

Student responses to the integration of generative AI into an upper division Engineering writing course (IUSE)

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Students who learn to critically integrate generative AI into their writing processes—using it to scaffold ideation, enhance revision, and refine rhetorical choices—will be better prepared to enter a workforce where human expertise lies not in replacing writing with automation, but in leveraging AI to amplify precision, creativity, and effective communication. In this way, developing AI literacy, “a set of competencies that enables individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace” (Long & Magerko, 2020, p.2), ensures that STEM graduates are equipped with the skills demanded by contemporary workplaces. Working in partnership with the lead instructor of the existing undergraduate engineering writing and communication course (second author), we sought to provide guidance on the ethical and effective use of generative AI for writing and increase students’ AI literacy.

Based on our work with instructors over the past two years, we have noted emerging best practices for using generative AI productively in academic writing and for integrating generative AI into writing-intensive courses. During our first year, we saw that an iterative prompting strategy, beginning with a “good enough” prompt followed by iterative refinement until the user’s needs are met by the AI output, proved an effective strategy for our students. We also find that the ability to prompt well and iterate requires both content knowledge and critical thinking. Corroborating the accuracy of the AI output is a critical skill that fits naturally in the existing instruction, as students must check their sources in their writing regardless of AI use and verifying the accuracy of AI output is a low-stakes way to practice these skills. Students who learn to “think first” about the writing task before turning to AI and practice interrogating AI output through asking for elaboration, clarification, expansion, or revision can engage in more productive interactions with AI and assert their agency over the writing process (Tate et al., 2025). This paper looks at data from students collected at the beginning and end of Spring 2025 through surveys of AI literacy from all 4 instructors’ courses, as well as qualitatively analyzing reflective journals from Harnick-Shapiro’s Spring 2025 course to analyze how students report using AI.

Methods

Setting

The University of California, Irvine (UCI) is federally designated as a Hispanic-Serving Institution and an Asian American and Native American Pacific Islander-Serving Institution. UCI engineering and computer science majors are 42% Asian, 15% Hispanic, 13% White, and 2% African American. Students are overwhelmingly male in this field (72%). 30% of these students qualify for the Pell Grant and 38% are first-generation college students. The Engineering Department requires an upper-division professional communication course designed

to provide students with the tools to plan, research, organize, write, and edit various forms of oral and written technical communication that they will need as professionals. The course is a graduation requirement for almost all engineering majors and complies with the requirements of the campus for upper-level writing courses. Students must produce 4,000 words or more.

Participants

For academic year 2024-5, Harnick-Shapiro and 3 additional course instructors were provided with the tool and curricular materials for use at their discretion. Each instructor taught at least two sections of approximately 20 students each.

Measures

Pre and post surveys combined measures of generative AI use developed by the research team and attitudes toward generative AI adapted from Strzelecki (2024). Survey results were analyzed descriptively using Stata. Paired *t* tests determined whether the changes from pre to post-survey responses were significant.

Students in Harnick-Shapiro's sections were assigned to keep a field notebook over the quarter to regularly document their experiences using generative AI tools in their course activities and assignments. Specifically, students were asked to "Record a reflection on the writing and oral communication processes as you move through the assignments in the course. Do the tools support or hinder the writing or communication goals?" Entries were required to be substantive, but not long, with a suggestion to keep most entries to about 100 words. Completed field notebooks were collected at the end of the 10-week term. Field notebooks were uploaded into Dedoose and coded by the first author. Coding was done using an inductive, grounded theory approach throughout (Charmaz, 2006), with codes emerging directly from participant responses as well as more focused codes based on our early research on effective use of generative AI in writing (Miles & Huberman, 1984; Author et al., 2025). Codes reflected the part of the writing process underway (planning, drafting, feedback, revision, and editing), with two additional codes for reading and for gathering research or content. Other codes included how the AI was used, such as to offload a task, or not used at all (and if so, why not).

Results

At the beginning of the Spring quarter, students showed fairly high expectations for the performance of generative AI (Figure 2), had relatively strong beliefs in their ability to navigate generative AI (Figure 3), and thought using AI would not be particularly difficult (Figure 4). More than half of the students reported using generative AI at least several times a week by spring 2025 (Figure 5).

Of the 80 students who completed both the pre and postsurvey, we found statistically significant increases in perceived resources (4.14 to 4.38, $p=.00$) and knowledge necessary for use (3.99 to 4.25, $p = .01$). Students also reported an increased ability to get help (3.67 to 3.95, $p = .01$), perceived ease of learning to use AI (4.02 to 4.29, $p = .00$) and become skillful at it (3.89 to 4.20, $p = .00$). By the end of the quarter more students also reported that they intend to continue using generative AI in the future, increasing from a mean of 3.95 to 4.18 ($p = .02$). Figure 6 shows these increases by question.

Figure 2.

Pre-Survey Student Responses: GenAI - Performance Expectancy

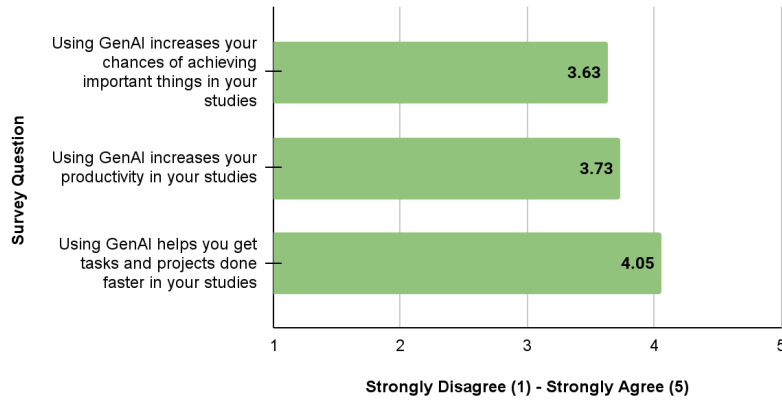


Figure 3.

Pre-Survey Student Responses: GenAI - Facilitating Conditions

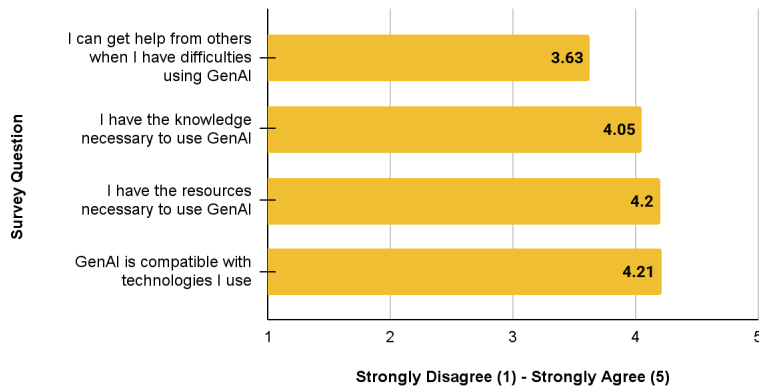


Figure 4.

Pre-Survey Student Responses: GenAI - Effort Expectancy

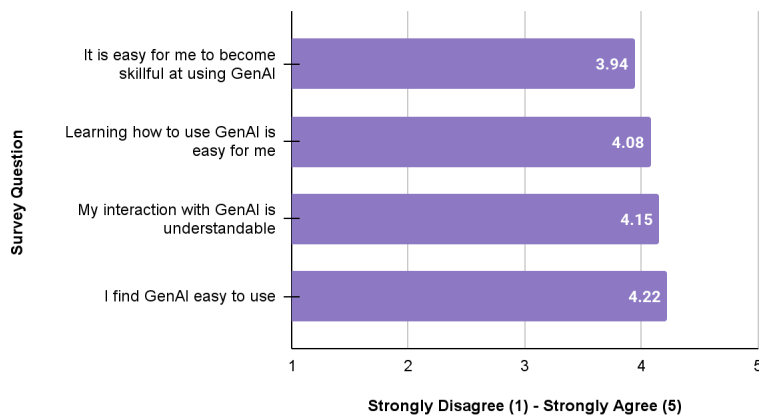
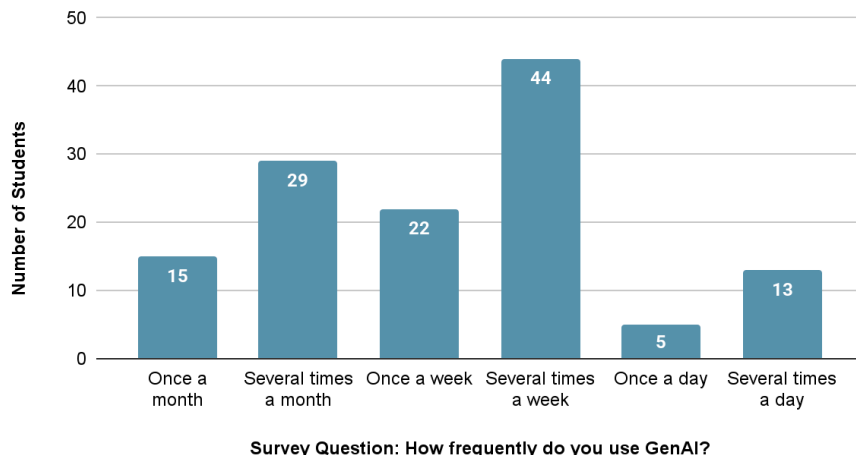


Figure 5.

Pre-Survey Student Responses: GenAI - Use Behavior



Students who completed field notebooks (n=35) reported using generative AI across the breadth of the writing process in at least one assignment (Figure 7): for feedback (n=33), planning (n=29), revision (n=27), drafting (n=24), and editing (n=14). They also used it for reading (n=16) and research or gathering information (n=18). 18 students reported essentially offloading at least one task to generative AI. In one or more assignments, students reported not using the AI (n=19), primarily because they deemed its use unnecessary (n=14), and a large number of students did not use genAI because they wanted to use their own effort in providing feedback to peers (n=11). A few students were concerned that using generative AI would take away a learning opportunity (n=4); a single student said that using genAI was more trouble than it was worth. Use of genAI was largely perceived as helpful (n=32) for at least one assignment, and less than half of that number reported it had been unhelpful for at least one assignment (n=12). Students reported collaborating (n=16) or getting tutored (n=15) for at least one assignment.

Figure 6.

Student Pre-Post Survey Responses: GenAI

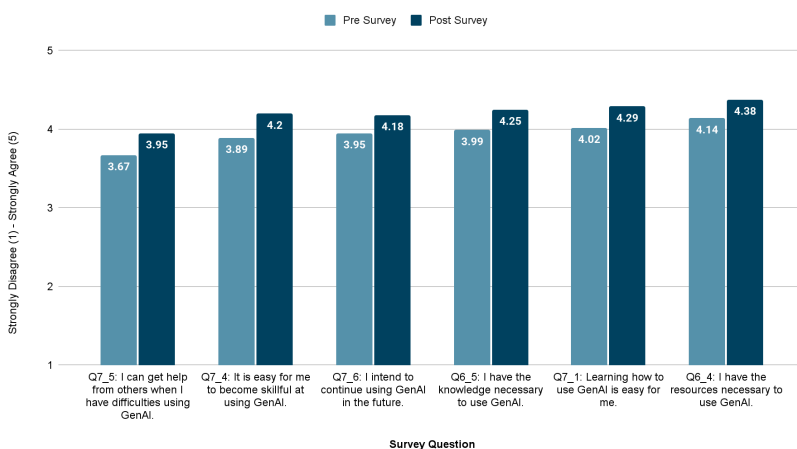
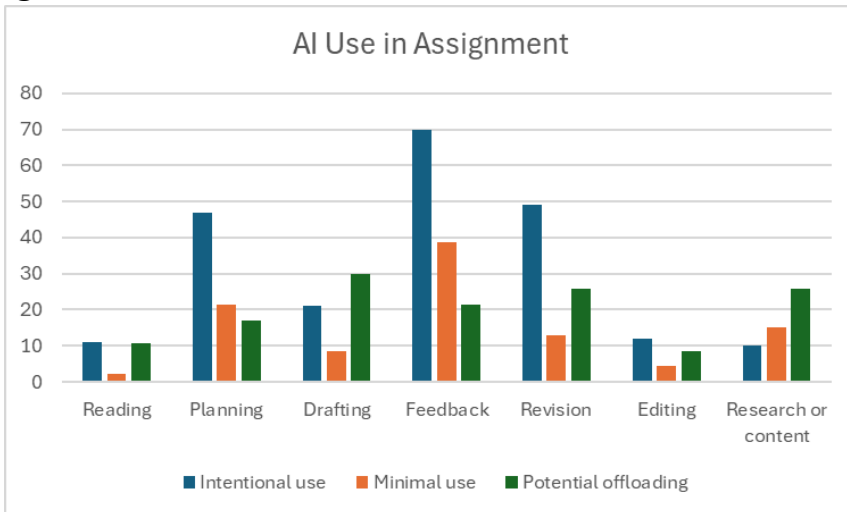


Figure 7.

We found that students could be characterized as one of three types: those who used the AI sparingly throughout the term (n=8), those who used AI intentionally to support but not replace their own effort (n=15), and those who appeared to off-load effort or learning in ways that may have compromised their ability to achieve course objectives (n=7).

Conclusion

We already see widespread adoption of AI in business and the world at large (Dell'Acqua et al., 2023). Banning or ignoring AI writing tools will fail to prepare our undergraduates for the professional world where such tools will be both embraced and valued. Indeed, AI literacy is a requisite for both future employment and civic engagement (Ng. et al., 2021) in today's and tomorrow's world. This study shows that students in an upper division writing course for engineers reported increasing familiarity and comfort with using generative AI. Their reflections suggest a majority of them used the AI responsibly and effectively when provided with instructional support for doing so. Thus, learning if, when, and how to effectively use generative AI as part of a writer's process is a key new part of literacy. If we can help students build effective habits and understanding of AI's affordances and limitations, they will be better prepared for their future.

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