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Generative AI and the Community of Inquiry Framework: A Scoping Review of Teaching, Social, and Cognitive Presence

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Abstract

This scoping review synthesizes empirical studies examining how generative AI is associated with teaching, cognitive, and social presence within the Community of Inquiry (CoI) framework. Although generative AI has rapidly entered educational practice, its impact on teaching, cognitive, and social presence remains conceptually fragmented. To address this gap, we systematically searched for eligible literature following PRISMA guidelines and reviewed 21 peer-reviewed empirical studies published after the emergence of large language model-based AI systems (between November 2022 and July 2026) to identify research trends, AI roles in teaching and learning, and patterns of presence activation related to learning experiences. Findings indicate that first, generative AI has evolved beyond conversational agents to include pedagogical agents, AI-generated instructors, collaborative cognitive tools, and AI-supported learning environments, while teaching presence remains comparatively underexplored as an independent construct. Second, the distribution of presence dimensions is uneven: cognitive presence was most frequently associated with AI-supported exploration and integration processes, whereas resolution and independent examinations of teaching presence remained comparatively limited. Third, the reviewed studies suggested that presence-related outcomes varied by instructional approaches. Discussion and task-based activity were more often associated with reported indicators of cognitive presence, whereas pedagogical agents and socially expressive AI designs more frequently supported perceived social presence. The findings suggest that generative AI should not be regarded as a universal solution for strengthening the CoI framework. Rather, its educational value depends on how it is pedagogically configured within specific instructional contexts. The review contributes to a more nuanced understanding of AI-mediated learning by positioning generative AI as a design-sensitive pedagogical mediator and identifying directions for future theoretical and empirical research.

Keywords: Generative AI, Community of Inquiry, cognitive presence, social presence, teaching presence, learning presence, scoping review

Introduction

As generative AI has rapidly permeated society, people have unprecedented opportunities to communicate and collaborate with it. The education sector is no exception to this trend. Since an increasing number of students use generative AI tools for learning (Freeman, 2025), these tools have begun to serve multiple roles in teaching and learning, such as substitutes for human participants in instructional contexts (e.g., instructors, learners, or peers) (Xu & Ouyang, 2021), collaborators in writing (Kim et al., 2025), problem-solving partners (Law et al., 2025), AI teammates in collaborative learning (Darban, 2026), and co-facilitators that work alongside human teachers in blended learning environments (Pan et al., 2026). Along these lines, the number of empirical studies examining the effects of generative AI on learning outcomes has been rapidly increasing. Several meta-analytic studies (Wu & Yu, 2024; Sun & Zhou, 2024; Deng et al., 2025; Doo & Park, 2026) reported medium to large effect sizes, indicating positive effects of using generative AI for teaching and learning. This shift highlights the need for conceptual frameworks that explain how generative AI shapes teaching and learning processes

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rather than learning outcomes alone. To this end, Stenbom and Garrison (2026) contended that the Community of Inquiry framework provides a valuable lens for understanding, designing, and implementing collaborative learning in AI-supported environments.

The Community of Inquiry (CoI) framework has been widely adopted to understand teaching, learning, and interaction in online and blended learning environments. Garrison et al. (1999) proposed the Community of Inquiry (CoI) model to explain the pedagogical, social, and cognitive processes in online learning contexts. Because asynchronous online learning is less visible and tangible than traditional classroom learning, they used the term *presence* to describe key dimensions of the learning experience: teaching presence, cognitive presence, and social presence (Shea & Bidjerano, 2010). Social presence is defined as "the ability to project oneself and establish personal and purposeful relationships" (p. 63), while cognitive presence refers to "the exploration, construction, resolution, and confirmation of understanding through collaboration and reflection in a community of inquiry" (p. 65). Teaching presence encompasses design, facilitation, and direction to support and enhance learning. The CoI framework has received increasing attention because numerous empirical studies demonstrate that cognitive, social, and teaching presences of the CoI framework correlate with or predict learning achievement, learning engagement, and learning satisfaction (Martin et al., 2022; Ng, 2022; Richardson et al., 2022; Shea et al., 2022).

Academic interest in CoI presences continues in current studies of generative AI and learning analytics. For example, Castellanos-Reyes et al. (2025) developed a model to automate content analysis of text data using cognitive presence based on the practical inquiry model (triggering, exploration, integration, resolution). Given the documented associations between the CoI presences and learner engagement and satisfaction (Yang et al., 2026), understanding how generative AI relates to each presence is theoretically meaningful. Recent empirical studies have begun to examine the relationships between generative AI and one or more CoI presences (i.e., Xie et al., 2024; Xu et al., 2025; Yu et al., 2025). Studies have further extended this line of the research by examining teacher–AI co-facilitation (Pan et al., 2026), AI-supported learning analytics (Dong et al., 2026), ChatGPT-assisted instruction (Gunbatar & Gokcearslan, 2026), and AI-supported virtual teamwork (Darban, 2026).

Although a growing body of empirical studies and several meta-analyses have examined the educational use of generative AI, these studies have primarily focused on learning outcomes rather than the learning processes through which those outcomes are achieved. An increasing number of empirical studies have begun to examine generative AI through the lens of one or more CoI presences. However, this evidence remains fragmented across different educational contexts, instructional approaches, and dimensions of presence. To date, no scoping review has synthesized how generative AI has been examined in relation to teaching, cognitive, and social presence within the CoI framework. Accordingly, this scoping review maps and synthesizes empirical evidence on how generative AI has been examined in relation to teaching, cognitive, and social presence within the CoI framework.

The research questions guiding this study are as follows:

1. How has the relationship between generative AI and teaching, cognitive, and social presence been characterized in the existing literature?

2. Which patterns and imbalances can be identified in the existing research on generative AI and presence within the CoI framework?

3. What instructional approaches involving generative AI have been associated with strengthened presence within the CoI framework?

Theoretical Framework

Generative AI within Community of Inquiry Framework

Recent research has begun to examine how generative AI functions within the CoI framework. Rather than viewing generative AI merely as a tool, emerging scholarship conceptualizes it as an active instructional agent capable of influencing the dynamics among teaching, cognitive, and social presence. Stenbom and Garrison (2026) argued that AI should be understood as a sociotechnical actor capable of assuming multiple instructional roles within a Community of Inquiry, while emphasizing the importance of shared metacognition in regulating AI-supported inquiry. Building on this perspective, Anderson et al. (2025) examined how generative AI can support personalized learning by enhancing teaching, cognitive, and social presence. They argued that generative AI can compensate for limitations of the CoI framework, which is grounded in community building and knowledge construction through facilitation, by offering functions such as generating dynamic and interactive responses and providing personalized feedback. Similarly, Ba et al. (2025), Gilson et al. (2023), and Shahzad et al. (2025) highlighted the adaptive capabilities of generative AI, suggesting that differentiated scaffolding based on learners' prior knowledge, task completion rates, and levels of engagement may strengthen cognitive presence while also supporting instructional facilitation. Pan et al. (2026) extended this perspective by demonstrating that human teachers and generative AI can jointly enact teaching, social, and cognitive presence through a distributed CoI model, indicating that instructional presence can be shared between human and AI agents.

Empirical studies provide more differentiated insights into how generative AI influences specific dimensions of presence. With respect to *cognitive presence*, findings consistently indicate an imbalance across its four phases. Generative AI appears to most strongly support exploration—such as brainstorming, questioning, and information exchange—while resolution remains comparatively underdeveloped. For instance, Nasr et al. (2025) found that undergraduate students primarily used generative AI for follow-up questioning and idea generation, whereas applying new knowledge to problem-solving (resolution) was least evident. ENA-based analyses by Yu et al. (2025) similarly showed that exploration was the most frequently activated phase, followed by integration, with resolution occurring least often. These findings indicate that generative AI may facilitate idea expansion more readily than deeper synthesis or application. Ba et al. (2025) further demonstrated that the type of AI-generated feedback shapes the activation of cognitive presence. In online inquiry-based discussions, students who received idea-oriented feedback showed significantly higher levels of cognitive presence than those who received task-oriented feedback, particularly in the exploration and integration phases.

In contrast, research on *social presence* has largely focused on the relational and affective affordances of generative AI. Human-like interaction cues, conversational tone, and feedback styles have been shown to enhance perceptions of connection and engagement (Samala et al., 2024). Empirical evidence further suggests that the orientation of AI feedback may differentially

activate social dimensions of presence. Ba et al. (2025) demonstrated that task-oriented feedback strengthened social presence through open communication and collaboration, whereas idea-oriented feedback more strongly supported cognitive presence. Similarly, Xu et al. (2025) found that AI-generated instructors with higher behavioral fidelity significantly increased perceived social presence, satisfaction, and motivation. Xia et al. (2026) demonstrated that identity anthropomorphism in AI-supported learning environments enhanced learners' social presence, with positive emotions serving as an additional mediating mechanism.

Although *teaching presence* has received comparatively less empirical attention than cognitive presence, studies suggest that generative AI can support instructional design, facilitation, feedback, and co-facilitation with human instructors (Gunbatar & Gokcearslan, 2026; Pan et al., 2026). Nevertheless, empirical evidence on how generative AI reshapes teaching presence remains relatively limited compared with research on cognitive presence. Notably, Narang et al. (2025) explicitly examined generative AI roles across teaching, cognitive, and social presence. Their analysis of AI functioning as tutor, tool, and teammate suggests that different AI roles selectively activate different presences. When used as a tutor, generative AI was most closely associated with teaching presence through personalized guidance and feedback. As a tool, it primarily contributed to cognitive presence by supporting higher-order analysis, whereas as a teammate it facilitated collaborative engagement, thereby strengthening both cognitive and social presence. These findings imply that generative AI does not uniformly enhance presence but rather reconfigures the balance among presences depending on its pedagogical role.

Overall, these conceptual and empirical studies suggest that generative AI may influence different dimensions of CoI in distinct ways depending on its instructional role, interaction design, and pedagogical context. Understanding these patterns provides a theoretical foundation for synthesizing the emerging evidence on generative AI and CoI presences.

CoI Presences as Mechanisms Linking Generative AI and Learning

Beyond examining CoI presences as learning processes, a small number of studies have begun to investigate whether they function as mechanisms linking generative AI use and learning outcomes. Empirical findings suggest that social presence, in particular, may function as a key explanatory pathway linking AI interaction and learner development. For instance, Xie et al. (2024) demonstrated that social presence fully mediated the relationship between chatbot interaction frequency and learning autonomy among students who preferred virtual companionship. In contrast, for students oriented toward knowledge acquisition, more frequent chatbot interaction was associated with decreased social presence and lower autonomy, despite a positive correlation between the two constructs. These findings indicate that the role of social presence is not uniformly positive but contingent upon learners' motivational orientation and patterns of AI use. Extending this line of inquiry, Dong et al. (2026) found that generative AI-supported learning analytics enhanced learning engagement both directly and indirectly through the partial mediation of CoI presences, with teaching presence emerging as the strongest mediator. Their findings suggest that CoI presences may operate collectively as process mechanisms linking AI-supported instructional interventions and student engagement.

Similarly, research on AI-generated instructors highlights how technologically enhanced behavioral cues can shape learners' perception of presence and indirectly affect learning

outcome. Xu et al. (2025) manipulated behavioral fidelity and visual cues in AI-generated instructors and found that higher behavioral fidelity significantly increased students' perceived social presence, satisfaction, and motivation, while also reducing cognitive load. Although the study did not directly test the mediating effect of social presence, improved learning performance was observed under conditions where social presence was enhanced, suggesting that AI design features may indirectly influence learning by strengthening learners' perceptions of presence.

With respect to cognitive presence, ENA-based analyses further illustrate how generative AI may influence the structure of knowledge construction. Yu et al. (2025) reported that exploration was the most frequently activated phase in scaffolded discussions supported by generative AI, followed by integration and triggering events, whereas resolution remained the least evident phase. Moreover, learners with higher creativity demonstrated stronger connections among exploration, integration, and resolution, suggesting that generative AI's contribution to cognitive presence may depend on individual learner characteristics.

Emerging evidence suggests that CoI presences function not only as outcomes of AI-supported learning but also as mechanisms through which generative AI influences learner engagement, interaction, and achievement. However, empirical evidence remains limited and uneven, with only a small number of studies explicitly examining the mediating roles of CoI presences. Moreover, most existing evidence has focused on individual presences or specific instructional contexts, highlighting the need for a more comprehensive understanding of how teaching, cognitive, and social presence jointly shape AI-supported learning.

Methods

This study employed a scoping review to synthesize empirical evidence on how generative AI is associated with the presences within the CoI framework. Given that generative AI represents a cutting-edge form of artificial intelligence that enables learners to generate content and receive more advanced and personalized feedback, this study focuses specifically on generative AI.

Inclusion and Exclusion Criteria

To identify eligible studies, we set the following five inclusion criteria. Studies were included if they:

1. examined the effects of generative AI on teaching presence, cognitive presence, social presence, and learning presence;
2. were published between November 2022 (since the emergence of ChatGPT) and July 2026;
3. employed a rigorous research design (e.g., experimental, quasi-experimental, correlational, observational, or learning analytics approaches);
4. reported quantitative, qualitative, or mixed-method data on teaching, cognitive, and social presence; and
5. were published in English.

Studies were excluded if they were non-empirical studies (i.e., conceptual papers or review papers); secondary data analyses such as meta-analyses or systematic reviews; publications prior

to November 2022; lacked sufficient methodological transparency or data, or were written in languages other than English.

Search Databases, Strategies, and Screening Process

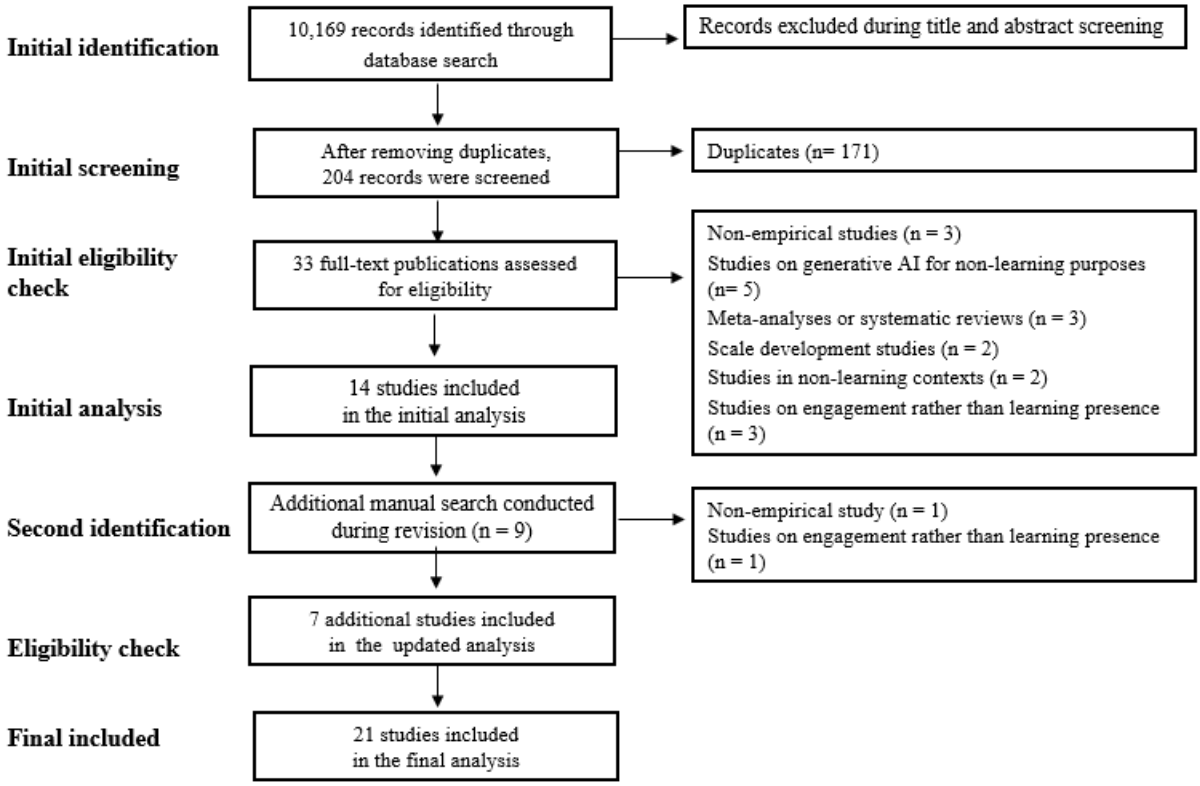
An electronic database search was conducted using Google Scholar as a general-purpose search engine and Education Source (EBSCOhost), ERIC (ProQuest), PsycINFO, and Web of Science, which are databases extensively used in the field of education. The keywords used for the search included “learning presence,” “teaching presence,” “cognitive presence,” “social presence,” “generative AI,” “ChatGPT,” “artificial intelligence in education,” “community of inquiry,” “learning outcomes,” and along with their combinations. The following Boolean search string was employed: ("learning presence" OR "teaching presence" OR "cognitive presence" OR "social presence") AND ("generative AI" OR "ChatGPT" OR "artificial intelligence in education") AND ("learning outcomes" OR "Community of inquiry").

To ensure comprehensive coverage, manual searches were conducted in leading journals in educational technology and online learning following Wilson and Ritzhaupt’s (2023) list of top journals in the field, including *Educational Technology Research & Development, Computers & Education*, *The Internet and Higher Education*, and the *British Journal of Educational Technology*. We also included the *Online Learning Journal*, the outlet for the present study, to ensure comprehensive coverage of relevant research.

The review process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (see Figure 1). After removing duplicate records, titles and abstracts were screened to exclude irrelevant studies. Full-text reviews and coding were then conducted independently by the two authors to determine eligibility. Studies identified during the manuscript revision were screened and coded using the same procedures before being incorporated into the final synthesis. Seven eligible studies published between February 2026 and July 2026 were incorporated into the final analysis, resulting in a total of 21 eligible studies.

Figure 1

PRISMA Chart



Data Extraction and Synthesis

For each eligible study, data were extracted to address the three research questions and to summarize the methodological and contextual characteristics of the included studies. Data extracted included publication characteristics (publication year, country, and research design), instructional characteristics (subject area, target learners, instructional approach, and type of generative AI), and analytical variables relevant to the review questions (CoI presences and AI roles). The coding scheme was developed to address the research questions and to analyze the characteristics of the studies (see Table 1). We managed the coding process using an Excel spreadsheet. Based on the coding results for randomly selected studies, intercoder reliability was high (Cohen's k= .82), and discrepancies were resolved through discussion. The final set of included studies was subjected to quality appraisal using the JBI Critical Appraisal Tools appropriate to each study design. Specifically, we used the analytical cross-sectional checklist for correlational studies; the quasi-experimental and randomized controlled trial checklists for quasi-experimental and experimental studies; and the qualitative research checklist for the qualitative components of mixed-method studies. No major methodological concerns were identified. Findings were synthesized narratively by identifying recurring themes and patterns across the included studies. The synthesis was organized according to the three CoI presences (teaching,

cognitive, and social presence) as well as the process mechanisms linking generative AI and learning outcomes.

Table 1

Coding Information for Systematic Literature Review

Category	Coding information
Types of AI	ChatGPT, chatbot, learning analytics, and relevant systems
Target learners	Elementary, middle/high, undergraduates, graduates, adult learners
Types of presence	Teaching, cognitive, social, and others
Instructional approaches	Discussion, lecture, and other approaches
Subject areas	Education, marketing, biology, and other fields
Publication details	Title, author, year, journal name, countries, and others

Results

Descriptive Data

The analysis results indicate that the term 'presence' was used in different contexts. For example, Hebert and Dołżycka (2024) examined the influence of an artificial pedagogical agent in online learning, measuring 'teacher presence' using a humanoid artificial agent and avatars for learners to examine 'self- and other-presence.' Feng (2025) also used the term 'the presence of GAI chatbots' alongside cognitive presence in their study. To avoid confusion, we decided to adhere to Garrison's CoI model—which consists of teaching, cognitive, and social presence—as the theoretical framework.

We identified 21 studies that examined teaching, cognitive, and social presence in the context of generative AI applications in learning. Three studies were published in 2022 (Ebadi & Amini, 2022; Kim et al., 2022; Lee et al., 2022), followed by two studies in 2023 (Han et al., 2023; Hew et al., 2023). One study was published in 2024 (Xie et al., 2024). The number increased substantially to seven publications in 2025, accounting for almost half of all studies included in this systematic review (Alfoldi, 2025; Ba et al., 2025; Huang & Hew, 2025; Narang et al., 2025; Nasr et al., 2025; Xu et al., 2025; Yu et al., 2025). Eight studies were published in 2026, representing the largest annual share of publications included in the analysis (Darban, 2026; Dong et al., 2026; Gunbatar & Gokcearslan, 2026; Özbilen et al., 2026; Pan et al., 2026; Xia et al., 2026; Xu et al., 2026; Yang et al., 2026).

The 21 publications represented eight countries. The United States and China were the most productive countries investigating the presences in the context of generative AI, accounting for about two-thirds of the total publications. Eight studies were conducted in the United States (38.1%) and were published between 2022 and 2026 (Alfoldi, 2025; Darban, 2026; Han et al., 2023; Kim et al., 2022; Lee et al., 2022; Narang et al., 2025; Nasr et al., 2025; Pan et al., 2026). Six studies were conducted in China (28.6%) and were published between 2024 and 2026 (Ba et al., 2025; Dong et al., 2026; Xia et al., 2026; Xie et al., 2024; Xu et al., 2025; Yu et al., 2025).

The remaining seven publications were conducted in Hong Kong (Hew et al., 2023; Huang & Hew, 2025), Iran (Ebadi & Amini, 2022), Australia (Yang et al., 2026), the Netherlands (Xu et al., 2026), Turkey (Gunbatar & Gokcearslan, 2026), and across both Turkey and Pakistan (Özbilen et al., 2026).

The 21 publications were spread across 16 journals. The most productive journal, or the one most focused on the topic of presences within the CoI framework in the context of generative AI, was the *British Journal of Educational Technology* (N = 4, 19%). Two publications each also appeared in *The Internet and Higher Education* and the *International Journal of Educational Technology in Higher Education.* The remaining journals each contributed one publication, including *Computers & Education, Online Learning, Interactive Learning Environments, Computers in Human Behavior, Education Sciences, Educational Technology Research and Development, IEEE Transactions on Learning Technologies, Journal of Computer Assisted Learning, Journal of Education for Business, Journal of Public Policy & Marketing, Discover Computing, and the International Journal of Technology in Education.*

In terms of participant level, more than three-quarters of the studies were conducted with undergraduate students. Specifically, 16 of the 21 publications involved undergraduates (Alfoldi, 2025; Ba et al., 2025; Ebadi & Amini, 2022; Gunbatar & Gokcearslan, 2026; Han et al., 2023; Hew et al., 2023; Huang & Hew, 2025; Kim et al., 2022; Narang et al., 2025; Nasr et al., 2025; Özbilen et al., 2026; Xia et al., 2026; Xie et al., 2024; Xu et al., 2025; Yu et al., 2025; Dong et al., 2026). The other five studies examined different participant groups, including primary school students (Xu et al., 2026), high school students (Pan et al., 2026), graduate students (Darban, 2026), graduates in MOOC contexts (Lee et al., 2022), and adult learners (Yang et al., 2026).

The types of generative AI used in the studies varied. ChatGPT was the most frequently identified specific tool category (N = 7, 33.3%) (Alfoldi, 2025; Ba et al., 2025; Darban, 2026; Gunbatar & Gokcearslan, 2026; Nasr et al., 2025; Xie et al., 2024; Yang et al., 2026). Another widely used category was chatbots (N= 4, 19.0%), developed through various platforms, including CSIEC (Ebadi & Amini, 2022), knowledge-based chatbots used in MOOCs (Han et al., 2023), a learning-buddy chatbot developed using Google Dialogflow (Hew et al., 2023), and a chatbot designed to support self-regulated learning and social presence (Huang & Hew, 2025). Other generative AI tools reported include BERT (Bidirectional Encoder Representations from Transformers) (Lee et al., 2022), SPARK (a Chinese AI developed by iFLYTEK) (Yu et al., 2025), an LLM-driven conversational AI agent (Pan et al., 2026), identity-anthropomorphized virtual companion AI (Xia et al., 2026), generative AI-based learning analytics embedded in learning platforms (Dong et al., 2026), and various generative AI applications (Narang et al., 2025; Özbilen et al., 2026). More details about the 21 studies included in the analysis are presented in Table 2 and Appendix A.

Table 2

Descriptive Characteristics of Included Studies (N=21)

Category	Subcategory	N	%
Year	2022	3	14.3
	2023	2	9.5
	2024	1	4.8
	2025	7	33.3
	2026	8	38.1
Country	United States	8	38.1
	China	6	28.6
	Other countries	7	33.3
Publication Outlet	British Journal of Educational Technology	4	19.0
	International Journal of Educational Technology in Higher Education	2	9.5
	Internet and Higher Education	2	9.5
	Other journals (13 journals)	13	61.9
Participant Level	Undergraduate	16	76.2
	K-12	2	9.5
	Graduates (MOOCs)	2	9.5
	Adults	1	4.8
Type of Generative AI	ChatGPT	7	33.3
	Chatbot	4	19
	AI-generated instructors or pedagogical agents	2	9.5
	Other AI tools	8	38.1

Note. Other countries include Australia, Hong Kong, Iran, the Netherlands, and Turkey. Other AI tools include BERT, SPARK, LLM-driven conversational AI, embedded AI applications, identity-anthropomorphized AI, and other generative AI systems.

Relationships Between Generative AI and CoI Presences (RQ1)

The first research question investigated the effects of generative AI on teaching, cognitive, social, and learning presence. Depending on the research design, some studies treated presences as dependent variables, while others examined them as independent or mediating variables that were expected to influence learning achievement or performance. The findings indicate that generative AI affects CoI presences in various ways, such as enhancing critical thinking in terms of cognitive presence, increasing learner autonomy, and strengthening social presence through personalized interactions and feedback, and supporting teaching presence through AI-assisted instruction and facilitation, which in turn can lead to improved engagement and learning

performance.

First, regarding the effects of generative AI on social presence, generative AI consistently increases *social presence* by using human-like cues and interactions (e.g., voice, emojis, or affective expressions). Huang and Hew (2025) and Xu et al. (2025) reported that human-like chatbots or pedagogical agents increased social presence, fostered rapport with instructors, and enhanced learners' sense of belonging. Xu et al. (2026) further found that AI-generated instructors with high behavioral fidelity were more effective in enhancing social presence, satisfaction, and motivation, and in reducing cognitive load, than those with low behavioral fidelity. However, Xu et al. (2026) also showed that, despite the enhanced social presence, the pedagogical agent did not significantly influence learning achievement in mathematics, either as an independent variable or as a mediating variable between generative AI and learning achievement. Xia et al. (2026) demonstrated that identity-anthropomorphized AI further strengthened learners' perceived social presence by eliciting positive emotional responses, while Pan et al. (2026) showed that LLM-based conversational agents enhanced both social and teaching presence in collaborative learning environments.

Generative AI supported cognitive presence by providing scaffolding and facilitating development through its four phases: triggering events, exploration, integration, and resolution. Several studies demonstrate how GenAI contributes to movement across these phases. In addition, unlike studies that focused primarily on social presence, publications examining cognitive presence tended to incorporate individual difference variables, such as creativity (Yu et al., 2025) or cognitive presence levels (Lee et al., 2022), to explain variations in learners' progression across cognitive presence phases. For example, Yu et al. (2025) compared cognitive presence between high-creativity and low-creativity pre-service teachers. While no significant differences were found in the exploration and interaction phases, participants in the high-creativity group were more active in the integration and resolution phases, suggesting deeper knowledge construction. Similarly, Lee et al. (2022) investigated how generative AI could classify students according to their cognitive presence levels in order to provide targeted scaffolding and promote more substantive discussion, ultimately improving learning outcomes. Yang et al. (2026) analyzed students' writing behaviors through the cognitive presence framework, examining progression from triggering events to resolution. Based on engagement in each phase, they identified distinct patterns of AI use, including AI-critical, AI-dependent, AI-independent, and AI-balanced writers. Recent studies further extended this line of inquiry. Dong et al. (2026) found that generative AI-supported learning analytics significantly enhanced cognitive presence while simultaneously strengthening teaching and social presence. Darban (2026) also reported that ChatGPT-assisted learning promoted higher levels of cognitive presence and self-directed inquiry among graduate students. Similarly, Özbilen et al. (2026) demonstrated positive associations between generative AI use and learners' cognitive engagement during university learning activities.

No study exclusively examined teaching presence; however, several studies explicitly examined teaching presence alongside cognitive and social presence. Narang et al. (2025) found that when generative AI functioned as a tutor—by providing personalized guidance and feedback—teaching presence was strengthened. Similarly, Ba et al. (2025) examined the effects of different types of AI-generated feedback (i.e., idea-oriented feedback and task-oriented feedback) on teaching, social, and cognitive presence. Their findings indicated significant differences in cognitive presence across feedback types, whereas no significant differences were

observed in teaching presence. Narang et al. (2025) compared the effects of generative AI on learning in a marketing course using the tutor–tutee–tool framework. Their findings indicated that, among the three dimensions of presences, cognitive presence was perceived as the most effective (85.71%), compared to teaching presence (42.86%) and social presence (35.71%). Pan et al. (2026) found that LLM-supported collaborative learning significantly enhanced teaching presence by supporting instructional facilitation and guidance, whereas Dong et al. (2026) reported that teaching presence served as the strongest predictor among the three presences when generative AI-supported learning analytics were introduced. Recent studies suggest that although generative AI positively influences all three CoI presences, its strongest and most consistent effects have been reported for cognitive presence, followed by social presence, whereas teaching presence appears to depend more heavily on instructional design and the specific role assigned to AI within the learning environment.

Although most empirical studies report positive effects of using generative AI, neutral or even negative effects also emerge. These were not our primary research questions; however, we identified several negative effects of using generative AI in the empirical studies included in our review. For example, Dong (2026) delineated that the impact of generative AI-based learning analytics is contingent upon the level of CoI support and students' digital competencies. Xia et al. (2026) found that, despite the positive influence of an identity-anthropomorphised virtual companion on learning outcomes, learners in the identity-anthropomorphism condition spent significantly less time on the learning videos than those in the non-anthropomorphism condition. Xia explained that a strongly human-like AI companion can distract learners' attention from the instructional video. Ba et al. (2025) reported that learners who received idea-oriented feedback prompts demonstrated higher cognitive engagement than those who received task-oriented feedback prompts, but also exhibited higher negative emotional engagement.

Patterns and Imbalances in CoI Presences Research (RQ2)

The second research question aimed to identify patterns and imbalances in the existing research on generative AI and presences within the CoI framework. As shown in Table 3, social presence emerged as the most frequently examined dimension, appearing in 61.9% of the included studies (13 out of 21), either as a standalone focus or in combination with other presences. In contrast, cognitive presence was examined in 47.6% of the studies (10 out of 21), while teaching presence appeared in only 23.8% of the studies (5 out of 21). All studies addressing teaching presence examined it together with one or more of the other presences.

A closer examination of the distribution reveals a structural imbalance in research attention. Eight studies focused solely on social presence, whereas six examined only cognitive presence. Notably, no studies investigated teaching presence as a standalone construct in the context of generative AI. Instead, teaching presence appeared only as part of broader analyses that examined multiple CoI presences simultaneously (e.g., Ba et al., 2025; Han et al., 2023; Narang et al., 2025; Dong et al., 2026; Pan et al., 2026), suggesting that it has not yet been independently theorized or empirically isolated in this line of research.

This distribution indicates that current scholarship disproportionately emphasizes the relational and affective dimensions of generative AI use, while comparatively limited attention has been given to instructional design and facilitation processes associated with teaching presence. Such an imbalance suggests that the integration of generative AI into the CoI

framework remains unevenly conceptualized across its three core dimensions.

In terms of generative AI applications, chatbot-based studies primarily examined social presence (e.g., Ebadi & Amini, 2022; Hew et al., 2023; Hwang & Hew, 2025), except Han et al. (2023), who reported all three presences. Studies using ChatGPT addressed a broader range of CoI presences, including cognitive presence (e.g., Nasr et al., 2025; Darban, 2026; Gunbatar & Gokcearslan, 2026; Yang et al., 2026), social presence (Xie et al., 2024), and all three presences (Ba et al., 2025). Several studies also employed AI-generated instructors or pedagogical agents (e.g., Pan et al., 2026; Xia et al., 2026; Xu et al., 2025; Xu et al., 2026), reflecting an expansion of generative AI applications beyond conventional chatbots and general-purpose LLMs. Table 4 lists the type of AI and the three presences examined in each study.

Table 3

Types of AI and Three Presences

Presence dimension	Studies examining this dimension (n)			% of total studies (N= 21)
	Single	Combined	Total	
Cognitive presence	6	4	10	47.6
Social presence	8	5	13	61.9
Teaching presence	-	5	5	23.8

Table 4

Generative AI Applications Examined Across the Three CoI Presences

Generative AI Application	Publications	Teaching	Cognitive	Social
ChatGPT	Alfoldi et al. (2025)		X	
	Ba et al. (2025)	X	X	X
	Darban (2026)		X	
	Gunbatar & Gokcearslan (2026)		X	
	Nasr et al. (2025)		X	
	Xie et al. (2024)			X
	Yang et al. (2026)		X	
Chatbots	Ebadi & Amini (2022)			X
	Han et al. (2023)	X	X	X
	Hew et al. (2023)			X
	Huang & Hew (2025)			X

Generative AI Application	Publications	Teaching	Cognitive	Social
AI-generated instructors / pedagogical agents	Pan et al. (2026)	X		X
	Xia et al. (2026)			X
	Xu et al. (2025)			X
	Xu et al. (2026)			X
Learning analytics	Dong et al. (2026)	X	X	X
Various generative AI applications	Narang et al. (2025)	X	X	X
	Özbilen et al. (2026)		X	
	Yu et al. (2025) (SPARK)		X	

Note. Studies focusing primarily on AI-supported measurement or classification (e.g., Lee et al., 2022) or broader AI-supported learning environments (e.g., Kim et al., 2022) were not categorized by AI application type.

Instructional Approaches to Strengthen Presences through GenAI (RQ3)

To address the third research question, we examined the instructional configurations in which generative AI was embedded and the specific pedagogical methods adopted in each study. Four dominant instructional groupings emerged: (1) online discussion–based environments, (2) AI-generated instructor and video-based contexts, (3) self-regulated learning support environments, and (4) task-specific collaborative activities.

First, several studies embedded generative AI within structured *online discussion* environments. These contexts included inquiry-based discussions (Ba et al., 2025), structured argumentation using the six thinking hats technique (Yu et al., 2025), and large-scale asynchronous discussion forums analyzed through machine learning models (Lee et al., 2022). In these dialogic settings, generative AI provided scaffolded feedback, guided argumentation, and supported idea elaboration. Ba et al. (2025), for example, demonstrated that idea-oriented AI feedback strengthened cognitive presence in inquiry-based discussions, particularly in the exploration and integration phases. Similarly, Yu et al. (2025) showed that combining generative AI with structured debate techniques facilitated deeper patterns of knowledge construction. Across these discussion-based environments, generative AI was most consistently associated with the enhancement of cognitive presence.

A second instructional configuration involved *video-based or MOOC-centered instructional delivery formats* in which generative AI functioned as an instructor-like agent. Xu et al. (2025) manipulated behavioral fidelity and dynamic visual cues in AI-generated instructors embedded within online instructional videos. Kim et al. (2022) examined differences between human-like and machine-like AI voices in voice-based lectures, while Xu et al. (2026) investigated animated pedagogical agents in elementary mathematics instruction. Narang et al. (2025) further discussed AI-generated lecture videos and simulation-based case analyses in project-based marketing courses. Pan et al. (2026) investigated an AI conversational agent (MathPal) designed to support mathematical dialogue and instructional interaction, extending AI tutor roles beyond video-based instructional delivery. In these lecture-oriented environments, generative AI was positioned as a tutor delivering content, and enhanced social presence was particularly evident when AI designs incorporated human-like instructional characteristics, such as realistic voice, dynamic visual behaviors, conversational interaction, and embodied tutor functions.

A third group of studies situated generative AI within *self-regulated learning (SRL)* interventions. These included SMART goal-setting chatbot activities (Hew et al., 2023), structured help-seeking and self-evaluation chatbot frameworks (Huang & Hew, 2025), informal chatbot interactions supporting learner autonomy in elective courses (Xie et al., 2024), and chatbot-mediated knowledge-based learning experiences in MOOCs (Han et al., 2023). In these contexts, generative AI functioned as a learning companion that supported monitoring, reflection, and goal alignment. Social presence frequently emerged as a mediating mechanism, particularly in relation to learning autonomy and perceived engagement.

Finally, several studies embedded generative AI within task-specific activities requiring human–AI collaboration. These contexts included AI-assisted creative and argumentative writing (Yang et al., 2026), lesson planning tasks supported by chatbot interaction (Nasr et al., 2025), chatbot-based English conversation practice within blended learning environments (Ebadi & Amini, 2022) and AI-supported collaborative learning enhanced through learning analytics (Dong et al., 2026) These instructional approaches emphasized applied task performance and iterative interaction with AI systems. In such settings, generative AI functioned primarily as a collaborative teammate or cognitive tool, contributing most strongly to cognitive presence while also shaping aspects of social engagement during dialogic exchanges.

The reviewed studies do not point to a uniform pattern across the three CoI presences. Rather, the different instructional configurations were associated with different presence-related findings. Discussion- and task-based instructional methods were most consistently associated with enhanced cognitive presence, whereas lecture-based designs emphasizing embodied AI characteristics were more often focused on social presence. Self-regulated learning frameworks highlighted the mediating role of social presence in fostering learner autonomy. Teaching presence appeared most evident when generative AI assumed explicit instructional roles, such as AI-generated instructors, conversational tutors, or AI-supported learning analytics integrated into structured instructional designs. Nevertheless, teaching presence remained the least frequently investigated of the three CoI Presence. Table 5 summarizes the instructional configurations and pedagogical roles of generative AI associated with the three CoI presences.

Table 5

Instructional Configurations of Generative AI Across the Three CoI Presences

Instructional group	Studies	Learning context and AI role
1. Online Discussion-based environments	Ba et al. (2025); Yu et al. (2025); Lee et al. (2022)	AI used to scaffold inquiry-based discussions, structured argumentation, and cognitive presence in online forums (AI as teammate or cognitive tool)
2. AI-Generated Instructor and tutor-supported instructional environments	Xu et al. (2025); Kim et al. (2022); Xu et al. (2026); Narang et al. (2025); Pan et al. (2026); Xia et al. (2026); Narang et al. (2025)	AI functioning as instructor/tutor in video-based or MOOC environments, emphasizing behavioral fidelity, voice realism, and instructional delivery
3. Self-Regulated Learning support environments	Xie et al. (2024); Hew et al. (2023); Huang & Hew (2025); Han et al. (2023)	Chatbot-supported goal setting, help-seeking, and self-monitoring activities in online learning environments (AI as tutor or learning buddy)

Instructional group	Studies	Learning context and AI role
4. Task-Specific Collaborative activities	Yang et al. (2026); Nasr et al. (2025); Ebadi & Amini (2022); Dong et al. (2026); Darban (2026); Gunbatar & Gokcearslan (2026); Alfoldi et al (2025)	AI-assisted writing, lesson planning, and conversational practice tasks emphasizing human–AI collaboration (AI as teammate or cognitive tool)

Discussion and Conclusions

The purpose of this study was to synthesize empirical evidence on how generative AI is associated with presence within the CoI framework. The reviewed studies did not reveal a single, uniform pattern across the three CoI presences. Instead, presence-related outcomes varied according to instructional configurations, AI roles, and measurement approaches, suggesting that the educational value of generative AI depends on how it is pedagogically designed and implemented. These findings have several implications for understanding the role of generative AI within the CoI framework.

With respect to *cognitive presence*, generative AI was most consistently associated with strengthened exploration and integration processes, particularly in discussion-based and task-oriented environments. AI-supported inquiry-based discussions (Ba et al., 2025), structured debate formats (Yu et al., 2025), and AI-assisted writing and lesson-planning tasks (Yang et al., 2026; Nasr et al., 2025), mathematical problem solving (Darban, 2026; Gunbatar & Gokcearslan, 2026), and AI-supported collaborative learning (Dong, et al., 2026) consistently facilitated idea generation, elaboration, and iterative refinement. However, across multiple studies, the resolution phase of cognitive presence remained comparatively underdeveloped. This recurring imbalance suggests that although generative AI may accelerate the exploration and integration phases of knowledge construction, sustained inquiry and resolution remain strongly contingent upon deliberate instructional design and facilitation.

Interpreted through this extended CoI framework, the findings of this review suggest that generative AI may support certain phases of cognitive presence, particularly exploration and integration, but does not consistently facilitate the regulatory processes required for sustained inquiry and resolution. While generative AI can scaffold idea generation and interaction, the monitoring and management of inquiry—central to learning presence—remain underdeveloped. This may help explain why the resolution phase of cognitive presence was consistently limited across the reviewed studies.

However, this imbalance can be more deeply understood when viewed through recent extensions of the CoI framework. In particular, the introduction of learning presence highlights the role of learners' self-, co-, and socially shared regulation in shaping collaborative inquiry (Shea et al., 2022). From this perspective, meaningful learning is not only a function of cognitive, social, and teaching presence, but also of how learners monitor and manage the inquiry process. Stenbom and Garrison (2026) asserted that learning in AI-supported environments requires reflective responsibility and control through metacognitive monitoring and collaborative inquiry processes. This perspective aligns with Garrison's (2022) concept of shared metacognition, which emphasizes that effective inquiry requires both individual and collective regulation through monitoring and managing learning activities. Shared metacognition

operates at the intersection of cognitive and teaching presence, suggesting that the progression of inquiry—particularly toward resolution—depends on the extent to which learners actively regulate their thinking and interaction. Several of the reviewed studies also illustrate this regulatory role in practice. Chatbot-supported goal setting and self-evaluation activities (Hew et al., 2023; Huang & Hew, 2025) and AI-supported self- and co-regulation of learning (Özbilen et al., 2026) show how monitoring and managing inquiry can be deliberately built into AI-supported learning designs.

S*ocial presence* was most strongly activated in contexts where generative AI incorporated anthropomorphic and socially expressive interactional cues. Studies involving AI-generated instructors, conversational tutors, and anthropomorphic pedagogical agents (Kim et al., 2022; Xu et al., 2026; Pan et al., 2026; Xia et al., 2026) demonstrated that behavioral fidelity, conversational tone, and perceived realism significantly influenced learners' sense of connection and engagement. Furthermore, in self-regulated learning environments (Xie et al., 2024), social presence frequently functioned as a mediating mechanism linking chatbot interaction to learner autonomy. Across the reviewed studies, social presence appeared particularly sensitive to design features that signal relational authenticity, positioning generative AI as a socially responsive agent.

Prior work has described presence as a perceived sense of connection between learners and instructors (Seo et al., 2021) or as the degree to which learners perceive the existence of others in mediated interaction (Kang & Im, 2013). The reviewed studies suggest that learners can experience a similar sense of connection in interactions with AI agents, particularly when the agents display human-like behavioral and conversational cues (Kim et al., 2022; Xia et al., 2026; Xu et al., 2026). At the same time, this connection is not equivalent to interpersonal connection between humans, and none of the reviewed studies examined its longer-term effects on learner relationships or engagement. How learners' perceived connection with AI agents relates to their connection with human instructors and peers remains an open question for future research.

A more cautious interpretation of these patterns is necessary because the reviewed studies did not define or operationalize the CoI presences in fully comparable ways. Some studies treated presence as a perceived outcome measured through self-report scales, whereas others inferred it from discourse patterns, interaction features, or design characteristics. In addition, not all studies examined the same dimensions of the CoI framework, and teaching presence was rarely isolated as a standalone construct. This construct instability limits direct cross-study comparison and suggests that the present review identifies recurrent tendencies in the literature rather than stable empirical regularities about how generative AI influences learning.

An additional pattern emerging from the reviewed studies is the diversification of AI roles in educational contexts. Early studies primarily examined chatbots designed to support communication and self-regulated learning, whereas later studies investigated AI-generated instructors, pedagogical agents, conversational tutors, collaborative cognitive tools, and AI-supported learning analytics. Recent studies thus embed generative AI within broader instructional designs.

Teaching presence, however, emerged as comparatively underexplored as an independent construct. Although teaching presence was identified in several recent studies (Ba et al., 2025; Han et al., 2023; Narang et al., 2025; Pan et al., 2026; Dong et al., 2026), it was rarely examined as an independent construct. Instead, it was typically examined alongside cognitive and social

presence. Given that teaching presence traditionally serves as the integrative force orchestrating cognitive and social processes within the CoI framework, its relative absence in the literature reveals an important research gap. As AI systems increasingly participate in instructional design and feedback processes, clearer conceptualization of shared instructional agency between human instructors and AI systems becomes necessary.

Collectively, these findings suggest that the three CoI presences do not operate in AI-mediated environments as originally assumed. The original CoI model assumes an interdependent and mutually reinforcing relationship among teaching, cognitive, and social presence. However, the current body of generative AI research reveals a more asymmetric activation pattern. Rather than strengthening all presences simultaneously, generative AI selectively activates particular dimensions depending on instructional format, AI role, and design features. Discussion- and task-based pedagogies tend to amplify cognitive presence, embodied AI instructor designs primarily enhance social presence, and tutor-like AI roles may contribute to teaching presence when explicitly structured within pedagogical design.

Some scholars have argued that generative AI can compensate for structural limitations of the CoI framework by offering dynamic, interactive responses and personalized feedback (Anderson et al., 2025). From this perspective, AI is positioned as a technological facilitator capable of strengthening community building and knowledge construction processes. However, the findings of this review suggest a more conditional interpretation. Generative AI appears to amplify particular dimensions of presence depending on instructional approaches and pedagogical configuration. In certain designs, AI-supported interaction enhanced cognitive presence; in others, anthropomorphic and socially expressive cues strengthened social presence. Yet teaching presence often remained underexamined or unevenly distributed. These patterns indicate that generative AI should not be conceptualized as a structural remedy for CoI limitations, but rather as a design-sensitive mediator whose impact emerges through instructional configuration. These patterns also underscore the role of regulation in AI-supported inquiry: across the reviewed studies, progress toward integration and resolution depended less on the availability of generative AI itself than on whether the instructional design supported learners in monitoring and managing their inquiry (Garrison, 2022).

These findings align with the four instructional configurations identified in this review, illustrating that the educational value of generative AI depends on how AI is pedagogically embedded. First, educators and instructional designers should recognize that generative AI does not inherently guarantee enhancement of presence within the CoI framework. Its impact depends on how it is pedagogically positioned. Designing AI-mediated learning environments requires intentional alignment between AI roles and desired dimensions of presence. Second, instructional strategies should extend AI-supported exploration toward deeper integration and resolution processes to avoid superficial engagement. Third, greater attention should be directed toward designing AI systems that meaningfully support teaching presence, particularly in relation to instructional orchestration and facilitation.

Limitations of this study

Several limitations of this review should be acknowledged. First, the number of empirical studies explicitly examining generative AI through the CoI framework remains relatively limited, and the distribution across presence dimensions was uneven. Additionally, only English-language

studies published after November 2022 were included, which may have excluded relevant emerging research. The rapid evolution of generative AI technologies also means that findings may reflect early-stage implementations. Future research should therefore examine longitudinal implementations of AI-mediated learning designs and further investigate how teaching presence is conceptualized and enacted in AI-supported instructional environments.

Second, the reviewed studies varied in their definitions and operationalizations of CoI presences, limiting comparability across studies. While some studies treated presence as a perceived outcome measured through self-report scales, others inferred it from discourse patterns, interaction features, or design characteristics. This variability limits direct cross-study comparison and suggests that the findings of this review should be interpreted as patterns and tendencies.

Third, although learning presence–emphasizing self-regulation, co-regulation, and shared regulation–has gained attention as a potential fourth element of the CoI framework, it was not included as a primary analytical category in this review. However, it was used as a theoretical lens to interpret the findings, particularly in relation to regulation of inquiry processes. At the same time, its conceptual status remains debated, as some scholars propose it as a distinct fourth element, while others view it as overlapping with or embedded within existing presences. Future research should further clarify its conceptual status and examine how learning presence interacts with cognitive, social, and teaching presence in AI-mediated learning environments.

Finally, during the literature review, it was observed that the term “presence” is used in varying ways across studies, including teacher presence, AI presence, and learner presence. To maintain conceptual consistency, this study adhered to the CoI framework, focusing specifically on teaching, cognitive, and social presence. Future work may benefit from more precise conceptual distinctions across different forms of presence in AI-mediated learning environments.

In conclusion, this review demonstrates that the educational value of generative AI is not determined by the technology itself, but by how it is pedagogically configured within specific instructional contexts. Generative AI selectively supports cognitive, social, and teaching presence depending on its instructional role, interaction design, and learning environment. These findings contribute to a more nuanced understanding of AI-mediated learning by positioning generative AI as a design-sensitive pedagogical mediator.

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*References marked with an asterisk indicate studies included in the systematic review.

Appendix A. Overview of Selected Papers

Authors (Years)	Participants	Learning Discipline	Instructional Approach	Role of AI	Presence
Ebadi & Amini (2022)	256 Undergraduate Students	English (EFL Speaking and Grammar)	English conversation practice and blended learning using CSIEC chatbot	Chatbot instructor / Learning companion	Social Presence (Predictor of learner motivation)
Kim et al. (2022)	223 Undergraduate Students	Biology (Basics of Cells)	Online voice-based lecture	AI instructor (Varying voice features and expertise)	Social Presence (Mediator of perceived credibility)
Lee et al. (2022)	MOOC & For-Credit Students	Computer Programming, AI	Asynchronous online discussion forums	Analysis tool (Using ML to predict presence phases)	Cognitive Presence
Han et al. (2023)	237 MOOC Learners	Mental Health for Journalists, etc.	Learning with knowledge-based chatbots in MOOCs	Knowledge-based chatbot	Social, Teaching, and Cognitive Presence
Hew et al. (2023)	29 Postgraduate & 38 Undergraduate Students	Adult Education, English (EFL Listening)	Fully online activities (Goal setting and listening practice)	Goal-setting support chatbot and Learning Buddy	Social Presence
Xie et al. (2024)	1155 Undergraduate Students	Informal Learning (Elective Computer Courses)	Self-regulated learning through chatbot interaction	Virtual companion vs. Knowledge acquisition tool	Social Presence (Mediator for Learning Autonomy)
Alfoldi (2025)	1,146 discussion posts (Business students)	International busiess	Yellowdig online discussion board	Instructor participation (teaching presence)	Teaching, social, cognitive, and learner presence
Ba et al. (2025)	105 Preservice Teachers	Biological Sciences	Online inquiry-based discussion (IBD)	Feedback provider (Idea-oriented vs. Task-oriented)	Cognitive Presence (Idea-oriented), Social Presence (Task-oriented), Teaching Presence
Huang & Hew (2025)	39 Undergraduate & 25 Postgraduate Students	Language Education, Educational Research	Online self-regulated learning (SRL) activities	Learning Buddy (Supporting goal-setting, help-seeking, self-evaluation)	Social Presence (Combined with instructor presence)
Narang et al. (2025)	Marketing Educators	Marketing	Project-based learning, simulation, instructional video	Tutor, Teammate, Tool	Teaching Presence (Tutor), Social Presence (Teammate), Cognitive Presence (Tool)

Authors (Years)	Participants	Learning Discipline	Instructional Approach	Role of AI	Presence
Nasr et al. (2025)	40 University Students	Education (Elementary Education)	Lesson planning task	Virtual assistant/Knowledge source (Passive/AI-directed vs. Collaborative/AI-supported)	Cognitive Presence (Triggering, Exploration, Integration, Resolution)
Xu et al. (2025)	36 Undergraduate/Graduate Students	English (EFL Vocabulary Learning)	Instructional videos for MOOCs and online lectures	AI-generated instructor (Providing behavioral fidelity and visual cues)	Social Presence
Yu et al. (2025)	108 Pre-service Teachers	Education (Integrating IT in Classroom)	Six-hat thinking technique scaffolded discussion	Partner for information retrieval and problem-solving	Cognitive Presence
Darban (2026)	356 University students (48 virtual teams)	Management Information Systems (MIS)	Team-based online collaborative learning	AI teammate (Explainable ChatGPT)	Social Presence (Mediator of intention to continue learning)
Dong et al. (2026)	400 University students (+12 interviewees)	Multidisciplinary, including Liberal Arts, Science, and Engineering	Generative AI-based learning analytics (GLAT)	Learning analytics advisor / Personalized learning support	Teaching, Social, and Cognitive Presence (Mediator of learning engagement)
Gunbatar & Gokcearslan (2026)	233 University students	Instructional Technologies and Sport Sciences	ChatGPT-assisted instruction vs. Open inquiry + lecturing	Teaching assistant	Teaching Presence, Cognitive Presence (Higher CoI index)
Özbilen et al. (2026)	249 Preservice teachers	Educational Leadership	AI-supported self-regulation + social-media co-regulation	Self-regulation support / Human–AI collaboration	Shared Metacognition (Extension of CoI framework)
Pan et al. (2026)	High school Algebra students	Mathematics (K–12 Algebra)	Micro-blended learning (Teacher-led instruction + AI-facilitated online learning)	Co-facilitator (Adaptive scaffolding, feedback, socio-emotional support)	Teaching, Social, and Cognitive Presence (Distributed CoI across teacher and AI)
Xia et al. (2026)	70 University students	Science/Technology (specifically fMRI technology)	Virtual companion AI during online learning	Virtual companion (Identity-anthropomorphized AI)	Social Presence (Sequential mediator with positive emotion)
Xu et al. (2026)	132 Primary School Pupils	Mathematics (Probability Problems)	Instructional video	Animated Pedagogical Agent (PA)	Social Presence
Yang et al. (2026)	63 Writers	Creative and Argumentative Writing	Generative AI-assisted writing process	Writing assistant (CoAuthor tool)	Cognitive Presence