Developing Higher Education Students' Artificial Intelligence (AI) Literacy for Academic Writing: A Pilot Study in A First-Year Seminar

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Abstract
As generative AI tools like ChatGPT become increasingly integrated into higher education contexts, the need to equip students with critical AI literacy has become urgent. This pilot study investigates how a four-lesson instructional module shaped undergraduate students' understanding of the ethical use, potentials, and limitations of generative AI tools, particularly in relation to academic reading and writing. Implemented in a First-Year Seminar (FYS) course at a U.S. university, the study employed a mixed-methods design, drawing on pre- and post-module AI Literacy Surveys (n=7), a post-semester instructor interview, and the researcher's reflection journal. Findings revealed a notable shift in students' awareness of ethical considerations, collaborative engagement with AI, and development of authorial voice when scaffolded through structured activities. However, these gains did not consistently transfer to independent academic tasks, pointing to the limitations of short-term interventions and the importance of integrating AI literacy instruction within foundational academic writing curricula. As an exploratory pilot study, the findings provide preliminary insight into the pedagogical potentials and constraints of early AI literacy intervention for college-level academic writing, suggesting the need for sustained, curriculum-embedded approaches to cultivate critical and ethical AI engagement among higher education students.
Keywords: AI literacy, higher education, generative AI, ChatGPT, academic writing, student voice, ethics in AI, instructional design, first-year seminar, digital pedagogy

Introduction
In recent years, generative AI (Artificial Intelligence) tools have increasingly transformed not only our professional and personal lives but also our academic lives. With its launch as an open access tool in late 2022, ChatGPT, a generative AI tool, has particularly attracted millions of users around the world, with a significant portion of students and educators exploring its potentials for academic uses (OpenAI, 2023). While such generative AI tools bring new opportunities and affordances, they also raise questions about authorship, authenticity, originality, and ethical engagement with these tools. As Ateriya et al. (2025) pointed out, the use of AI systems to produce content has sparked worries about intellectual-property protection, since these tools may output material that is very similar to existing publications, which in turn heightens the possibility of accidental plagiarism. Such questions are of particular interest to higher education institutions and educators, where students need to learn how to deeply engage with texts, construct evidence-based arguments, conduct research, and create original texts with original arguments.

Due to this increasing use of generative AI tools and the new understandings of their potentials in academic settings, higher education (HE) institutions are now grappling with issues of how to address students' ethical engagement with these tools, as overreliance on these tools create problems of academic integrity, although the tools also have benefits. As Mollick and Mollick (2023) argue, "while AI has the potential to help students learn, its ability to quickly output writing tasks, summarize information, provide outlines, analyze information, and draw conclusions may mean that students will not learn these valuable skills." (p. 3), which raises important concerns about the value of higher education experience. Moreover, despite the increasing use of these tools, many students still lack sufficient knowledge about how they operate and what constitutes ethical uses of AI tools for academic purposes. Educators seeking support with the complexities of AI in education—whether technical, ethical, or conceptual—can refer to institutional policies, international guidelines, or scholarly discussions on the core principles of AI use (Wiese, et al., 2025). Promma, et al., (2025; as cited in Ng., et al. (2022) noted that although AI literacy is vital, research shows that students often lack key competencies in this area, underscoring the pressing need to develop curricula that strengthen these abilities. Therefore, there is now an increasing need in HE settings for educators to "play an active role in teaching students how and when to use AI as they instill best practices in AI-assisted learning" (Mollick & Mollick, 2023, p. 3). However, such studies exploring the development, implementation, and effects of instructional modules

and interventions in HE settings that teach students how to engage with AI tools ethically and responsibly are still scarce in literature.

Designing a curriculum that fully addresses the multifaceted skills and knowledge outlined in AI education frameworks is a highly challenging task as there is no universal model that fits all contexts (Wiese et al., 2025). Even when focusing narrowly on AI ethics literacy, instructors must navigate complex factors such as students' lived experiences and external institutional or societal pressures (Dai et al., 2023). Moreover, the issue is not only about AI literacy but also about academic literacy. As reading and writing are central to most university curricula, it is important to design learning opportunities to develop students' ability to critically engage with AI in these areas. This means going beyond simplistic 'do not use ChatGPT' policies to instead foster meaningful conversations and activities with students about what constitutes appropriate use, what limitations AI-generated content has, and how students can responsibly integrate these tools into their learning. Students need to learn the technical aspects of these tools, how to evaluate these tools, and what constitutes academic integrity, all at the same time.

Departing from these gaps and needs in the literature, we designed, implemented, and piloted a 4-lesson AI-literacy-focused instructional module, focusing particularly on AI use in academic writing, in a first-year seminar of a HE institution in the United States. This pilot study explored how such an intentional pedagogical intervention can shape first-year students' AI literacy in relation to academic writing tasks. More specifically, this pilot study aimed at addressing the following research question: "How does participation in an AI-literacy-focused instructional module shape undergraduate students' understanding of the ethical uses, potentials, and limitations of generative AI tools like ChatGPT in relation to academic writing tasks?"

Literature Review

Generative AI in Higher Education

The emergence of generative AI tools has sparked intense interest in higher education settings. Particularly ChatGPT, the tool that was used in this pilot study, quickly became popular among higher education (HE) students across disciplines. Recent studies have shown that HE students use it regularly for various academic tasks, such as coding or lesson planning depending on their major, but also for a variety of writing tasks from brainstorming to editing regardless of students' specific majors (Onal, Kulavuz-Onal, & Childers, 2025). The widespread adoption of ChatGPT by HE students is because of not only its tool-specific versatility, efficiency, and ease-of-use as perceived by students (Holland & Ciachir, 2024; Fauzi, et al. 2023), but also social norms and campus infrastructure (Agyare et al., 2025) and individual differences among students, such as students' positive attitudes towards AI and digital literacy and confidence (Kim, Ham, and Lee, 2024). Moreover, students perceive ChatGPT to be useful and sometimes treat it as a 'private tutor' for understanding complex academic tasks, such as reading lengthy academic texts (Das & Madhusudan, 2024), translating and paraphrasing (Gupta, et al., 2022; Kim et al., 2025), solving problems, generating ideas, and saving time while managing multiple tasks at a time (Onal, et al., 2025).

Despite its perceived usefulness, many students also report concerns with the use of AI tools for academic tasks. These concerns particularly center on academic integrity violations and 'hallucinated' facts created by AI tools that lead to spreading misinformation and causing mistrust in AI-generated material (Črček & Patekar, 2023; Kim, et al., 2025). There have also been raising concerns about the AI tools' environmental impact among students, although their concerns of immediate educational outcomes still surpassed such environmental concerns (Zhao, et al., 2024).

Academic Writing in the Age of AI

Artificial Intelligence (AI) tools, particularly ChatGPT, have become a supportive learning tool for HE students especially in academic writing. Recent studies show that students are using ChatGPT for a variety of academic writing tasks, benefiting from its capabilities to enhance grammatical accuracy and writing quality, improve coherence, streamline idea development and provide translation and paraphrasing support (Amrullah et al., 2024; Onal et al., 2025; Wang, 2024). Moreover, the tool supports learners' efficiency in writing by providing immediate feedback, enabling better vocabulary use, and facilitating structured outlines and topic exploration (Amrullah et al., 2024; Wang, 2024).

Studies demonstrated that students generally perceive AI tools as versatile partners in the writing process. In Kim, Yu, Detrick and Li (2025) study, students described AI as a "multi-tasking writing assistant," a "virtual tutor," and a "digital peer," capable of supporting ideation, drafting, revising, and proofreading tasks. Similarly, Črček and Patekar (2023) found that students most commonly used ChatGPT to generate ideas, summarize texts, and check grammar and spelling. Students appreciated AI's capacity to scaffold writing by offering immediate feedback and suggestions, positioning it as a time-saving and motivational resource. Such positive experiences with AI tools in academic writing tasks also showed positive correlation with students' level of writing self-efficacy (Bouzar. et al, 2024).

Studies also reported students' use of AI tools such as ChatGPT for academic reading purposes in connection with their writing tasks. Onal et al., (2025) found that it has been increasingly common for students to use ChatGPT to summarize long or complex readings assigned as homework or check their understanding of texts, especially in source-based writing tasks. Other studies also suggest that students get assistance from ChatGPT for rephrasing text and summarizing readings (Zhao, et al. 2024).

In addition to benefits and increasing adoption of AI tools such as ChatGPT for academic reading and writing tasks, students also report hesitancy and caution in their use. Cummings, Monroe, and Watkins (2024), examined that many first-year students still preferred to develop their own ideas and voice, expressing reservations about the reliability of AI outputs. According to their study, when given the choice, students often limited their use of AI to early drafting stages, preferring to revise and synthesize ideas independently as their writing progressed. Similarly, Tarchi, Fidalgo, and Brante (2024) observed that HE students in their study with source-based writing tasks using ChatGPT, rarely copied AI-generated content verbatim, instead using it selectively. While some viewed ChatGPT as helpful for paraphrasing or identifying relevant themes, others doubted its credibility.

Artificial Intelligence (AI) Literacy

With the rapid integration of AI into all aspects of our lives, there is now an urgent need for educating the public to engage with AI tools in an informed and critical way. The concept of *AI literacy* has emerged in response to this need, aiming to equip learners with the knowledge and skills necessary to understand, evaluate, and use AI systems ethically and effectively. One AI Literacy framework developed by Mills et al. (2024) defines AI literacy as "the knowledge and skills that enable people to critically understand, evaluate, and use AI systems and tools to safely and effectively participate in an increasingly digital world" (p. 4). They assert that "understanding and evaluating AI is critical to making informed decisions about if and how to use AI in different contexts" (p. 5). The framework is built around three interrelated Modes of Engagement**:** Understanding**,** Evaluating**,** and Using AI. These components are not linear stages but concurrent, mutually reinforcing ways of engaging with AI systems. Each of these modes is operationalized through six AI Literacy Practices (algorithmic thinking, data analysis and inference, data privacy and security, digital communication and expression, ethics and impact, and information and mis/disinformation) and emphasizes two core values: *centering human judgment* and *centering justice*. For example, in the practice of Algorithmic Thinking, students are expected to break down complex problems and understand how algorithms automate decisions. In Ethics and Impact, learners question how datasets and algorithmic design can reproduce bias and cause harm. It is intended that learners' understanding of the workings of these systems and the likely consequences of unethical uses that may result in dissemination of misinformation should be understood by learners and evaluated carefully for them to use them effectively and ethically. As such, to develop AI literacy, students need to engage in such activities and practices, preferably with the guidance of educators in their unique learning contexts.

According to Almatrafi, Johri, and Lee (2024) and Ng et. al. (2021), AI literacy frameworks generally integrate six common constructs: *Recognize*, referring to understanding and noticing whether or not AI was used in the creation of an output; *Know and Understand*, referring to acquiring foundational knowledge of how AI systems function, including concepts like data, algorithms, and machine learning processes; *Use and Apply*, which involves interacting with AI systems, using them purposefully, and applying them in diverse contexts for learning, communication, or problem-solving; *Evaluate*, which refers to critically assessing the outputs of AI systems, understanding their limitations and potential biases, and determining their appropriateness for specific tasks; *Create*, referring to designing, modifying, or developing AI systems or tools, including the ability to train models or customize outputs through prompting or coding; and *Navigate Ethically*, which encompasses awareness of and engagement with the ethical, social, and cultural implications of AI, such as fairness, transparency, privacy, and accountability. Almatrafi et al. (2024) also found that many studies emphasize the necessity of learners engaging in critical evaluation of AI tools and using and applying AI as fundamental components of AI literacy frameworks.

Instructional Interventions for Teaching AI and AI Literacy Skills

Recent empirical and theoretical work has examined instructional interventions to foster AI literacy in both K–12 and higher education. Systematic reviews show that K–12 AI literacy initiatives generally follow two paths: direct learning experiences aimed at technical, conceptual, and applied skills, and curriculum frameworks that provide overarching design principles (Casal-Otero et al., 2023). The "AI4K12" initiative's "five big ideas" has informed many such curricula, offering conceptual anchors for embedding AI into STEM and interdisciplinary programs (Gu & Ericson, 2025).

Though still in its infancy, research on exploring the effects of structured interventions to help students develop AI literacy that focus not only on technical but also evaluative and ethical competencies has also been growing. The results of these studies suggest engaging learners in hands-on contextualized learning tasks where they directly engage and interact with AI tools. In their systematic review, Casal-Otero et al. (2023) identified that in K-12 settings, efforts of AI literacy development generally included activities where students learned to recognize AI-generated artifacts, understanding how AI works, and critically evaluating how AI impacts our lives.

Many interventions adopt task-based or design-based learning models, providing opportunities for students to create AI-driven projects. For example, Akman (2025) investigated the effects of AI-assisted video and graphic design projects on college undergraduate students' AI literacy. Both groups showed significant improvements in AI literacy and attitudes toward AI, with the video design group demonstrating a greater increase than the graphic design group. Similar evidence comes from middle school programs such as the DAILy workshop (Lee et al., 2021) and the ActiveAI goal-based scenario app (Tseng, et al., 2024), which integrate project-based learning with ethical considerations. The AI Audit card game (Ali, Kumar, & Breazeal, 2023) further illustrates how gamified simulations can prompt learners to design, critique, and reconsider AI systems, fostering awareness of potential societal harms. These findings suggest that authentic, creative, task-based and production-oriented activities may enhance not only technical understanding but also evaluative and ethical engagement.

Specifically, in teaching AI literacy in relation to academic writing in HE, studies show similar recommendations for critical engagement with AI-generated outputs. For example, Van Niekerk, Delport, and Sutherland (2025) conducted an active learning intervention in which students generated academic essays using ChatGPT and then critically evaluated them based on pre-determined academic writing criteria. Initially impressed by the tool's ease of use and fluent output, students later became more skeptical after recognizing limitations such as fabricated references, lack of critical insight, and superficial argumentation. The intervention successfully reduced students' behavioral intention to rely on ChatGPT uncritically and fostered metacognitive engagement by prompting students to reflect on the tool's appropriate and inappropriate uses in academic writing. Similarly, Agyare, et al. (2025) conducted a cross-national study to investigate college physics students' perceptions and usage of ChatGPT across four universities in Ghana, Jordan, and the United States. They found that ethical concerns negatively moderated students' behavioral intentions in using this technology, indicating that students who were more ethically cautious were less likely to use ChatGPT despite favorable intentions, which supports integrating ethical AI literacy into instructional design. Moreover, Yang, Huang, and Liu (2025) found that when instructors encourage students to reflect critically on the advantages and risks of AI tools, learners begin to treat AI as a collaborative resource rather than an authoritative one. Their study highlights that effective integration of generative AI requires not only tool adoption but also shifts in pedagogical mindsets, where students and teachers co-construct norms for responsible AI use.

All in all, studies on instructional interventions to teach AI literacy collectively recommend embedding contextualized, participatory and active engagement with AI tools, explicit ethics discussions, discipline-specific guidelines, and reflective activities in the classroom to move students from passive consumption toward critical, strategic AI use.

Voice in Academic Writing

In academic writing, voice is a complex and debated concept, yet Elbow shows it remains central to how students and teachers understand written communication. He notes that readers often experience writing as if it carries an "audible voice" – a quality that makes language clearer and more engaging because "when readers hear a voice in a piece of writing, they are often more drawn to read it – and that audible voice often makes the words easier to understand" (Elbow, 2007, p. 7). Elbow also clarifies that the term voice contains multiple dimensions, explaining that he has previously distinguished five senses of voice: audible voice, dramatic voice, recognizable or distinctive voice, voice with authority, and resonant voice (Elbow, 2007, p. 12). Each of these describes a different way writers project presence, stance, or personality through language. Elbow further emphasizes why attention to voice matters for

developing academic writers: students instinctively talk about voice, teachers continue to reference it, and writing that carries a sense of voice is typically easier to follow and more rhetorically effective because "when they do [write with voice], their words are more effective at carrying meaning" (Elbow, 2007, p. 9). His discussion also shows that attention to voice helps writers shape how they are perceived, since qualities such as sincerity, authority, or resonance influence how readers interpret ideas and respond to arguments. For first-year college students – who are still forming their academic identities and learning to navigate unfamiliar discourse expectations – Elbow's work demonstrates that understanding voice and learning to control it can support clearer communication, stronger ethos, and greater confidence as they enter academic conversations.

Several studies have explored how to help higher education students develop their voice in academic writing. Vengadasalam (2020) emphasizes that voice is "how each student contributes to scholarship" and that developing it involves "struggle, risk-taking, and reconstruction," (p. 13) making voice an important marker of academic success. Because students' voices can be silenced by academic norms or feelings of marginalization, she argues that instructors must intentionally create classroom spaces where students feel safe, recognized, and able to assert their perspectives. To guide this work, she proposes the S.E.A. framework – scaffolding, empowerment, and awareness. Empowerment comes from creative, interdisciplinary writing prompts that encourage students to take innovative positions. Awareness grows through critical questioning of texts and disciplinary conventions. Scaffolding supports voice development by structuring the writing process and modeling voiced writing through outlining, drafting, revising, and peer review. Together, these practices help students develop confident and original academic voices. Similarly, Healey, Matthews, and Cook-Sather (2020) emphasize that developing a strong voice in academic writing involves intentionally presenting one's identity, values, lived experience, and standpoint. They explain that an author's voice conveys identity, experiences, values, and perspectives, allowing writers to assert authority while resisting impersonal, jargon-laden prose. Using examples such as Alise de Bie's personal narrative and Tara Yosso's authoritative assertions, the authors illustrate how voice helps writers situate themselves within scholarly conversations and make their ideas more hearable.

Significance of the Present Study

Across AI literacy scholarship, several recurring constructs emerge despite differences in terminology. Frameworks such as Mills et al. (2024), Ng et al. (2021), and Almatrafi et al. (2024) consistently emphasize three interrelated dimensions of AI literacy: (1) understanding how AI systems function, (2) critically evaluating AI-generated outputs and their ethical implications, and (3) using AI tools strategically and responsibly in domain-specific contexts. These dimensions suggest that effective AI literacy instruction should not focus solely on technical knowledge but should also engage learners in critical evaluation and purposeful application of AI tools within authentic tasks.

In the context of academic writing, these dimensions intersect with the development of personal voice, where students must learn to use AI tools as supportive collaborators rather than replacements for their own ideas and rhetorical choices. Drawing on these converging perspectives, the present study conceptualizes AI literacy in academic writing as the ability to critically evaluate AI outputs, ethically apply AI tools, and integrate AI assistance while maintaining personal authorial voice

Developing voice in academic writing is not isolated from understanding the constraints of genres of writing, by which students gain insight into how to align their writing with academic standards while negotiating their individual voice. In this effort, AI tools offer additional support for students to navigate academic conventions. However, as AI literacy frameworks also emphasize, as discussed above, students need opportunities of active engagement to understand the role of personal voice in academic writing, and how AI tools can reinforce, not impede, their authorial identity. To our knowledge, there have been no instructional intervention in HE and Generative AI literature that explored the potential of the design of such an instructional intervention to help students develop and integrate their voice into academic writing through developing their AI literacy and learning to use AI tools responsibly and ethically. This pilot study aims to provide perspectives into how this could be achieved in an HE classroom with first-year undergraduate students.

Method

Setting and Context

This study was conducted in a First-Year Seminar (FYS) course at a regional university in the US that focuses on undergraduate education. FYS is a 100-level general education requirement typically taken in the first year alongside First-Year Composition (FYC). Students usually enroll in FYC during the fall semester and FYS in the spring, though

the sequence may vary. Both courses support students' academic literacy and critical thinking, often working in tandem to develop foundational skills in writing, inquiry, and reflection. In addition to its focus on developing students' academic literacy, this FYS course was also chosen as the setting for this pilot study because it explores language-related issues across different disciplines, such as language matters in AI and technology, among others.

Instructional Module Overview

In order to purposefully align with the content of this First-Year Seminar course, this instructional module was implemented during the *Language Matters in Technology* unit. Spanning two weeks, the module consisted of four lessons, each lasting 75 minutes and held twice a week. Designed to align with the course's emphasis on language and social relevance, the module explored the language of AI and the intersection of personal voice and artificial intelligence in academic writing.

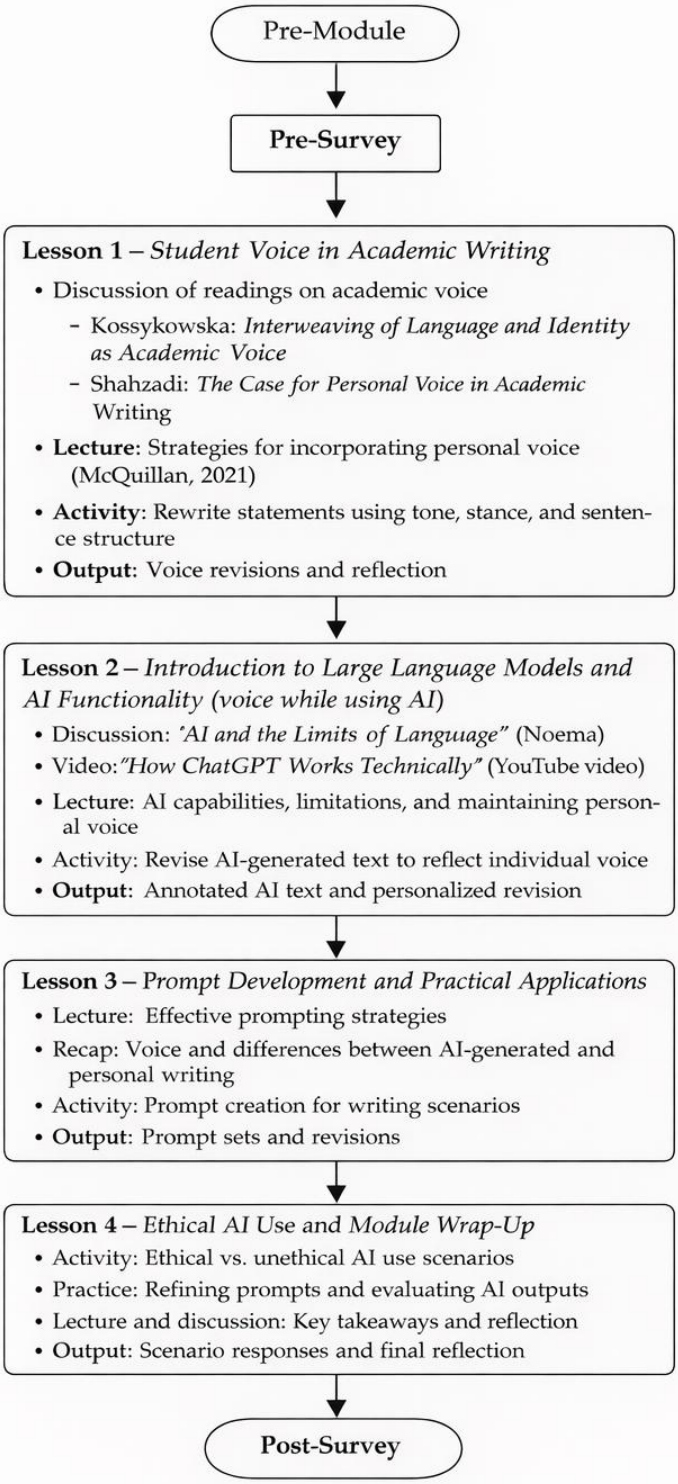
Conceptual Framework for the Instructional Module

The design of the instructional module was informed by converging AI literacy frameworks that emphasize three core dimensions of engagement with AI systems: understanding AI functionality, critically evaluating AI-generated outputs, and using AI tools responsibly and ethically in authentic contexts (Almatrafi et al., 2024); Mills et al., 2024; Ng et al., 2021. These principles were integrated with scholarship on personal voice in academic writing, which emphasizes the importance of helping students maintain ownership, stance, and rhetorical identity when engaging with external sources or tools (Elbow, 2007; Hyland, 2002; Ivanič, 1998). Together, these perspectives guided both the instructional design and the measurement of learning outcomes in this study.

With the increasing uses of AI tools in Higher Education institutions, professors in FYS and FYC courses in this university also noted significant increases in students' AI use without understanding how AI works and how to use them responsibly and ethically. Since these courses are taken by students in their first years, and have a focus on understanding the demands of academic life, especially as regards to academic writing and research, it was determined that teaching and guiding students about AI tools in academic writing and research may be a useful addition to these courses. Therefore, in developing and piloting this instructional module, the goal was to improve students' understanding of ethical uses of AI tools in their academic writing in ways that raise their awareness of personal voice in writing and how to adopt AI tools to support one's writing rather than replacing it. With these goals in mind, the four lessons in this module were organized in a consecutive manner as shown in the flowchart in Figure 1 below:

Figure 1

Flowchart of the Two-Week AI Literacy Instructional Module



Lesson 1: Student Voice in Writing
This lesson focused on the importance of personal voice in academic writing. Students explored why voice matters and examined strategies for expressing their personal voice in their writing.

Lesson 2: Introduction to Large Language Models and AI Functionality
This lesson introduced students to large language models and how they function. Emphasis was placed on maintaining a personal voice while engaging with AI-generated content. As part of this lesson, students interacted with AI outputs and reflected on ways to engage with and personalize them.

Lesson 3: Prompts and Practical Applications
In this lesson, first the key concepts were reviewed, including student voice and the distinctions between human and AI-generated writing. Students were introduced the idea of creating effective prompts to support personal and academic goals in an ethical way. As part of this lesson, students also practiced creating prompts for different scenarios, focusing on how to guide AI in producing academically ethical content.

Lesson 4: Practice and Wrap-Up
In this lesson, students practiced identifying ethical versus unethical uses of AI tools through various scenarios and refined their prompt development. The lesson concluded with a review and reflective discussion on the main takeaways.

Collectively, following the existing AI Literacy frameworks' components of recognizing, knowing and understanding, using and applying, creating, evaluating, and navigating ethically, the four lessons were designed to move students from understanding AI systems, to critically evaluating AI outputs, and finally to strategically using AI tools in ways that preserve their own authorial voice in academic writing, reflecting the progression suggested by AI literacy frameworks.

Participants
Participants were first-year undergraduate students all enrolled in the same First Year Seminar (FYS) course. A total of 18 students were registered in the course roster, including one student never attending any of the modules. The class population included 9 female and 9 male participants all of whom were 18 years of age or older. This population was chosen because first-year students are often new to higher education contexts and may face challenges navigating academic reading and writing demands. As mentioned previously, this course was selected due to its thematic alignment with language and technology, including content related to AI tools and digital literacy, making it an appropriate context for the intervention.

Data Collection and Analysis
Data for this study came from three sources: a Perceived AI Literacy Survey that was collected before and after the instructional module, the first author's (also the module instructor) researcher reflection journal, and an end-of-semester interview with the FYS course instructor. All participants completed informed consent forms prior to data collection.

Perceived AI Literacy Survey
An AI Literacy Survey was created by reviewing the previous research and through expert reviews prior to the study to explore students' perceptions and beliefs about their AI literacy, rather than their actual AI Literacy performance. The survey then was distributed online to students through Qualtrics before the instructional module and right after the final lesson in the module.

The finalized survey consisted of 26 items asking students their perceptions on a 5-point Likert-scale, 1 being 'strongly disagree', and 5 being 'strongly agree'. Internal consistency for the overall AI literacy survey was assessed using Cronbach's alpha. The 26-item scale showed acceptable reliability, $\alpha = .88$, indicating that the items collectively measured a cohesive construct. The items in the survey were also grouped into 4 different categories reflecting key dimensions of AI literacy identified in prior frameworks, including use and application of AI tools, ethical awareness, critical collaboration with AI in writing, and perceptions of AI's role in academic success (Almatrafi et al., 2024; Mills et al., 2024; Ng et al., 2021). These categories were used to support analysis and interpretation of the results, as shown in Table 1.

Table 1. *Perceived AI Literacy Survey Components*

Category	Number of Items	Sample item	MPS*
Use and Application of AI Tools in Academic Contexts	7	*I believe AI tools can help me improve my writing skills.*	35
Awareness of Ethical Considerations	4	*I am aware of the unethical uses (i.e., misuses) of AI tools for academic purposes.*	20
Collaborative Writing with AI Tools and Voice	7	*I know how to add my personal voice to AI-generated content in a way that maintains my academic integrity.*	35
AI's Impact on Student Success and Access	8	*I believe AI tools can help me improve my writing skills.*	40

*MPS: Maximum Possible Score

In this survey, *Use and Application of AI Tools in Academic Contexts* (7 items; MPS = 35) assessed students' perceived familiarity with generative AI and confidence using tools like ChatGPT to support academic reading and writing (e.g., drafting, idea generation, comprehension support), including perceived ability to write effective prompts and review/revise AI outputs for errors. *Awareneess of Ethical Considerations* (4 items; MPS = 20) category aimed to capture students' perceived awareness of ethical concerns and misuses of AI in academic work (e.g., plagiarism, bias), as well as their perceived understanding that responsible use involves actively interacting with AI and revising outputs rather than relying on a first response. *Collaborative Writing with AI tools and Voice* (7 items; MPS = 35) focused on understanding students' perceived ability to work with AI as a writing partner while maintaining their writing voice, style, authorship and ownership of their work (e.g., differentiating AI vs. human text, using AI output as a starting point, revising and reshaping AI-generated content, and integrating their personal academic voice in ways that align with integrity). Finally, *AI's Impact on Student Success and Access* category explored students' perceived beliefs about AI's usefulness for academic success and access, including whether AI can improve writing quality, increase efficiency, support comprehension, expand access to resources, and help address language- or writing-related challenges.

In this study, only data from the students who provided informed consent and who completed both the pre- and post-module surveys were included. A total of 7 students completed both surveys, although all 18 students participated at least three of the four lessons in this instructional module. Scores from individual items were summed within their respective categories to produce an overall score for each student in each of the survey's five categories. Because of the small-scale nature of this study, the data with students' pre- and post-module survey scores were analyzed through descriptive statistics.

Interview with the Course Instructor

In addition to student data, a one-hour semi-structured interview was conducted with the course instructor toward the end of the semester. This interview explored the instructor's perspective on students' engagement with AI tools and any observable changes in their writing practices or written products over the course of the semester, through interview questions such as "Have you noticed any shifts in how students are using AI tools since the AI literacy modules were introduced? In what way?", and "What else do you think could be done to raise students' awareness of effective and ethical use of AI tools for academic purposes?" among others.

Qualitative data obtained through this semi-structured interview with the course instructor were then analyzed following the qualitative thematic analysis techniques through coding, theming, and categorizing the transcribed interview data (Braun & Clarke, 2006; Saldana, 2021). After the interview was transcribed, the transcription was coded by both researchers. These initial codes were then categorized into larger themes in response to the research question.

Researcher Reflection Journal

This reflection journal was written retrospectively by the first author after the completion of the instruction on the four-lesson AI literacy module in the FYS course. While informal notes and impressions were taken during and immediately after each lesson, the full journal was composed at the end of the module. This allowed for a broader

view of the overall progression – particularly how students' understanding of voice, AI functionality, and ethical writing practices evolved over time.

The reflections focused on the first author's observations and experiences while teaching each lesson, with particular attention on classroom activities including in-class writing samples, peer-sharing discussions, and instructional materials, as well as her evaluations on which activities most effectively supported student learning and engagement, and how student responses challenged or confirmed the pedagogical intentions behind each lesson. Special attention was given to moments when students demonstrated increased confidence, questioned AI-generated content more critically, or engaged in nuanced ethical reasoning.

Writing retrospectively provided space to synthesize immediate observations with long-term outcomes. It also helped surface areas for improvement, such as the need to adjust scenarios to better match students' academic backgrounds and writing skills. Overall, the journal served as both a pedagogical self-assessment and a qualitative record of how students negotiated voice, authorship, and responsibility in AI-supported writing environments to triangulate the quantitative data obtained in the pre- and post-module surveys.

Ethical Considerations and Researcher Positionality

This study was approved by the Institutional Review Board of the institution where it took place. Additionally, several steps were taken to ensure ethical integrity and data reliability. First of all, all the data collection procedures (including the surveys, and the teaching of the instructional module) was completed by the first author who maintained a neutral role in the classroom. As this was the first time meeting the students, the first author was positioned solely as a guest instructor facilitating the instructional module, with no involvement in grading or prior relationships with the participants. This separation helped reduce bias and increase the trustworthiness of the data collected. All participation was voluntary, and students were informed that they could withdraw at any time without academic consequences. On the other hand, although the researcher was not the course instructor for this particular course, she was an instructor for First-Year Composition courses. Therefore, she was knowledgeable and experienced about the pedagogies of teaching and the needs of first-year college students.

Moreover, the actual course instructor was not present at any time during the course of the two weeks when the instructional module was implemented. This allowed for neutral participation by the students during the lessons, free of fear of their grades being affected by their participation or lack thereof.

The surveys did not ask for any identifiable information, such as students' names or majors. Each participant was assigned a unique identification number to ensure confidentiality and to match pre- and post-surveys. Only the first author had access to the identification key. Survey responses remained confidential and were accessible only to the student researcher and the principal investigator. All data were de-identified prior to analysis. The second author only had access to this de-identified data.

All students in the course engaged in the instructional module as part of regular class activities; however, participation in the survey was entirely voluntary. Both pre- and post- surveys were collected by the first author (aka "the researcher"), who designed and facilitated the instructional module but had no role in grading or academic evaluation of the students. The course instructor was not present during survey collection and remained unaware of which students participated.

Results

In this study, a 4-lesson instructional module was designed to teach students how to use Generative AI tools, specifically ChatGPT, in academic writing in ethical and responsible ways considering their own voice. In order to understand the usefulness of this module, it was implemented with first-year college students in a First Year Seminar (FYS), and collected data to answer the following research question: "How does participation in an AI-literacy-focused instructional module shape undergraduate students' understanding of the ethical uses, potentials, and limitations of generative AI tools like ChatGPT in relation to writing tasks?" To answer this question, data were collected from three sources: pre- and post-module Perceived AI Literacy Surveys, a post-semester interview with the course instructor was analyzed, and the researcher's reflection journal as the module instructor. Because the survey assessed perceived AI literacy rather than performance-based competencies, the findings should be interpreted as students' reported confidence and awareness rather than direct evidence of skill development.

All 18 students in this class attended at least three of the four lessons in the instructional module. However, 7 of them completed the AI-literacy survey both before and after the module. Therefore, Table 2 below presents only these students' scores and the descriptive statistics on the Perceived AI literacy Survey before and after the instructional module, based on their self-reported data.

Table 2. *Pre- and Post-Module Perceived AI Literacy Survey Scores across Four Categories*

St ID #	Use and Application of AI Tools in Academic Contexts (MPS*: 35)		Awareness of Ethical Considerations (MPS*: 20)		Collaborative Writing with AI Tools and Voice (MPS*: 35)		AI's Impact on Student Success and Access (MPS*: 40)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	26	28	16	16	23	28	32	27
4	26	35	20	20	20	35	25	40
5	27	35	17	20	26	34	34	40
6	26	35	18	20	30	35	34	40
13	23	25	13	15	21	27	25	28
17	27	35	15	20	28	33	32	40
18	21	26	13	16	15	26	26	30
M	25.14	31.29	16	18.14	23.29	31.14	29.71	35
SD	2.10	4.37	2.39	2.17	4.77	3.68	3.88	5.83

*MPS: Maximum Possible Score

Given the small number of students who completed both surveys (n = 7), inferential statistical analyses were not computed; therefore, descriptive statistics were used to explore patterns in students' self-reported perceptions following the module. Overall, Table 2 above suggests positive shifts in students' self-reported perceptions following the module, with increases in mean scores in all four categories, although they should be interpreted as exploratory and descriptive rather than conclusive. The largest increase appears in *Collaborative Writing with AI Tools and Voice* category (Pre $M = 23.29$, $SD = 4.77$; Post $M = 31.14$, $SD = 3.68$), indicating that students left the module feeling more confident about revising AI-generated text, maintaining ownership, and integrating their voice. Also, the decrease in SD suggests students became more consistent in these perceptions after the instructional module. *Use and Application of AI Tools in Academic Contexts* also shows substantial perceived shifts (Pre $M = 25.14$, $SD = 2.10$; Post $M = 31.29$, $SD = 4.37$), indicating an increase in perceived competence using AI for academic tasks and prompting. On the other hand, the increase in SD in this category implies more variation in how strongly students reported growth and that they perceived varying degrees of benefits of the instructional module. *AI's Impact on Student Success and Access* showed perceived increases as well (Pre $M = 29.71$, $SD = 3.88$; Post $M = 35.00$, $SD = 5.83$), suggesting stronger beliefs in AI's potential to support achievement and access, as opposed to pre-module beliefs, though the larger post-module SD signals that students diverged more in how beneficial they believed AI to be (partly reflected in one student reporting a decline (e.g., Student (St) #1). Finally, *Awareness of Ethical Considerations* shows a smaller but still positive mean increase (Pre $M = 16.00$, $SD = 2.39$; Post $M = 18.14$, $SD = 2.17$), suggesting modest growth in students' perceived ethical awareness with slightly reduced variability; however, some students showed no change at the top end (e.g., students already at the MPS). Although these observed increases are not statistically significant because of the small sample that represents only one class at one university, they may indicate possible shifts in students' perceptions of their AI literacy, suggesting that the module most strongly may have contributed to students' perceived ability to collaborate with Generative AI while maintaining voice and control, while also improving perceived use/application skills and (for 6 out of 7 students) perceived impact on success/access, with more modest but still meaningful gains in perceived ethical awareness.

The quantitative perceived AI literacy data collected before and after the module were also triangulated with the researcher's (the first author's) reflective journal and the end-of-course interview with the course instructor to gain qualitative insights into how the module might have shaped students' understanding and experiences of AI in education and academic writing during the module and throughout the semester. In the sections below, a cross-analysis of quantitative and qualitative findings is reported to understand patterns that emerged in the data that can be attributed to students' perceived shifts (or lack thereof) at the end of the module, pertaining to the focus areas in the research

question: understanding of the ethical uses, potential, and limitations of generative AI tools such as ChatGPT in relation to academic writing tasks.

Understanding the Ethical Uses of AI Tools

In the Perceived AI Literacy Survey the *Awareness of Ethical Considerations* category primarily targeted students' overall beliefs and confidence in understanding the overall ethical issues with and misuses of AI tools in academic work. This category showed small to moderate post-module shit's for 5 out of 7 students, with St #1 reporting the same score and St #4 reporting the MPS of 20 in both pre- and post-module surveys. 4 out of 7 students reported the MPS of 20 in the post-module survey, with St #17 reporting the highest increase (5 points) in their perceived awareness of the ethical considerations at the end of the module. These moderate shift's suggest that students perceived an increased awareness of responsible and ethical AI use after the module, though they were not completely unaware of them pre-module. Similar observations were also noted in the researcher's reflection journal as she noticed thoughtful ethical reasoning emerging during class activities, particularly in Lesson 4 when students evaluated ethical/unethical practices in imaginary scenarios. According to her, "Students were highly engaged during the scenario-based discussions, often debating what should be considered ethical" and she found that students' responses were "thoughtful and nuanced [...] especially when they challenged the examples I considered ethical."

The course instructor during the end-of-semester interview, however, expressed no meaningful change in students' understanding of ethical AI use in general. In reference to a task where students were supposed to conduct interviews with selected participants, the instructor observed: "Most of them appeared to just create the quotes and everything using AI […] it was obvious that, that was not something that, you know, a nurse would say [in an interview]." This observation complicates the positive shifts reported in the post-module survey results by the students. Apparently, for that task, students used AI-generated interview data rather than conducting authentic interviews themselves. He explained that he had "not noticed a shift per se […] those who were using AI continue to use it […] but they're just using AI to generate everything," indicating that, in his view, students' use of AI in graded work remained largely habitual and insufficiently critical later in the semester. Rather than critically revising or interacting with AI-generated content – as seen during hands-on classroom tasks in the instructional module – the instructor perceived a pattern of overreliance on AI and minimal critical intervention. Building on this concern, the instructor argued that the definition of ethical AI use may be relative and task-based and should be determined by placing learning at the center of the task at hand; as he framed it, students should ask themselves questions such as "is it helping [me] learn?" He emphasized that anytime students learn something from interacting with AI, it should be considered a gain, but he also suggested that clearer ongoing guidance is needed beyond one-time intervention, including "a program-wide course on this [AI use] to set the ground rules".

This contrast between the observed growing awareness of ethical AI use during the instructional module (as reflected in the researcher's journal and post-module survey scores) and the continuance of ethically questionable AI practices later in the semester suggests that students' ethical AI awareness was stronger when course tasks explicitly scaffolded and focused on reflective, task-based, learning-centered AI use (e.g., with prompt chaining and revision) under the guidance of an instructor. However, these skills did not adequately transfer to new assignments and tasks beyond the module. Moreover, these findings also suggest that ethical decision-making about the use of Generative AI tools in academic tasks might be task-dependent and depend on students' attitudes towards and understandings of academic integrity. As such, students might need further guidance and focused instructional scaffolding across different assignments to develop more ethical and responsible practices with AI tools.

Understanding AI's Potentials and Limitations in Academic Writing

The main goals of the instructional module in this pilot study were to raise students' awareness of AI's potentials and limitations when using them in academic contexts, particularly in academic writing. As such, several activities throughout the module, particularly in Lesson 2, engaged students in critically analyzing AI-generated texts and discussing how such texts may (or may not) meet expectations for academic writing. The researcher's reflective journal noted that, during the module, students "correctly identified the AI-generated text by noticing its lack of depth, vague tone, and absence of real-world examples." Students were able to distinguish AI-generated writing from human-written academic writing, and articulate specific textual features that signaled limitations in AI authorship and output in meeting academic writing expectations.

Consistent with these classroom observations, the AI Literacy Survey results showed overall growth in students' perceived ability to use AI tools purposefully in academic contexts. As shown in Table 2, students' scores increased

in *Use and Application of AI Tools in Academic Contexts* (Pre: *M* = 25.14, *SD* = 2.10; Post: *M* = 31.29, *SD* = 4.37), with all seven students reporting post-module increases (e.g., St #4: 26 – 35; St #6: 26 – 35; St #18: 21 – 26). Together, the survey data and the researcher's observations indicate that students moved beyond viewing AI output as inherently reliable and began approaching it with greater attention to its quality, specificity, and usefulness for academic writing tasks.

In addition to recognizing limitations in AI-generated texts, during the module, students practiced revising AI-generated paragraphs to reflect their own ideas and writing voice. For example, Lesson 1 focused on teaching students the role of voice in academic writing and students practiced rewriting statements by using voice strategies such as adjusting tone, stance and sentence structure. The researcher acknowledged in her journal that "this lesson was one of the most productive and engaging" as it helped students understand that "their voice is what personalizes their writing". During the activity, she observed that "As students shared their rewritten versions aloud, I could see from their expressions that they were beginning to understand and appreciate the value of their own voice." Students also expressed in their exit ticket quotes a growing sense of confidence in asserting their opinions and recognized the importance of voice in making their writing more authentic and impactful. Several noted a desire to move beyond bland or impersonal writing by incorporating more emotion, clarity, and individuality in their work. As she noted, "Watching them do this so successfully – and seeing how each version became distinct and personal – was one of the highlights of the lesson." Furthermore, in Lesson 2, despite beginning with the same prompt and output, students applied voice strategies introduced in Lesson 1 – such as modifying tone, integrating specific examples, and asserting perspective – to revise AI-generated outputs. The researcher observed that this activity resulted in distinctly different texts at the end of the lesson and it contributed to students' growing ability to adapt generic AI outputs into personalized academic writing, indicating not only technical competence but also a growing awareness of authorship and individuality in academic writing. This also affirms the module's goal of supporting student agency in AI-supported environments. According to the researcher, students articulated intentions to "be more confident in expressing their opinions" and "make their voice louder and clearer." These student comments reflect a shift from passive AI consumption to active, author-driven engagement, which in turn shows their growing ability to turn the limitations of Generative AI tools into potential collaborations with them.

These observations are also aligned with the survey results, especially in *Collaborative Writing with AI Tools and Voice* category, where students' scores increased from pre- to post-module (Pre: *M* = 23.29, *SD* = 4.77; Post: *M* = 31.14, *SD* = 3.68; *Mdn* = 23 [pre], 33 [post]), and all seven students reported post-module gains (e.g., St #4: 20 – 35; St #6: 30 – 35; St #1: 23 – 28). These perceived increases reflect students' increased confidence in working with AI as a writing tool and learning to integrate their voice in academic writing.

While most students reported higher post-module scores across categories, one pattern that complicates a simple 'more is better' narrative is that increased critical awareness may also lead some students to evaluate AI's benefits more cautiously. This means that as they learn more about these tools, they may view them to be more limited than having potentials. In Table 2, for example, one student reported a decline in *AI's Impact on Student Success and Access* (St #1: 32 – 27), even though the overall group mean increased (Pre: *M* = 29.71, *SD* = 3.88; Post: *M* = 35.00, *SD* = 5.83; *Mdn* = 32 [pre], 40 [post]). This shift is compatible with the researcher's classroom observations that students were increasingly interacting with AI outputs more actively rather than accepting them at face value. As the researcher's journal notes: "They were not only writing more thoughtful prompts, but also engaging in prompt chaining – a sign that they were thinking critically and interacting with AI outputs rather than passively accepting them." In other words, as students became more discerning about AI's limitations, some may have simultaneously become less confident that AI is uniformly beneficial for success and access in all academic tasks.

While the researcher observed strong classroom engagement, particularly during hands-on, exploratory, and discussion-based activities during the module, the course instructor, who was able to observe the students across the semester, noted a general lack of engagement from the students with class content throughout the course, which could be a reason for their continuing overreliance on AI tools over the semester as observed by the course instructor. This tension between productive in-class engagement during the piloted instructional module and uneven transfer beyond the module (as observed by the course instructor) also surfaced in Lesson 4, whose goal was "to help students practice everything they had learned in the previous three lessons – voice, AI capabilities and limitations, and effective prompting – by applying those concepts to real-world [academic] writing scenarios." The researcher noted that students' ability to engage with these scenarios seemed to depend also partly on prior writing preparation:

> "One challenge I encountered was with Scenario 8… many students hadn't yet taken [First-Year Composition (FYC) course]. Since students are required to take the FYS and FYC in different semesters, the majority of the class didn't have the foundational knowledge to fully understand the scenario." (Researcher Reflective Journal)

According to her, students who had completed FYC were able to approach the scenario with more confidence and attention to nuance, while others struggled to apply the concepts of voice, revision, quote interpretation in source-based writing, and audience awareness, and in general, engaging with AI in this specific writing task. This suggests that critical, learning-centered AI use in academic writing may depend not only on familiarity with AI tools, but also on students' foundational knowledge of academic writing conventions and revision practices, which also helps explain why post-module perceptions (especially in *AI's Impact on Success and Access*) may become more variable across students.

Finally, the researcher's in-class observations of students' active engagement revising AI outputs with voice and purpose, and the higher post-module survey scores collected right after the instructional module, contrast with the course instructor's broader concerns about student engagement and overreliance on AI across the semester. This pattern suggests that AI literacy activities may be most effective when embedded repeatedly across assignments and genres, rather than implemented as a single module, so that students have multiple opportunities to apply voice strategies, critical evaluation, and purposeful prompting in varied academic writing tasks and across different genres.

Discussion

This pilot study examined how a short instructional module shaped first-year students' perceived AI literacy in academic writing, triangulating (a) pre/post Perceived AI Literacy Survey scores, (b) the researcher's reflective journal, and (c) the course instructor's end-of-semester interview. Across all four survey categories, mean scores increased from pre- to post-module, with the largest gains in *Collaborative Writing with AI Tools and Voice* (Pre $M = 23.29$, $SD = 4.77$; Post $M = 31.14$, $SD = 3.68$) and notable gains in *Use and Application of AI Tools in Academic Contexts* (Pre $M = 25.14$, $SD = 2.10$; Post $M = 31.29$, $SD = 4.37$). These patterns may suggest that the module contributed to shifts in students' confidence in working with AI as a writing partner while maintaining authorship, voice, and revision control, rather than simply increasing enthusiasm for AI. As such, students' strongest perceived growth clustered around *Use, Apply* and *Evaluate* constructs of AI literacy frameworks (Almatrafi, et. al., 2024). This outcome aligns with broader AI literacy scholarship that defines AI literacy as competencies for interacting with and reasoning about AI intentionally, rather than merely knowing about it, scaffolded through task-based, learning-centered and reflective activities that target the development of these skills (Almatrafi et al., 2024; Long & Magerko, 2020; Mills et. al., 2024; Ng, et al, 2021).

The main focus of our instructional module was to help students position AI writing support as collaborative and learn how to foreground voice and revision strategies as they interact with generative AI tools in academic writing contexts. In particular, students' post-module gains in *Collaborative Writing with AI Tools and Voice* category align with long-standing writing scholarship that treats voice as a rhetorical and identity-laden dimension of academic writing (Elbow, 2007; Hyland, 2002; Ivanič, 1998). When students practiced revising AI-generated text to better reflect their stance, tone, and specificity, they were not only learning how to use a tool, but also practicing how to *reclaim ownership* of meaning and argument, which also resonates with AI literacy frameworks that centers human judgment and agency when using AI-enabled tools (Mills et al., 2024). Our findings and observations also complement Tate et al. (2025), who argue that generative AI can function as a *productive writing partner* only when instruction is designed to preserve students' authorial agency. In their design-based implementation of an AI-supported writing approach, they emphasize that students learn most when they engage in iterative prompting and reflection by treating AI output as a revisable resource and making intentional decisions about how (and whether) to incorporate it into their drafts.

Prior instructional interventions have suggested that AI literacy develops most robustly when students engage in task-based, hands-on, learning-centered activities that position AI as something to *work with* and *think against*, rather than something to passively accept. Systematic reviews of K–12 AI literacy work show that learning experiences commonly emphasize recognizing AI artifacts, building conceptual understanding of how AI works, and critically evaluating AI's implications through contextualized, rather than decontextualized, activities (Casal-Otero et al., 2023). Similarly, empirical examples, such as the project-based experiences like the DAILy curriculum (Lee et al., 2021) and video and graphic design projects (Akman, 2025), gamified simulations such as the AI Audit card game (Ali et al., 2023), and goal-based scenario learning designs (Tseng et al., 2024), further demonstrate that learners need to be given

structured design-based opportunities to test AI's capabilities and limits while also foregrounding ethical and societal considerations. In higher education writing contexts, similar active-learning approaches have been shown to shift students toward more skeptical, metacognitive engagement with AI outputs (van Niekerk et al., 2025). Our findings align with this intervention literature: the task-based, discussion-driven, scaffolded, and reflective activities in our module appeared to support students' developing agency (particularly around voice and revision) and more critical engagement with AI's affordances and constraints, suggesting that 'learning-by-doing' designs may be important for moving students from passive AI consumption toward strategic, learning-centered use.

Across our cross-analysis of survey data, the researcher's journal, and the course instructor's end-of-semester interview, an important finding was a transfer gap, meaning that the observed improvements in students' ethical reasoning and attention to personal voice in academic writing during the activities in the instructional module did not carry over to later, independent course assignments, as reported in the course instructor's end-of-semester interview. This pattern is consistent with the view in AI literacy frameworks that ethical engagement is not a one-time achievement but a context-sensitive practice shaped by task design, incentives, and what students perceive to 'count' as learning (Almatrafi et al., 2024; Mills et al., 2024). At the same time, the course instructor's later observation about the students' tendency to rely on AI-generated interviews rather than conducting authentic interviews themselves illustrates a familiar challenge in writing pedagogy: strategies developed in scaffolded learning contexts may not generalize automatically to new tasks unless instruction explicitly supports transfer across contexts (Wardle, 2007). This pattern may reflect a broader challenge identified in learning sciences research: knowledge developed in structured instructional contexts does not always transfer to new tasks unless learners recognize when and how previously learned concepts apply.

This disconnection reflects what Bransford, Brown, and Cocking (2000) describe as a *failure of learning transfer*, or the ability to apply knowledge and skills to new contexts. As they note, "students often fail to transfer knowledge because they do not recognize when it is relevant" (Bransford et al., 2000, p. 53). Similarly, from a situated learning perspective, knowledge and practices are often tied to the specific contexts in which they are learned (Lave & Wenger, 1991), meaning that students may not automatically apply ethical AI practices developed in guided classroom activities to different assignments unless those practices are repeatedly embedded across learning environments. In our context, students may have articulated ethical principles within guided scenario-based discussions but did not recognize that those same principles should guide decision-making in unfamiliar, less structured, and higher-stakes writing assignments later in the semester. This also connects to Ng et al.'s (2022) argument that meaningful AI literacy requires a practical understanding of AI's potentials, challenges, and limitations, including knowing "when and how to use it ethically" (p. 122), which must be internalized to guide authentic behavior beyond instructional discussions. Bransford et al. (2000) further emphasize that transfer depends heavily on the conditions of initial learning, noting that "organizing information into a conceptual framework allows for greater transfer" (p. 17). While our instructional module's guided discussions and activities likely supported such conceptual organization in the moment, those frameworks may not have been cued or activated later without continued scaffolding, reinforcement, and task designs that make ethical decision-making unavoidable and visible.

Finally, transfer of learning also requires sufficient time and repeated opportunities to apply learning across contexts, as Bransford et al. (2000) remind us that "the learning of complex content cannot be rushed" (p. 58). All in all, it can be conclude that the module likely provided an important starting point for ethical awareness, but sustained transfer may require recurring, assignment-embedded opportunities that repeatedly cue ethical and learning-centered AI use across genres and tasks (Almatrafi et al., 2024; Mills et al., 2024).

Although our study did not directly measure students' prior writing preparation or enrollment in First-Year Composition (FYC), our triangulated observations suggest that foundational academic writing knowledge may influence how students evaluate and engage with generative AI. This interpretation aligns with Kim, Ham, and Lee's (2024) findings that students with stronger domain-relevant skills and more positive orientations toward AI demonstrated more reflective, iterative, and metacognitively regulated interactions with the tool. Similarly, our findings support the view that critical AI literacy in academic writing is not simply 'tool literacy,' but a situated practice requiring familiarity with genre expectations, revision strategies, and rhetorical decision-making about evidence, interpretation, and audience (Wang & Wang, 2025). When students have stronger foundations in academic writing, they may be better able to discern when AI outputs support learning rather than replacing it. In contrast, students with less confidence or experience in these areas may be more likely to rely heavily on AI-generated text without critical evaluation. While this was not a measured outcome in our study, the parallel with Kim et al.'s high-

skill groups suggests that prior domain knowledge may provide an important foundation for ethical, autonomous, and critically engaged AI use. It also helps explain why perceived gains may be uneven across the students in our study and why some struggled with more advanced source-based and revision-intensive scenarios. These concerns also align with research showing that while many students use ChatGPT for writing-related tasks, they often remain uncertain about appropriate boundaries and integrity implications (Črček & Patekar, 2023; Gruenhagen et al., 2024).

Taken together, this study contributes to emerging research on generative AI in higher education in three ways. First, it provides an instructional design example demonstrating how AI literacy instruction can be integrated into first-year seminar and writing contexts through activities that combine ethical AI use, prompting strategies, and explicit attention to student voice. Second, the study contributes to writing pedagogy by framing generative AI not simply as a tool to regulate or prohibit, but as a collaborative writing partner whose outputs require critical revision and critical decision-making. Third, although exploratory in scope, the study offers early empirical insight into how first-year students perceive and negotiate the use of generative AI in academic writing tasks, including the challenges of transferring ethical AI practices beyond structured instructional contexts.

This study faced several limitations that should be acknowledged. First, the student sample in our study only represents a portion of the students in one class at one university. Because of the small sample in this study, the results of this study cannot be generalized to other populations, and nor was this intended to. The findings should be taken as descriptive, rather than conclusive. Additionally, the study relied on self-reported perceptions of AI literacy rather than direct assessments of students' AI-related writing practices or performance. While perception-based measures provide insight into students' awareness and confidence, future studies should incorporate behavioral or performance-based assessments to more directly examine AI literacy development. In addition, subsequent studies should consider implementing the similar modules with larger student populations, preferably representing more than one class.

Additionally, despite being offered the opportunity, no students volunteered for follow-up interviews after the module implementation. This limited our ability to gather in-depth qualitative insights into students' perceptions and experiences. Incorporating open-ended questions within the survey instrument in future iterations of the study may help capture richer qualitative data while accommodating students' time constraints and willingness to participate. In addition, adding reflection-based assignments in the instructional module through which students reflect on their learning processes would support deeper metacognitive engagement and offer a valuable window into students' evolving understanding.

Moreover, the two-week timeframe allocated for the module delivery, which adhered to ethical considerations required by the IRB approval for this study, was relatively short, especially considering that the the researcher was only the module instructor but not the course instructor. This created challenges in terms of continuity, relationship-building, and sustained engagement with students. It is suggested that having the course instructor also serve as the module facilitator in the future would enhance integration of the content into the course and allow closer observation of student progress throughout the semester.

Additionally, this alignment would create ongoing opportunities to implement and practice the module content through regular class assignments, reinforcing key concepts of AI literacy in more authentic and scaffolded ways.

Finally, the timing of the collection of the post-survey data presents limitations. While the immediate post-module survey responses indicated positive shifts in students' understanding, these results may not reflect the longer-term effects of the intervention. The course instructor, interviewed only at the end of the semester – a time typically marked by fatigue and increased workload – expressed more tempered views about the module's impact. A more comprehensive understanding could have been achieved by conducting interviews at multiple points, such as immediately after the module's delivery and again at semester's end.

Implications

The findings of this study offer important implications for the design and implementation of AI literacy instruction in Higher Education settings. First of all, it is important that students receive focused instruction on how to recognize, use and evaluate AI, such as the instructional module designed for this study, to develop their AI literacy skills. Such focused instruction should involve hands-on tasks, allow student reflection, and provide space for discussion, all of which encourage active engagement with generative AI tools. Since AI use and ethical evaluation will depend on the

particular course or task, it may also be beneficial for HE instructors to make such focused instruction part of their specific courses to guide students.

As AI literacy lies at the intersections of traditional literacy and digital literacy, the findings suggest that students' foundational academic writing knowledge reinforces the development of AI literacy. If students do not have knowledge and experience in academic writing, or if they do not have awareness of their own personal voice in academic writing, their critical evaluation of the AI-generated academic writing may be limited. Therefore, it is recommended that integrating AI literacy instruction with, or sequencing it after, writing instruction that builds rhetorical awareness. For example, institutions could consider embedding it within FYC courses to ensure students have the rhetorical tools to use AI as a support rather than a substitute for learning.

Finally, this study reinforces the need for reassessing how student work is evaluated in the age of generative AI. While students may demonstrate critical awareness and thoughtful engagement in class, such behaviors are not always visible in current final assignments and traditional assessment methods. Instructors may need to adopt more process-based and reflection assessment tools – such as annotated drafts, process journals, or AI-use reflections – to gain a fuller picture of how students are using these tools. These practices not only uphold academic integrity but also encourage responsible, intentional use of AI.

Conclusion

This pilot study highlights both the promise and the limitations of short-term AI literacy interventions in first-year seminar classrooms. The instructional module demonstrated potential to increase students' knowledge and ability to use and apply AI tools in academic contexts, their sense of authorial voice when engaging with generative AI tools, and their critical evaluation skills. Survey results and classroom observations revealed early signs of critical literacy, particularly when students were guided through scaffolded, hands-on, reflective activities. However, these gains did not consistently transfer to independent academic tasks, suggesting that deeper, more durable understanding requires more than one-time instructional intervention.To foster truly reflective, voice-driven, and context-aware AI use, AI literacy focused instruction needs to be integrated across the curriculum – especially in writing-intensive courses – through repeated, varied opportunities for application.

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