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Generative AI and Meaningful Learning through the Community of Inquiry Framework

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Abstract: Generative artificial intelligence can provide explanations, feedback, and conversational support, but fluent interaction does not by itself demonstrate meaningful learning. This essay will examine AI-generated content (AIGC) and conversational AI through the Community of Inquiry (COI) framework, focusing on social, cognitive, and teaching presence. The essay reviews the COI framework and reinterprets its three presences for AI-assisted learning. The main argument is that an AI agent can simulate the three presences, but it does not truly possess them. Implications for research and practice are discussed.

Keywords: Community of inquiry; AIGC; Human–AI co-inquiry

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1. Introduction

Generative artificial intelligence is creating new possibilities for educational dialogue. Students can request explanations, rehearse arguments, and obtain feedback beyond scheduled lessons. However, the availability of responsive tools raises a more demanding question: under what conditions does AI assistance support learning rather than simply improve the work students submit? These concerns require an account of learning processes as well as technological capabilities.

The Community of Inquiry (COI) framework provides a useful starting point. Developed for text-based online learning in higher education, it explains educational experience through the interaction of social, cognitive, and teaching presence [1]. Subsequent work has examined their relationships and implications for online learning [2–3]. Its emphasis on reflection, dialogue, and instructional guidance makes it relevant to AI-assisted learning, but we need to update its indicators for a new kind of participant: the generative AI agent.

This essay offers a conceptual analysis. Much of the current discussion about AIGC in education is driven either by enthusiasm for the pedagogical possibilities of emerging generative AI tools or by concerns about plagiarism and academic integrity, while these debates do not always share a common framework for

systematic analysis [4–5]. The COI framework offers exactly such a framework, because it asks not "Is AI good or bad?" but "What happens to social, cognitive and teaching presence when AI tools join the community?"

2. The COI framework reconsidered for AIGC-assisted learning

2.1. The three presences and their relationships

The COI framework was developed in the late 1990s to explain the learning experience of students in online courses in higher education [1]. It draws on Dewey's perspective of collaborative constructivism and on the practical inquiry model to argue that meaningful online learning emerges from the dynamic interaction of three core elements, which are social presence, cognitive presence, and teaching presence.

Social presence concerns participants' ability to express themselves and develop relationships that support purposeful communication. Its categories include affective expression, open communication, and group cohesion. Affective expression means that learners are capable of sharing emotions, humor, and personal experiences, which keeps motivation high and brings people together. Because text-based online communication removes facial expressions and tone of voice, learners often use emoticons or other signs to express feelings [6]. Open communication requires learners to be able to reply to one another, refer to the specific content of each other's messages, and recognize each other's contributions, so that discussion can continue. Group cohesion refers to the perception that learners see themselves as members of a group, with willingness to collaborate and share personal views [7]. The level of social presence is also shaped by several background factors, such as learners' motivation, communication competence, mutual familiarity with one another, and the time they spend using the medium [1].

Cognitive presence is the extent to which learners can construct and confirm meaning through reflection and discussion. It follows a practical inquiry model with four phases: (1) a triggering event, in which a problem or puzzle raises questions that call for inquiry; (2) exploration, in which learners search for information and exchange ideas; (3) integration, in which learners work individually or cooperatively to scaffold the knowledge developed in the exploration phase into a more logical idea by looking for more insights and further understanding of knowledge; (4) resolution, in which learners apply the new knowledge to real situations [8]. Whether the newly learned knowledge is applied or confirmed successfully also decides whether the next round of inquiry can begin.

Teaching presence plays a central role in the COI framework, binding the other two presences together, establishing and sustaining the virtual learning environment so as to ensure the successful achievement of intended learning outcomes [3]. Teaching presence has three indicators: design and organization (planning the curriculum, choosing teaching methods, designing assessment and selecting the learning medium), facilitating discourse (guiding discussion and keeping it productive, for example by asking probing questions, drawing quiet students into the conversation and summarizing long threads), and direct instruction (giving explanations, diagnosis and feedback). **Table 1** summarizes the framework's categories and illustrative indicators [2].

Table 1. COI categories and illustrative indicators

Presence	Category	Classical indicators
Social	Affective expression	Emotion, humor, Self-disclosure
	Open communication	Mutual awareness, recognition
	Group cohesion	Group identity; collaboration
Cognitive	Triggering event	Dissonance, dilemma
	Exploration	Information search, exchange
	Integration	Connecting, synthesising
	Resolution	Application, defence
Teaching	Design & organisation	Curriculum, assessment, media
	Facilitating discourse	Scaffolding, regulation
	Direct instruction	Diagnosis, feedback

Source: Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. The Internet and Higher Education, 10(3), 157-172.

2.2. AI as a contributor to inquiry

In a classical COI community, the participants are learners, peers, and teachers. In an AIGC-assisted learning community, a fourth type of contributor enters the discussion: the generative AI tools. They can play several roles at once: a dialogue partner that simulates social presence (empathy, warmth, sustained rapport); a scaffolder that simulates cognitive presence (questions, analogies, worked examples, summaries); and a tutor or moderator that simulates teaching presence (feedback, hints, grading support).

However, the AI agent does not truly possess social, cognitive, or teaching presence in the way Garrison and colleagues intended. It produces these presences by imitating patterns in human language. This difference—between real presence and simulated presence—is the key to judging both the benefits and the risks of AIGC-assisted learning in the rest of this essay. It also explains why the same tool can be helpful in one course and harmful in another: what matters is not the fluency of the simulation, but whether genuine presence still stands behind it.

2.3. Reinterpreting the three presences in AIGC-assisted Learning

2.3.1. Social presence: between simulated warmth and reduced human contact

Each of the three indicators of social presence changes when AI enters the community. For affective expression, an AI agent can be given a persona, for example, a patient and encouraging coach, and can reply with warmth, humor, and encouragement. A learner who is stuck on a maths problem at midnight may genuinely feel supported when the AI replies, “Good effort! Let’s try another way.” The support feels real, even though it is generated by a model. For shy learners, or for learners studying in a second language, an AI partner can also be a low-pressure place to express feelings and opinions first, which may later help them speak up in front of classmates.

For open communication, chatting with an AI is structurally mutual; every message will be read and answered. But classical open communication means mutual recognition between people who hold their own views. An AI agent does not hold views in the human sense; its apparent “recognition” is generated computationally. The indicator looks satisfied, but the social reality behind it is thinner than the dialogue suggests.

For group cohesion, AI tools can support a class—for example, when a whole cohort works with the same AI tutor and shares the results in discussion—but they can also weaken the group when learners turn to private AI chats instead of talking with classmates. The result can be a split experience: strong support from the AI, but a weaker sense of belonging to the class.

2.3.2. Cognitive presence: Amplified exploration, weakened resolution

The four phases of cognitive presence demonstrate both the strengths and limitations of AI-assisted learning. In the triggering phase, authentic learning typically begins with thought-provoking problems that initiate inquiry. Generative AI is capable of producing tailored dilemmas, scenarios, counterexamples, and Socratic questions adapted to individual learners' proficiency levels. A teacher or student may use generated cases, counterexamples, or competing explanations to identify a problem. Students also approach AI after encountering a difficulty independently. Neither sequence is inevitable. What matters is whether learners recognize a question worth investigating and can explain why it matters.

The role of AI tools is strongest in the phase of exploration. It can explain, re-explain, translate, and give examples instantly. A student, for example, can ask the same question five times in five different ways until an idea becomes clear, which may be difficult for human tutors to provide at the same scale or with the same immediacy. A learner reading in a second language can also ask the AI to explain a difficult passage in their first language, which lowers the cost of exploration.

The phase of integration is where the picture becomes more complicated. Generative AI can support learners to connect disparate ideas by generating summaries and concept maps, yet the substantive cognitive work of knowledge integration must remain the responsibility of the learner. Reading a generated summary may contribute to understanding, but it provides weak evidence of independent integration. In this sense, generative AI can function as a useful scaffolding tool, but it cannot substitute for learners' active sense-making, which lies at the heart of cognitive presence within the COI framework. Asking students to explain why they accepted one connection and rejected another makes their reasoning more visible.

The resolution phase raises the greatest concerns. Resolution refers to applying newly acquired knowledge to novel contexts and justifying that knowledge when challenged. If a learner simply prompts AI to "solve it for me" and submits the generated answer, cognitive presence collapses into mere AI output. Traditional COI theory had no need to guard against such risks, yet this precaution becomes essential in the AIGC era. To mitigate this threat to cognitive presence, educators may embed project-based tasks into instruction alongside AI-assessed drafts: AI delivers rapid feedback on each draft, while students must revise their work incrementally and justify their final decisions in class. In this manner, AI supports the learning process, yet the resolution itself remains completed—and intellectually owned—by the learner.

2.3.3. Teaching presence: Redistribution, not elimination

AIGC-assisted learning does not mean the elimination of teachers' role; it redistributes it.

As for the indicator of design and organization, teachers no longer design only content and exams; they now also design how AI is used in the course. For example, a writing teacher may allow AI for brainstorming but not for drafting, and must state such rules clearly in the course outline. Teachers also have to decide which tasks may be done with AI, which must be done alone, and how to assess learning fairly when AI use is invisible.

Facilitating discourse. Facilitating discourse also changes when AI joins the discussion. The teacher becomes a moderator of both human–human and human–AI interaction. In practice, teachers may also need to teach students how to formulate effective prompts and critically evaluate AI-generated answers, which is a skill that did not exist in the classical COI classroom.

Direct instruction can also be supported by automated explanations and preliminary feedback. AI may identify some misconceptions when students provide sufficient information about their reasoning. Teachers remain responsible for interpreting difficulties in context, checking consequential judgements and deciding when further support is needed. Teaching presence can therefore be strengthened by selected uses of AI, provided that instructional decisions and routes to human assistance remain clear.

3. Advantages of AIGC-based learning through the COI framework

3.1. Timely access to learning support

AIGC can provide timely scaffolding at the exact moment a learner is stuck: a hint instead of an answer, a worked example before a similar problem, or a quick summary before a harder reading. In the classical COI model, such scaffolding belongs to teaching presence, and it depends heavily on the teacher's limited working hours. AI makes this kind of support continuously available. For learners in under-resourced contexts, this may meaningfully expand access to instructional support and opportunities for cognitive engagement.

3.2. Personalized explanations and feedback

Generative AI can vary the wording, examples, and complexity of a response in light of a student's questions. Classical COI analysis often struggled to account for individual differences within the same community; AI tools make the indicators more adaptive. For example, affective expression can be softened for an anxious learner; exploration can be deepened for an advanced learner; direct instruction can be re-explained for a struggling one.

3.3. Incremental scaffolding

Generative AI enables incremental scaffolding for inquiry-based learning. AI can deliver supports in graduated steps rather than offering complete solutions at once. Instead of providing full arguments or finished analyses, it may offer minor hints, partial reasoning chains, or guiding questions in response to each attempt made by the learner. Within the COI framework, such incremental scaffolding can support cognitive presence, particularly during the exploration and integration phases.

4. The limitations and risks of AIGC-based learning through the COI framework

4.1. Simulated social presence

The strongest disadvantage concerns social presence. AIGC-based dialogue is functionally real but generatively produced rather than intentionally authored [9]. The agent has no lived experience, no vulnerability, no genuine emotion. Learners who build strong rapport with an AI tool may mistake simulated warmth for real social presence—only to discover, when they need authentic human support, that the warmth cannot be transferred. In COI terms, the indicator looks satisfied while the presence behind it is hollow.

4.2. Contamination of cognitive presence

Cognitive presence in COI is about constructing trustworthy meaning. However, AI tools sometimes produce fluent but incorrect answers, often called hallucinations. If learners integrate such hallucinations into the inquiry process, the exploration and integration phases may be compromised. Namely, learners absorb fabricated sources, treat hallucinations as true information, and develop their cognition on false foundations. The indicators can still look strong—the discussion is rich, the writing is elegant—while the knowledge itself is corrupt. In addition, generative models reproduce and sometimes amplify the biases in their training data, which may quietly narrow the range of views that learners encounter.

4.3. Displacement and ambiguity of teaching presence

When AIGC takes on tutoring, feedback, and explanation at scale, the visibility and authority of human teaching presence can erode. The first is role ambiguity. If the AI explains, scaffolds, and assesses, students may not know who holds intellectual authority at any given moment. The second is responsibility ambiguity. When an AI-generated explanation or assessment is wrong or harmful, it is unclear who is accountable. The classical COI framework divides teaching presence cleanly into design, facilitation, and direct instruction; this division becomes blurred when all three are partly delegated to AI.

5. Conclusion

The COI framework, originally designed for asynchronous text-only online learning, can be extended to the AIGC era—but only if its categories are explicitly re-examined rather than mechanically applied. This essay has argued that AIGC functions as a new kind of inquiry-supporting agent that simulates, rather than truly possesses, each of the three presences. This single distinction explains both sides of AIGC-assisted learning: the benefits come from simulation that is good enough to support learners, and the risks come from simulation that is mistaken for the real thing.

Based on this, for teaching and learning practice, teachers should use the COI framework not as a description of what their AI-supported course already has, but as a checklist for what it should have: genuine rather than simulated social presence, learner-led rather than AI-led cognitive presence, and human-led rather than AI-delegated teaching presence.

None of this means that AIGC should be kept out of education. The benefits described in this essay—availability, personalization, scaffolding and wider access—can be educationally significant. The COI framework simply reminds us of the condition under which these benefits count: AI should strengthen the human community of inquiry, not quietly replace it. Keeping that condition in view is, in the end, a task of teaching presence—and therefore a task that cannot be delegated to the AI itself.

Disclosure statement

The author declares no conflict of interest.

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