement frameworks, contributing to emerging research on student-AI interactions in educational settings. As such, the research presented here lays a foundation for future research in this exciting area.

Conclusion

This study opens avenues for longitudinal research to track how engagement patterns change and how instructors may address some of the limitations of using AI in the teacher education context (Almassaad et al., 2024). For instance, investigating high engagement users' long-term outcomes, such as procrastination or overreliance (Abbas et al., 2024; Darvishi et al., 2024), could clarify AI's sustained influence on engagement patterns and learning processes. Further, medium engagement users' balanced use warrants comparative studies across disciplines for subject-specific literacy differences (O'Dea et al., 2024). For low engagement users, exploring prior experiences, beliefs and values (O'Dea et al., 2024; Dunn & Kennedy, 2019) could elucidate reasons behind agentic refrain.

This study offers insight that a balanced approach is key and instructor guidance remains indispensable. Notably, medium users showed how selective engagement accompanied by verification and reflection may maximise benefits while limiting risks. Further, they reinforced the need for instructor guidance as a condition for ethical and effective use. Through modelling and clear expectations, they showed trust in the tool, questioned outputs and kept AI support aligned with course goals. For pre-service teachers, ensuring ethical AI engagement may be necessary to prepare them for their future classroom practices, where technology and human agency coexist (Moorhouse et al., 2024). The insights from this study advocate for a proactive and informed integration of AI chatbots, such as Cipherbot, to ensure they enhance rather than undermine the development of reflective and autonomous individuals, capable of navigating the complexities of a future with AI.

Acknowledgements

The authors disclose that they have no actual or perceived conflicts of interest. The authors disclose that they have not received any funding for this manuscript beyond resourcing for academic time at their respective universities. The authors have not used artificial intelligence in the ideation or design of this research as per Crawford et al. (2023). The authors confirm that they have met the ethical standards expected as per Purvis and Crawford (2024).

The authors list the following CRediT contributions: Conceptualisation [Youmen Chaaban, Soon-Gyo Jung and Bernard Jansen]; Methodology: [Youmen Chaaban and Bernard Jansen]; Formal analysis and investigation: [Youmen Chaaban and Bernard Jansen]; Writing - original draft preparation: [Youmen Chaaban and Bernard Jansen]; Writing - review and editing: [Youmen Chaaban, Soon-Gyo Jung and Bernard Jansen], Resources: [Soon-Gyo Jung].

References

Abbas, M., van Rosmalen, P., & Kalz, M. (2024). Is it harmful or helpful? Examining the causes and consequences of generative AI usage among university students. *Education Sciences, 14*(6), 607. https://doi.org/10.3390/educsci14060607

Aldous, K., Salminen, J., Jung, S.G., Azem, J., Medina, J., Khan, S. M., Alabed, A., and Jansen, B. J. (2025) Investigating the Usability of an Educational AI Chatbot by Middle School Teachers and Students for Enhanced Learning, *The 3rd International Conference on Foundation and Large Language Models (FLLM2025),* 25-28 November 2025, Vienna, Austria.

Almassaad, A., Aleisa, A., Alghamdi, S., Alharbi, S., Alfaleh, R., & Alwabari, N. (2024). Student perceptions of generative artificial intelligence: Investigating utilization, benefits, and challenges in higher education. *Frontiers in Education, 9*, Article 1335337. https://doi.org/10.3389/feduc.2024.1335337

Anderson, L. W. and Krathwohl, D. R., et al (Eds.) (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group)

Annamalai, N., Eltahir, M. E., Zyoud, S. H., Soundrarajan, D., Zakarneh, B., & Al Salhi, N. R. (2023). Exploring English language learning via chatbot: A case study from a self-determination theory perspective. *Computers and Education: Artificial Intelligence, 5*, 100148. https://doi.org/10.1016/j.caeai.2023.100148

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. Psychology in the Schools, 45(5), 369-386. https://doi.org/10.1002/pits.20303

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Chaaban, Y. (2025). Exploring research ethics through the lens of critical posthumanism in the age of Artificial Intelligence. *Teaching in Higher Education, 30*(7), 1740-1755. https://doi.org/10.1080/13562517.2025.2465995

Chaaban, Y., Qadhi, S., Chen, J., & Du, X. (2024). Understanding researchers' AI readiness in a Higher Education context: Q methodology research. *Education Sciences, 14*, 709, https://doi.org/10.3390/ educsci14070709

Chaaban, Y., Jung, S.G., Medina, J., Azem, J. Y., Salminen, J & Jansen, B. J. (2025). Examining student teachers' agency in an AI-supported learning environment: Q methodology research. *International Journal of Artificial Intelligence in Education.* https://doi.org/10.1007/s40593-025-00529-y

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational psychologist, 49*(4), 219-243.

Darvishi, A., Khosravi, H., Sadiq, S., Gašević, D., & Siemens, G. (2024). Impact of AI assistance on student agency. *Computers & Education, 210*, 104967. https://doi.org/10.1016/j.compedu.2023.104967

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Springer. https://doi.org/10.1007/978-1-4899-2271-7

Dillon, J. T. (1981). A norm against student questions. The Clearing House: *A Journal of Educational Strategies, Issues and Ideas, 55*(3), 136-139.

Dunn, T. J., & Kennedy, M. (2019). Technology enhanced learning in higher education: Motivations, engagement and academic achievement. *Computers & Education, 137*, 104-113. https://doi.org/10.1016/j.compedu.2019.04.004

Finn, J. D., & Zimmer, K. S. (2012). Student engagement: What is it? Why does it matter? In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of Research on Student Engagement* (pp. 97-131). Springer. https://doi.org/10.1007/978-1-4614-2018-7_5

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109. https://doi.org/10.3102/00346543074001059

Gašević, D., Dawson, S., Rogers, T., & Gasevic, D. (2015). Learning analytics should not promote one size fits all: The effects of instructional conditions in predicting academic success. *The Internet and Higher Education, 28*, 68-84. https://doi.org/10.1016/j.iheduc.2015.10.002

Guan, L., Zhang, Y., & Gu, M. M. (2025). Pre-service teachers' preparedness for AI-integrated education: An investigation from perceptions, capabilities, and teachers' identity changes. *Computers and Education: Artificial Intelligence, 8*, 100341. https://doi.org/10.1016/j.caeai.2024.100341

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588-600. https://doi.org/10.1037/a0019682

Khalil, M., & Ebner, M. (2017). Clustering patterns of engagement in Massive Open Online Courses (MOOCs): the use of learning analytics to reveal student categories. *Journal of Computing in Higher Education, 29*(1), 114-132.

Kovanović, V., Gašević, D., Joksimović, S., Hatala, M., & Adesope, O. (2015). Analytics of communities of inquiry: Effects of learning technology use on cognitive presence in asynchronous online discussions. *The Internet and Higher Education, 27*, 74-89. https://doi.org/10.1016/j.iheduc.2015.06.002

Lee, H., & Bryan, L. M. (2025). Integrating AI in teacher education: Exploring the impact on pre-service teacher competencies. *Professional Development in Education, 51*(3), 478-494. https://doi.org/10.1080/19415257.2025.2490000

Moorhouse, B. L., Wan, Y., Wu, C., Kohnke, L., Ho, T. Y., & Kwong, T. (2024). Developing language teachers' professional generative AI competence: An intervention study in an initial language teacher education course. *System*, *125*. https://doi.org/10.1016/j.system.2024.103399

O'Dea, X., Wang, X., & Stern, J. (2024). Factors affecting university students' generative AI literacy: Evidence and evaluation in the UK and Hong Kong contexts. *Asia Pacific Education Review*. Advance online publication. https://doi.org/10.1177/14782103241287401

Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Computers and Education: Artificial Intelligence, 2*, 100033.

Purvis, A. & Crawford, J. (2024). Ethical Standards in Educational Research and Publication. Journal of University Teaching and Learning Practice, 21(9). https://doi.org/10.53761/hqnqr710

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology, 105*(3), 579-595. https://doi.org/10.1037/a0032690

Reeve, J., & Tseng, C.-M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology, 36*(4), 257-267. https://doi.org/10.1016/j.cedpsych.2011.05.002

Reeve, J., Basarkod, G., Jang, H.-R., Gargurevich, R., Jang, H., & Cheon, S. H. (2025). Specialized purpose of each type of student engagement: A meta-analysis. *Educational Psychology Review, 37*(13). https://doi.org/10.1007/s10648-025-09989-z

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology, 61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Salminen, J., Jung, S., Medina, J., Aldous, K., Azem, J., Akhtar, W., & Jansen, B. J. (2024a). Using Cipherbot: An Exploratory Analysis of Student Interaction with an LLM-Based Educational Chatbot. *Proceedings of the Eleventh ACM Conference on Learning @ Scale*, 279-283. https://doi.org/10.1145/3657604.3664690

Salminen, J., Jung, S.-G., Medina, J., Aldous, K., Azem, J., Akhtar, W., Häyhänen, E., & Jansen, B. J. (2024b). Communication Design for an Educational AI Chatbot: Analyzing Cipherbot's Communication Style and Challenges. *Proceedings of the 27th International Academic Mindtrek Conference*, 176-187. https://doi.org/10.1145/3681716.3681727

Sun, F., Tian, P., Sun, D., Fan, Y., & Yang, Y. (2024). Pre-service teachers' inclination to integrate AI into STEM education: Analysis of influencing factors. *British Journal of Educational Technology.* Advance online publication. https://doi.org/10.1111/bjet.13469

Skinner, E. A., Furrer, C., Marchand, G., & Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of Educational Psychology, 100*(4), 765-781. https://doi.org/10.1037/a0012840

Li, Q., Li, Y., Zhang, S., Zhou, X., & Pan, Z. (2025). A theoretical framework for human-centered intelligent information services: A systematic review. *Information Processing & Management*, *62*(1), 103891. https://doi.org/10.1016/j.ipm.2024.103891

Vetter, M. A., Lucia, B., Jiang, J., & Othman, M. (2024). Towards a framework for local interrogation of AI ethics: A case study on text generators, academic integrity, and composing with ChatGPT. *Computers and Composition*, *71*. https://doi.org/10.1016/j.compcom.2024.102831

Wang, Y., & Xue, L. (2024). Using AI-driven chatbots to foster Chinese EFL students' academic engagement: An intervention study, *Computers in Human Behavior, 159*, 108353. https://doi.org/10.1016/j.chb.2024.108353

Yang, S. J., Ogata, H., & Matsui, T. (2024). Human-centered AI in education: Augmented intelligence for enhanced learning environments. *Educational Technology Research and Development*. Advance. https://doi.org/10.1007/s11423-024-10407-3

Appendix

Question Theme	Example
Content clarifications	Can you elaborate more the definition of the model
Deepening understanding	What are some examples of differentiated instruction strategies that can be used in the classroom?
Discussion of perspectives	What are the consequences of not taking bullying as a serious phenomenon?
Application of knowledge	Develop 3-5 classroom rules that you will implement at the start of the school year.
Assignment assistance	make 3 slides power point about that and give examples.
Greetings	Hello
Critical Thinking	How can teachers effectively implement CBT in their classrooms?
Group collaboration	The teacher's approach of dividing students into groups with names like "Queens" and "Butterflies" fosters a sense of community and collaboration among students. how does that align with the psychological theory by calling them in names they like?
Making connections	Relation between cognitive development and moral development
Practical challenges	Relation between cognitive development and moral development
	Read the two case studies 6.1 and 6.2, from week 6 and then decide what function the bulletin boards perform in each case, name the case and the function
Potpourri	Can you give other recommendations?
	Where is Badr now?
	Make up your own