

Online AI Literacy Course Design and Measurement: A Community of Inquiry Framework and the Scale for the Assessment of Non-Experts' AI Literacy

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Abstract

Artificial intelligence (AI) is increasingly embedded in everyday life, reshaping how people think, live, and work. AI outputs include hallucinations because they are likelihoods and probabilities derived from the trained data. The AI outputs reinforce existing biases because AI systems are trained on content that already contains them. AI literacy and critical thinking are crucial, debunking AI hype and enabling people to leverage AI's potential effectively and ethically. This study is theoretically rooted in constructivism, which holds that individuals actively construct and confirm knowledge. This paper proposes three pillars for an online AI literacy course: technical understanding, critical appraisal, and practical application, which correspond to the three factors of the scale for the assessment of non-experts' AI literacy (SNAIL). This paper also suggests an instrument to measure learning outcomes for non-expert AI users, serving as both a theoretical framework for AI literacy course design and an educational intervention. A community of inquiry (CoI) framework provides a theoretical foundation for an online AI literacy course and supports critical thinking. Integrating the three pillars of the course into the SNAIL offers methodological and pedagogical benefits by enabling educators and instructional designers to ensure alignment between what is taught and what is evaluated.

Keywords: AI literacy, SNAIL, constructivism, a CoI framework, critical thinking, hallucinations

Introduction

The rise of artificial intelligence (AI) goes beyond just technological progress, transforming how people think, work, and learn. AI has the potential to free humans from the labour of basic research, allowing them to focus on core, essential questions that foster insight and understanding (Garrison, 2023; Gerlich, 2025; Szmyd & Mitera, 2024). However, AI outputs cannot be relied upon without validation because they are based on probabilities and on statistical patterns trained on past data (Beinborn & Pinter, 2023; Jurafsky & Martin, 2025; Russell & Norvig, 2022). Furthermore, hallucination is an inherent limitation of AI leading to AI outputs that are false, incorrect, or misleading (Gerlich, 2025; Szmyd & Mitera, 2024; Walter, 2024; Zhai et al., 2024). As AI outputs are plausible and convincing, humans can cede cognitive tasks and decision-making to AI systems (UNESCO, 2023, 2024a, 2024b). If AI users do not apply critical thinking when engaging with AI outputs, they might internalize hallucinations or AI-driven misinformation and, consequently, reproduce inaccurate or false information (Garrison, 2023; Hughes, 2024; University of Calgary, n.d.). Furthermore, AI outputs can amplify existing biases because AI systems are trained on content with human biases (Nicoletti, 2023; UNESCO, 2023, 2024a, 2024b; University of Calgary, n.d.; University of Kansas, n.d.). Critical thinking is key to harnessing AI's potential (Garrison, 2023; Hughes, 2024; Park, 2025; UNESCO, 2023, 2024a, 2024b; University of Calgary, n.d.).

This paper aims to propose three pillars for an online AI literacy course and an instrument to measure learning outcomes for non-expert AI users, serving as both a theoretical framework for AI literacy course design and an educational intervention (Laupichler et al., 2023b; Messick,



1995). This will contribute to the body of knowledge and offer insights for designing an AI literacy course aligned with the assessment instrument.

Background

AI has transformed various aspects of human life, presenting new ways to process information, solve problems, and make decisions. However, hallucinations present a significant challenge for AI users and highlight the need to be aware of them (Zhai et al., 2024). An overreliance on AI can lead to complacency, which is particularly detrimental to the development and practice of critical thinking (Gerlich, 2025; Szmyd & Mitera, 2024; Walter, 2024; Zhai et al., 2024). Incidents involving hallucinations and overreliance on AI outputs have taken place across various levels of society worldwide, including hallucinated legal factums (Charlotin, n.d.), hallucinated corporate reports (Paoli, 2025), a hallucinated newspaper content (Stechyson, 2025), a hallucinated travel policy (Belanger, 2024) and academic misconduct involving AI use (Birks & Clare, 2023; Elali & Rachid, 2023). Therefore, educational intervention is needed to address the negative impacts of AI through AI literacy and critical thinking (Garrison, 2023; Gerlich, 2025; Walter, 2024).

Theoretical Framework

The study is grounded in constructivism, which holds that individuals learn best when they actively construct their own meaning (Bruner, 1961; Dewey, 1910; Piaget, 1950; Saleem et al., 2021; Vygotsky, 1978). A community of inquiry (CoI) framework, which is rooted in constructivism and John Dewey's progressive understanding of education (Garrison, 2013, 2017; Stenbom & Cleveland-Innes, 2024; Swan et al., 2009). This study uses a CoI framework as a theoretical foundation because it is the most established framework in digital teaching and



learning research (Befus, 2016; Caskurlu et al., 2021; Garrison, 2017; Park & Shea, 2020; Stenbom, 2018; Yildirim & Seferoglu, 2021). The framework consists of three interconnected and dynamic elements: Cognitive Presence, Social Presence, and Teaching Presence. Cognitive Presence is “the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry” (Garrison et al., 2001, p. 11). Social Presence is defined as “environmental conditions such as feelings of trust, open communication, and group cohesion” (Garrison, 2024, p. 28). Teaching Presence is referred to as “the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes” (Anderson et al., 2001, p. 5). Deep and meaningful learning takes place through three interconnected and overlapping presences in the community of inquiry (Garrison et al., 2000, 2001).

Review of Literature

This study aims to provide three pillars for an online AI literacy course, along with an instrument to measure learning outcomes, thereby supporting stakeholders in designing an AI literacy course aligned with an assessment instrument. The literature review situates the study within the literature on the key aspects of the AI literacy course and the evaluation instrument. In the AI era, AI literacy is needed to debunk AI hype, avoid overreliance on and addiction to AI outputs, strengthen AI citizenship, preserve the environment sustainably, maintain human autonomy, and enhance human agency (UNESCO, 2023, 2024a). AI literacy is grounded in human rights because AI affects digital divides, equity, diversity, inclusivity, and accessibility. Therefore, AI literacy should be accessible to everyone. Critical thinking is essential to use AI effectively and ethically (Garrison, 2023; Hughes, 2024; Park, 2025; UNESCO, 2024a, 2024b).

AI Literacy

Laupichler et al. (2022) reviewed 30 of 902 articles published since 2000 to define AI literacy for non-expert AI users in higher and adult education. A subsequent study by Laupichler et al. (2023a) developed the SNAIL (scale for the assessment of non-experts' AI literacy), comprising 31 items on a 7-point Likert scale. The SNAIL's efficiency, validity, and reliability inform its suitability as an instrument to measure the online AI literacy course and provide empirical foundations for its possible pedagogical effectiveness (FAIH, n.d.; Laupichler et al., 2023a, 2023b, 2024; Si, 2025; Topal et al., 2025).

Laupichler et al. (2022) defined AI literacy as “the ability to understand, use, monitor, and critically reflect on AI applications without necessarily being able to develop AI models themselves” (p. 1). AI literacy is “the set of foundational values, ethical principles, knowledge and understanding that can ensure the proper and effective use of AI by students” (UNESCO, 2024a, p. 27). This study integrates the definitions of AI literacy from Laupichler et al. (2022) and UNESCO (2024a) because it focuses on AI literacy course design for non-expert AI users. UNESCO is a reputable international organization recognized for its extensive expertise in education, and its recommendations are supported by comprehensive research and global expert input (Chan, 2023). Laupichler et al. (2022)'s definition, derived from a rigorous study, highlights the importance of critical thinking.

The Scale for the Assessment of the Non-Experts' AI Literacy

A systematic literature review of instruments for AI literacy, conducted through 22 papers with 16 scales, using the PRISMA method (Lintner, 2024). Lintner (2024) identified MAIRS-MS, AILS and SNAIL as existing scales in 2024, but SNAIL appears to be the most suitable for

non-expert AI users because it originally targeted higher and adult education. MAIRS-MS was explicitly designed for medical students, whereas AILS, with 12 items and four factors (awareness, use, evaluation, and ethics), poses challenges for ensuring validity and reliability. Therefore, the SNAIL is an ideal AI literacy assessment instrument for non-expert AI users (Si, 2025; Topal et al., 2025), aligning with UNESCO's definition of AI literacy (UNESCO, 2024a). Table 1 shows the SNAIL with three factors: technical understanding, critical appraisal, and practical application (Laupichler et al., 2023a).

Table 1

Scale for the Assessment of Non-Experts' AI Literacy (SNAIL)

No.	Factor	Item
1	TU1	I can describe how machine learning models are trained, validated, and tested
2	TU2	I can explain how deep learning relates to machine learning
3	TU3	I can explain how rule-based systems differ from machine learning systems
4	TU4	I can explain how AI applications make decisions
5	TU5	I can explain how 'reinforcement learning' works on a basic level (in the context of machine learning)
6	TU6	I can explain the difference between general (or strong) and narrow (or weak) artificial intelligence
7	TU7	I can explain how sensors are used by computers to collect data that can be used for AI purposes
8	TU8	I can explain what the term 'artificial neural network' means
9	TU9	I can explain how machine learning works at a general level
10	TU10	I can explain the difference between supervised learning and unsupervised learning.
11	TU11	I can describe the concept of explainable AI
12	TU12	I can describe how some artificial intelligence systems can act in their environment and react to their environment
13	TU13	I can describe the concept of big data
14	TU14	I can evaluate whether media representations of AI (eg, in movies or video games) go beyond the current capabilities of AI technologies
15	CA1	I can explain why data privacy must be considered when developing and using artificial intelligence applications
16	CA2	I can explain why data security must be considered when developing and using artificial intelligence applications
17	CA3	I can identify ethical issues surrounding artificial intelligence
18	CA4	I can describe risks that may arise when using artificial intelligence systems
19	CA5	I can name weaknesses of artificial intelligence
20	CA6	I can describe potential legal problems that may arise when using artificial intelligence
21	CA7	I can critically reflect on the potential impact of artificial intelligence on individuals and society
22	CA8	I can describe why humans play an important role in the development of artificial intelligence systems

23	CA9	I can explain why data plays an important role in the development and application of artificial intelligence
24	CA10	I can describe what artificial intelligence is
25	PA1	I can give examples from my daily life (personal or professional) where I might be in contact with artificial intelligence
26	PA2	I can name examples of technical applications that are supported by artificial intelligence
27	PA3	I can tell if the technologies I use are supported by artificial intelligence
28	PA4	I can assess if a problem in my field can and should be solved with artificial intelligence methods
29	PA5	I can name applications in which AI-assisted natural language processing/understanding is used
30	PA6	I can explain why AI has recently become increasingly important
31	PA7	I can critically evaluate the implications of artificial intelligence applications in at least one subject area

Note. TU refers to technical understanding, CA to critical appraisal, and PA to practical

application. SNAIL by Laupichler et al. (2023a) is licensed under CC BY 4.0.

Critical Thinking

Given 2500 years of critical thinking history, it is not easy to define it in a single phrase (Paul et al., 1997). Etymologically, the word critical is derived from two Greek roots: *kriticos* (meaning discerning judgment) and *criterion* (meaning standards), which implies the development of discerning judgment based on standards (p. 2). Sternberg defined critical thinking as “the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts” (Sternberg, 1986, p. 3). Garrison (2017) defined “critical thinking in terms of cognitive presence operationalized through the practical inquiry (PI) model” (p. 54). The collaborative and reflective process of a CoI framework supports critical thinking as an educational experience. Promoting critical thinking is a primary goal of education (Bailin et al., 1999; Dewey, 1910; DiPasquale, 2017; DiPasquale & Hunter, 2018; Garrison et al., 2000; Hughes, 2024; Lipman, 2003; Pavlis, 2025). Education should “increase the awareness of the individual about their thinking process and how to assess the validity of various ideas, whether they be socially transmitted or generated by the individual” (Garrison, 2017, p. 51).

Critical thinking empowers AI users to use AI judiciously (Garrison, 2023; Park, 2025; UNESCO, 2024a, 2024b).

Course Design and Evaluation

This study is theoretically rooted in constructivism, which holds that individuals actively construct and confirm knowledge within a community and that learning is a social activity (Garrison 2013, 2017; Stenbom & Cleveland-Innes, 2024; Swan et al., 2009). On the other hand, the research design is grounded in pragmatism, which is a philosophical paradigm that evaluates ideas and theories based on their practical outcomes (Cohen et al., 2018; Creswell & Creswell, 2018).

Figure 1

AI Online Literacy Course Design and Measurement

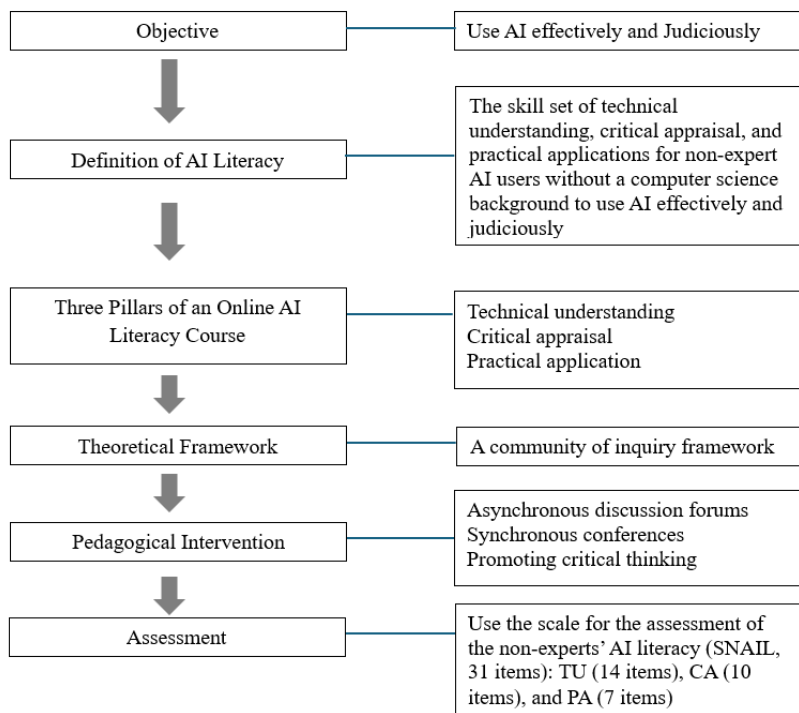


Figure 1 presents the phased process for designing the AI literacy course and evaluating learning outcomes. This study defines AI literacy as the skill set of technical understanding, critical appraisal, and practical applications for non-expert AI users without a computer science background to use AI effectively and judiciously (Laupichler et al., 2022; UNESCO, 2024a). The term judicious means “having sound judgment; careful, prudent” (Etymonline, n.d.), and AI users must use AI judiciously to mitigate the limitations of AI. A CoI framework is a theoretical framework, a course design guideline, and a pedagogical intervention that promotes critical thinking, thereby enhancing learning outcomes (Cleveland-Innes et al., 2024). The course design is guided by the following principles: ensuring inclusive digital futures (equity, diversity, and inclusivity); adopting a human-centred mindset; promoting trustworthy, environmentally sustainable AI in life; ensuring applicability for everyone; reflecting digital evolution; and supporting lifelong learning (UNESCO, 2024a, 2024b).

Conceptualizing AI literacy through technical understanding, critical appraisal, and practical application offers distinct and complementary benefits for non-expert AI users (Laupichler et al., 2022, 2024; Si, 2025; Topal et al., 2025). Technical understanding enables learners to develop an accurate foundational comprehension of how AI systems function, including their underlying mechanisms, capabilities, and limitations, thereby reducing misconceptions and unrealistic expectations about AI technologies. Critical appraisal equips learners with the ability to evaluate AI systems responsibly by recognizing ethical, legal, and societal implications, such as data privacy, security, bias, and risk, while reinforcing the essential role of human judgment and oversight in AI development and use. Practical application supports learners in confidently identifying, selecting, and using AI applications in everyday contexts,

fostering informed decision-making about when and how to apply AI. These three factors promote the development of AI literacy that emphasizes not only understanding and critique but also meaningful, contextually appropriate engagement with AI (Laupichler et al., 2022, 2023a, 2023b, 2024; Si, 2025; Topal et al., 2025).

Table 2

The SNAIL with Three Factors and the AI Literacy Course Topics

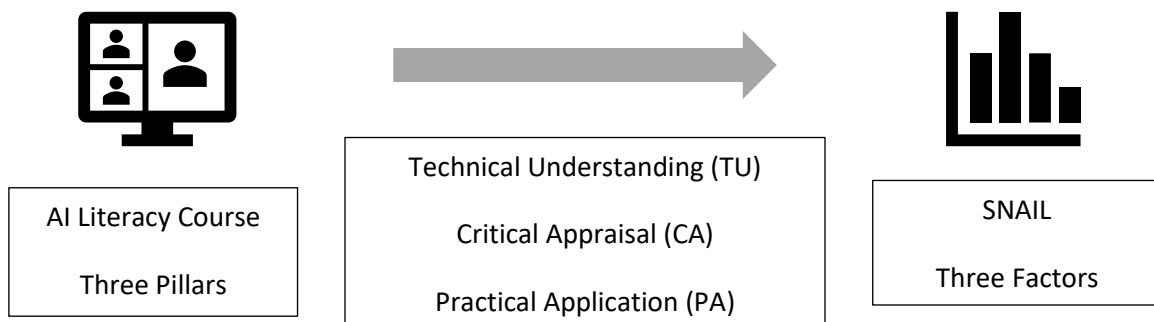
SNAIL with three factors	AI literacy course topics
Technical understanding (TU) (TU1-TU14)	Machine learning, deep learning, neural networks, reinforcement learning
	Narrow and general AI
	Supervised and unsupervised learning
	Explainable AI and big data
Critical appraisal (CA) (CA1-CA10)	Media portrayals
	Data privacy and security
	AI hype, hallucinations, and bias
	Ethical risks and societal implications
	Humana role
Practical application (PA) (PA1-PA7)	Importance of data
	Legal issues
	AI applications in everyday life
	AI application evaluation
	Technologies supporting AI
	Importance of AI

To enhance learning outcomes, this study integrates the three pillars of the AI literacy course into the SNAIL instrument, as shown in Table 2. This provides methodological and pedagogical benefits (Messick, 1995). From a methodological perspective, the SNAIL-based

course structure is backed by empirical studies (Laupichler et al., 2023b, 2024; Si, 2025; Topal et al., 2025). It also reduces the mismatch between what is taught and what is evaluated. Most importantly, the assessment results justify evidence-based course improvement and identify each learner's strengths and weaknesses. From a pedagogical perspective, the alignment justifies topic selection by ensuring that each module directly targets an assessed component of non-experts' AI literacy, thereby supporting coherent curriculum design and transparent expectations for learners (Laupichler et al., 2023b). Figure 2 illustrates the integration of the SNAIL and the AI literacy course. Integrating three AI literacy course pillars with the SNAIL allows instructional coherence and rigorous evaluation, enhancing the credibility and usability of the AI literacy course for non-expert AI users (Laupichler et al., 2022; Messick, 1995).

Figure 2

The Integration of the AI Literacy Course and the SNAIL



Future Research

This study proposed an AI literacy course design with an assessment instrument as a theoretical framework and an educational intervention. This proposed framework can be

empirically tested to evaluate the effectiveness of an AI literacy course or to identify instructional elements that foster AI literacy. By doing so, it will advance the design of the online AI literacy course and confirm the validity of the AI literacy assessment instrument. Since the AI literacy course with a CoI framework, along with the assessment instrument, remains empirically unexplored, the study will contribute to the body of knowledge and present evidence-informed practice to educators, instructional designers, and stakeholders. Furthermore, future research can examine the correlation between the critical appraisal factor in the SNAIL and Cognitive Presence within a CoI framework, as both are closely related to critical thinking.

Conclusion

AI is increasingly integrated into everyday life, reshaping how people think, live, and work. AI outputs include hallucinations because they are likelihoods and probabilities derived from the trained data. The AI outputs also reinforce existing biases, as AI systems are trained on content that contains biases. AI literacy and critical thinking are crucial, debunking AI hype and enabling people to leverage AI's potential effectively and ethically. This study is theoretically rooted in constructivism, which holds that individuals actively construct and confirm knowledge within a community and that learning is a social activity (Garrison 2013, 2017; Stenbom & Cleveland-Innes, 2024; Swan et al., 2009). On the other hand, the research design is grounded in pragmatism, which is a philosophical paradigm that evaluates ideas and theories based on their practical outcomes (Cohen et al., 2018; Creswell & Creswell, 2018). This paper proposed three pillars for an online AI literacy course and an instrument to measure learning outcomes for non-expert AI users, serving as both a theoretical framework for AI literacy course design and an educational intervention. Integrating the three pillars of the course into the SNAIL offers

methodological and pedagogical benefits by enabling educators and instructional designers to ensure alignment between what is taught and what is evaluated.

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