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Enhancing disciplinary voice through feedback-seeking in AI-assisted doctoral writing for publication

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Artificial Intelligence (AI) tools are reshaping academic writing, yet their impact on disciplinary voice in writing for publication remains underexplored. This study examines the integration of AI in a writing-for-publication course, using a pedagogical framework that emphasizes human-human interaction to develop feedback-seeking strategies. Fifty-five linguistically and disciplinarily diverse doctoral students engaged in structured activities to explore how AI can support and challenge their disciplinary voices. Through textual analysis of students' reflections and interactions with AI, findings reveal that while these tools can enhance certain aspects of writing, their effective use requires critical engagement. Feedback-seeking emerged as a key skill, shaping how writers negotiate AI's role in their writing process—determining when input from AI tools, which operate outside the students' disciplinary boundaries, strengthens their writing and when disciplinary expertise remains essential. The study highlights the interplay between AI tools, feedback-seeking, and disciplinary voice, offering insights into their pedagogical potential in academic writing and writing for publication.

Introduction

The integration of Artificial Intelligence (AI) tools, and specifically Generative AI tools—machine learning-based technologies designed to generate content, such as text and images—into academic settings has sparked significant debate, particularly regarding their role in writing for publication (Kuteeva and Andersson 2024). While much of the current discourse focuses on distinguishing AI-generated content from human-authored texts (Casal and Kessler 2023; Else 2023; Mitrović, Andreoletti and Ayoub 2023; Orenstrakh et al. 2023), there is growing recognition of their potential to support and enhance academic writing—for instance, by providing textual feedback (Stevenson and Phakiti 2014; Sasaki, Mizumoto and Matsuda 2024) or assisting in writing assessment (Pfau, Polio and Xu 2023). However, beyond text development, it is equally crucial to examine writer development and how these tools shape aspects of the writerly self (Ivanič 1998), particularly in relation to disciplinary voice.

Using AI tools in high-stakes writing, such as writing for publication, presents a fundamental challenge: distinguishing the boundaries between human voice and AI-generated voice and determining how to balance the two (Siemens et al 2022). A key issue lies in delineating human vs. AI-generated input and understanding how their integration influences students' disciplinary voice—a core aspect of academic identity developed through engagement with discourse communities and reflective practice (Hyland 2008; Tardy 2009). While AI tools offer new possibilities, their increased reliance, particularly among novice researchers, may disrupt traditional engagement with disciplinary communities, replacing interactions with supervisors and peers. Therefore, it is crucial to guide the use of these tools in ways that support disciplinary voice, ensuring they enhance rather than replace essential academic interactions.

Adopting a Vygotskian perspective on learning, which emphasizes social interaction and the scaffolded use of tools to enhance development (Vygotsky 1987), this study explores a pedagogical approach to integrating AI into the writing process. It investigates how such an approach can foster doctoral students' textual representation of their disciplinary voice—the distinct language, conventions, and perspectives that characterize academic writing within a specific discipline—while also evaluating its effectiveness from students' perspectives.

Literature review

Integration of AI tools in writing processes

In academic writing, several studies have examined the role of AI tools in revising scholarly texts. Casal and Kessler (2023) conducted a controlled study in which academic papers were edited using AI tools and then reviewed by a panel of experienced editors. Their findings suggested that AI-edited papers had fewer grammatical errors and improved clarity compared to those revised solely by humans. Similarly, Marzuki et al. (2023) explored how AI tools assist in restructuring complex arguments and improving the logical flow of academic papers. Their study demonstrated that papers edited with AI exhibited better organization and readability, indicating that these tools can play a supportive role in refining scholarly writing.

Beyond academia, AI tools have also been integrated into professional writing, such as healthcare documentation. Ayers et al. (2023) examined how healthcare professionals evaluated ChatGPT-generated medical reports compared to those written by human physicians. The study assessed accuracy, adherence to genre norms, and overall quality. Findings revealed that ChatGPT-generated responses were rated higher in quality, leading researchers to recommend a collaborative approach: (1) Human-augmented output—using ChatGPT as an initial baseline draft, which is then refined by human experts, and (2) AI-augmented output—inputting a human-written draft into ChatGPT for enhancement and finalization.

However, while AI tools offer substantial benefits, their effectiveness depends on how they are used. Over-reliance on these tools, particularly for content generation, may lead to technically accurate but superficial outputs that fail to fully engage with the research question (Liu et al. 2023). This underscores the need for structured, critical engagement with AI tools, ensuring they complement rather than replace the writer's intellectual contribution.

AI, feedback-seeking, and disciplinary voice

The interplay between feedback and disciplinary voice has been widely explored in academic writing research. Prior (1998) highlights how extensive supervisor feedback altered a student's disciplinary voice, illustrating that excessive revisions can diminish a writer's control over their academic identity. In contrast, constructive, non-intrusive feedback fosters intellectual development and strengthens students' engagement with their disciplinary community (Eyres et al. 2001). Denis, Colet and Lison (2019) emphasize that suggestive rather than directive feedback enhances autonomy, allowing students to refine their disciplinary voice while maintaining ownership of their work.

These insights are relevant when considering how AI tools interact with disciplinary voices. Just as feedback approach influences student writing, so too does interaction with AI. This highlights the need for deliberate, structured engagement with AI tools, particularly through self-regulated feedback-seeking strategies that encourage students to actively monitor, critique, and refine their writing rather than passively accepting AI-generated outputs (Ou et al. 2024). Effective integration of AI tools in language teaching hinges on precise prompt engineering, a skill that demands expert-level feedback-seeking, where prompts should be specific and concise addressing singular issues (Tian 2024). However, such proficiency in describing precise adjustment needs is typically exhibited by disciplinary experts (Hyland 2008), that is writing experts in this context. This underscores the need to provide students access to expert knowledge (Sadler 1989) in order to allow for effective feedback-seeking (Khuder 2025).

In human-human feedback interactions, teachers and supervisors rely on social and emotional intelligence to interpret students' writing expectations and offer nuanced, context-aware feedback—a capability that AI lacks (Mitrović, Andreoletti and Ayoub 2023). Consequently, implicit human feedback processes must be made visible to enable effective AI integration into academic writing. Current research in feedback literacy primarily focuses on how feedback is provided, yet an equally important aspect is how students monitor and seek feedback (Nicol and MacFarlane-Dick 2006; Khuder 2025). Structured approaches, such as revision heuristics, can help students develop a systematic way of interacting with AI tools, ensuring that their disciplinary voice remains intact.

An example study in writing for publication that makes human-human interactions visible is Khuder and Petrić (2022) via analyzing coauthors' comments on drafts written for publication and providing a revision heuristic, developed inductively during data analysis, that looks into areas and levels of intervention. Khuder and Petrić (2022) have identified three areas of intervention (disciplinary, publishing, and writing conventions) and five levels of intervention based on the level of directness, ranging from overwriting the text to merely highlighting problematic areas in the text. This framework is significant to this study as it is used for the pedagogical intervention, further explained next.

The pedagogical intervention

Context

This study took place at a European technical university, in an introductory-level doctoral course. The iteration of the course examined in this study was attended by 55 first- or second-year doctoral students from a range of STEM disciplines. The cohort was culturally diverse, with most students being English as an Additional Language students from countries such as India, Mexico, Spain, Germany, Greece, Italy, and China. Adding to this diversity is the wide age range of students, spanning from 30 to 50 years old. While most of the students had experience with writing course assignments and scientific reports, only a few, specifically four, had experience in publishing academic articles.

This study adhered to ethical research standards, with all participants providing informed consent prior to participation, ensuring confidentiality, voluntary involvement, and compliance with institutional ethical guidelines. All data from participating students were anonymized before analysis and publication.

The feedback-seeking revision models

This section details the adaptation of the revision heuristic developed by Khuder and Petrić (2022), which categorizes areas and levels of intervention. The revised framework, introduced to students in a classroom setting, is outlined in Table 1. It structures three primary areas of revision: disciplinary, writing, and publishing conventions, each further divided into sub-areas. Students were encouraged to critically reflect on potential sources of assistance for each area and to evaluate whether AI tools could support them in addressing these revisions.

Table 1. Areas of revision (adapted from Khuder and Petrić (2022) .

Areas of revision	Example question(s)
<i>Disciplinary conventions</i>	
Terminology check	Have I used the correct terminology throughout my paper?
Argument support	Are my arguments robustly supported with evidence from the literature and/or my results?
Research positioning	Is my research perspective clearly stated? Do I reference studies and argue from within the same field of research? Have I made the relevance of my research clear to an international audience?
Precision of information	Is the information I present accurate and precise?
Reader-awareness	Can my reader easily follow and understand my arguments? Are they likely to find them persuasive?
<i>Writing conventions</i>	
Text organization	Is the structure of my text clear, facilitating comprehension at both detailed (micro) and overall (macro) levels?
Language and grammar	Is the language in my text clear and concise? Have I thoroughly checked for grammatical and lexical errors?
<i>Publishing conventions</i>	
Journal guidelines compliance	Have I followed the journal's author guidelines? Have I reviewed recent articles published in the journal to match their formatting style?

Following the introduction of the revision areas, students were presented with a structured approach to how they could engage with these revisions through the use of five distinct levels of revision, as detailed in Table 2 below. These levels of revision delineate a spectrum of interactions with AI tools, ranging from basic to advanced engagement.

At level 1, students use AI tools for immediate corrections, which provide direct and quick fixes to their texts. As they progress to higher levels, the interaction with the AI becomes increasingly sophisticated. For example, at level 5, students utilize AI tools to self-test and validate their pre-existing knowledge. The intermediate levels involve more dynamic interactions where students engage in a dialogue with the AI tool, asking for feedback and suggestions.

Following the introduction to the areas and levels of revision, students were engaged in a practical application of the heuristic using an introduction that was submitted for publication, provided by an academic in biology. This choice was deliberate; though none of the participants specialized in biology, it is a STEM discipline, which provided a degree of familiarity while also allowing sufficient detachment. This detachment was crucial as it enabled the students to focus more on developing prompting strategies and analyzing the feedback from AI tools, rather than on the content improvements of a personally authored text. Students were allowed to select any AI tool they preferred; while most chose ChatGPT3.5, some opted for CoPilot.

Additionally, the students were prompted to reflect on their interaction with the AI tool through reflective questioning, which was integrated into their task. The students were asked to document their thoughts and decisions during the revision process, which included the following questions:

- Why did you decide to implement this revision using this specific level of intervention?
- What are your thoughts on the output provided by the AI tool?

Table 2. Levels of revision (adapted from [Khuder and Petrić \(2022\)](#)).

Levels of revision	Examples
Level 1 (<i>immediate correction</i>) Overwriting your text	Rewrite this text to fix the grammatical mistakes"
Level 2 (<i>educational revision</i>) Ask for feedback and suggestions	Provide feedback on the grammatical mistakes in this text and suggest edits with explanations"
Level 3 (<i>critical engagement</i>) Ask a AI tool to ask you questions about your text	Ask me questions related to the arguments in relation to XY in the text
Level 4 (<i>interactive learning</i>) Ask to highlight errors in the text and give examples of correct (form)	Point out whether I have positioned my research correctly within my academic field and provide examples of correct ways to do so". You can attempt to correct yourself and (if relevant) ask the AI tool if you got it right.
Level 5 (<i>self-test</i>) Ask to highlight errors in the text	Point out where the grammatical mistakes are.

Table 3. The writing portfolio task.

Task: AI tools in writing for publication
In Workshop 3, you were tasked with using AI tools to edit a text from the introduction section of an article draft. Please include the following:
1) Interaction History: Provide the interaction history with the AI tool, including the prompts used and the responses received for text improvement.
2) Reflective Process on using AI tools: Engage in a reflection process to evaluate the entire learning experience, focusing on the effectiveness of your prompts, your satisfaction with the output, and the impact your use of the tool might have on your long-term learning process.

These questions encouraged students to critically assess their interactions with the AI tools, reflecting on both the process and the effectiveness of AI in assisting with various levels of text revision. Students' reflections were submitted in their writing portfolio at the end of the course, alongside their interactions with AI tools, which were copied and pasted into the portfolio using the instructions in [Table 3](#).

Research methods

This study aims to evaluate a feedback-seeking pedagogical approach designed to integrate AI tools into academic writing for publication. Specifically, it examines how guided AI-assisted text revision influences the development of writers' disciplinary voices. Additionally, the study assesses the intervention from the students' perspective, exploring how effectively it supports their learning, engagement, and interaction with AI tools. The research is guided by two key objectives:

1. To investigate the impact of the feedback-seeking pedagogical approach on students' development of disciplinary voice in AI-assisted writing for publication.
2. To evaluate the effectiveness of this pedagogical intervention from the students' perspective.

Data collection

For data collection in this study, I adopted the dual role of teacher and researcher ([Borg 2010](#)), which allowed for the integration and oversight of the intervention directly within the classroom. This approach ensures high ecological validity ([Schmuckler 2001](#)) by situating

the research within the authentic learning environment of the course curriculum, thereby reflecting genuine student experiences and interactions. However, as an insider researcher, there is a potential limitation: participants may feel inclined to provide responses they think I want to hear, which could influence their feedback and possibly affect the evaluation of the intervention. To mitigate this challenge, students' reflections were supported by their actual usage of the AI tools.

The data gathered were interactive and reflective. Interactive data included students' direct engagements with AI tools during classroom activities, capturing how they navigated revision tasks. Reflective data were collected from students' written assignments, submitted after exposure to the intervention. Reflective writing, long recognized as a critical pedagogical tool, fosters self-instruction, and deeper learning (Campbell et al. 2018) while providing valuable insights into students' cognitive processes during writing and revision (Rose 2019). In addition, students were required to submit a short evaluation of the revision heuristic introduced in the intervention. These evaluations, submitted alongside their AI-assisted assignments, provided insights into the pedagogical approach's effectiveness.

Data analysis

The methodological approach to analyzing both sets of data involved a combination of deductive and inductive thematic analysis. Initially, the analysis was guided by the established revision heuristic framework provided by Khuder and Petrić (2022), by focusing on how the students interacted with AI tools. The inductive component focused on both why they have chosen to use AI tools in a specific way and how they made a decision about the output of the AI text. The unit of analysis in this study is defined as the integrated intelligence episode, which refers to moments within the writing process where students actively engage with AI tools to make revisions, integrating AI-generated suggestions with their own disciplinary knowledge. An integrated intelligence episode encompasses four main categories, derived from both interactive and reflective data, summarized in Table 4.

For detailed reference, a full codebook outlining all codes and themes identified during the analysis is provided in Supplementary Appendix 1. Next, I report the study's findings by focusing on the integrated intelligence episodes and the students' evaluation of the heuristic.

Table 4. Four categories to analyze integrated intelligence episode.

<i>Interactive data categories</i>	
What (areas of revision)	This category captures the specific aspects of the text targeted for revision using the revision heuristic (e.g. grammar, argument support, or disciplinary terminology.)
How (process—level of revision)	The level of interaction students engaged in with the AI tools using the levels of revision (e.g. immediate correction, educational revision, critical engagement.)
<i>Reflective data categories</i>	
How (structure—final decision)	This involves how students made a decision about the output resulting in two categories: human-augmented and AI-augmented output.
Why	This involves students' reasoning behind their interaction process and includes three categories: automation, activation preexisting knowledge, and poor knowledge.

Findings

Integrated intelligence episodes: disciplinary conventions

In the analysis of 254 prompts used by students during the study, it was observed that 95 of these prompts were directed toward disciplinary conventions, comprehensively addressing all five areas identified in the heuristic framework. Notably, only seven of these prompts pertained to level 1 and 5 changes, which involve more straightforward, less critical revisions.

A significant finding from the data was that the most frequently addressed area was argument support, with students predominantly using revision levels 2 and 3 for this purpose. These levels indicate a deeper engagement with the text, where level 2 involves asking for feedback and suggestions, and level 3 may involve more analytical inputs from the AI tool, where it asks the writer questions about the text.

The most frequently addressed category was argument support, where students primarily relied on level 2 and level 3 prompts. These levels indicate a deeper interaction with the text—level 2 involves seeking suggestions, while level 3 prompts the AI tool to ask questions that encourage reflection and refinement. One example illustrating this dynamic is integrated intelligence episode 1 (Table 5), where S1 experimented with ChatGPT 3.5 for argument revision. Initially, the student used a level 3 prompt, requesting analytical suggestions. However, after attempting a level 1 prompt for more basic corrections, the student found the latter unsatisfactory, concluding that argument revision benefits most from human-augmented engagement. The student noted that level 3 prompts were particularly useful in activating preexisting disciplinary knowledge, reinforcing the idea that AI tools function best as facilitators rather than autonomous revisers in argumentative revisions.

The second most frequently addressed category was research positioning; however, several students expressed uncertainty about what this category entailed. In response, five students used AI tools to define research positioning before applying it to their revisions. In integrated intelligence episode 2 (Table 6), Student S23 initially asked AI to clarify what constitutes research positioning. Once this definition was established, the student used AI to analyze the text for its research positioning and then requested specific suggestions for improvement.

Given that the text was outside of the student's own discipline, further engagement was challenging. Nonetheless, the student found that using levels 2 and 3 prompts—where the AI tool is asked to generate questions, make suggestions, and provide answers—was particularly beneficial when the student lacked specific knowledge. This approach facilitated a more dynamic interaction with the text, albeit the student acknowledged that the ultimate revisions and strategic decisions regarding research positioning would benefit significantly from human augmentation. This reflection echoes similar sentiments expressed in argument revision, reinforcing the idea that while AI tools are valuable for initial explorations and generating ideas, the depth and

Table 5. Integrated intelligence episode 1.

What and How (process)	Why	How (structure)
P1. Ask me questions related to the arguments in relation to Iron deficiency in the text.	ChatGPT should be used carefully to help stimulate the brain so we don't compromise the originality of a paper or its credibility and innovation.	AI should be used judiciously as an auxiliary tool, ensuring that authors conduct thorough research, think independently, and deliver original ideas.
P2. Add some appropriate content based on the text.		
<i>Argument support</i> <i>Revision levels 3 and 1</i>	<i>Activating preexisting knowledge</i>	<i>Human-augmented output</i>

Table 6. Integrated intelligence episode 2.

What and How (process)	Why	How (structure)
P1. Lets define this terminology: Research Positioning: Is my research perspective clearly stated? Do I reference studies and argue from within the same field of research? Have I made the relevance of my research clear to an international audience?	I was not clear what research positioning is. I had a vague idea and also this is not in my field so it helped me understand more where the text is positioned	I only want suggestions on how to change my texts and doing the changes myself, as opposed to letting the chat bot make the actual changes.
P.2 Give this definition, can you analyze this text with respect to research positioning		
P.3 Could you comment on the text again with regards on how the concepts are introduced and are interlinked		
<i>Positioning the research</i> <i>Revision levels 2 and 3</i>	<i>Poor knowledge</i>	<i>Human-augmented output</i>

Table 7. Integrated intelligence episode 3.

What and How (process)	Why	How (structure)
P1. have I included enough details for the reader to follow?	As the writer you sometime miss on adding all the details so would be good to have a reader like ChatGPT.	Upon reading the AI-generated text, it became apparent that some manual work is required to further improve the text and ensure all information is 100% correct.
P2. suggest me resources to read more about the questions you asked.		
<i>Detail adequacy</i> <i>Revision levels 2 and 3</i>	<i>Activating preexisting knowledge</i>	<i>Human-augmented output</i>

accuracy required for academic writing in specific disciplinary contexts often necessitate human augmentation.

In examining the third most used category of revision, details adequacy, 20 students noted the utility of AI tools in providing insights into what details might be missing from a text, effectively offering a reader's perspective. This feedback was appreciated for helping to identify gaps that may not be evident to the writer. However, 17 of these students also emphasized the importance of a critical approach when using AI tools, comparing the AI's input to that of a "mislead peer" rather than an expert reader. This shows a cautious attitude towards relying solely on AI for content accuracy and completeness.

A typical interaction in this regard is highlighted in integrated intelligence episode 3 (Table 7), where a student explicitly discusses the collaborative nature of the AI tool and the writer. In this episode, the student acknowledges the benefits of the initial insights provided by the AI tool but insists that the final output should be "manually" revised—indicative of a human-augmented approach. This perspective aligns with the students' broader view that while AI tools

are instrumental in enhancing the writing process by filling in gaps, the ultimate responsibility for the text's accuracy and depth lies with the human writer.

It is evident from the analysis that when addressing revisions related to disciplinary conventions, students predominantly used levels 2 and 3 of prompting. This choice reflects a deliberate control over the disciplinary aspects of their writing, where such prompts indicate a critical engagement with the text. This strategic use of AI tools underscores the students' understanding that while AI can assist in refining and enhancing their work, the nuanced and critical aspects of disciplinary writing require human intelligence.

Integrated intelligence episodes: writing and publishing conventions

Regarding revisions of writing conventions, many students chose to focus on language, grammar, and text organization, with 159 out of 254 prompts addressing these areas. Students mainly used levels 1, 4, and 5 for making revisions related to writing conventions. An example from integrated intelligence episode 4 (Table 8) shows how S12 employed these strategies effectively. Initially, the student used a level 1 prompt to correct grammatical errors directly using the AI tool. Afterward, she asked the AI to highlight errors, which helped refine the accuracy of the feedback provided by the tool.

The student noted that this approach ensured more precise corrections. Her main goal was to automate the task of grammar checking. She observed that the AI tool provided consistent suggestions across different students, which reinforced her trust in the tool's reliability for grammatical revisions. Consequently, she felt confident that the text, now refined with the help of AI, achieved a level of quality that could be considered reliably augmented by the technology (AI-augmented output).

While the predominant use of AI tools was to streamline revisions concerning writing conventions, there was also significant evidence that students utilized these tools as a learning aid to understand writing norms. A notable instance of this, as illustrated in integrated intelligence episode 5 (Table 9) involving Student S45, demonstrates a more engaged and educational use of the technology. Initially, the student asked the AI tool to identify errors and provide examples of the correct forms. This approach allowed him to attempt corrections independently, thereby actively involving him in the learning process.

After making his revisions, he used CoPilot to verify if his corrections aligned with the standard writing conventions, providing an immediate feedback loop that reinforced learning (Ajogbeje 2023). Subsequently, he prompted CoPilot to offer explanations on why certain forms

Table 8. Integrated intelligence episode 4.

What and How (process)	Why	How (structure)
P1. edit the grammatical errors in the text.	AI tools are good at organizing text broadly but are most helpful with language and grammar. It can save time and improve readability when writing, depending on the topic given. However, for a given text, such as the example of text above, it tends to suggest the same changes to everyone, regardless of the specific prompt or user. This suggests that for language and grammar, AI can be reliable.	grammar and structure are rather simple tasks and because AI has access to all this data, it knows what the usual verb form is. This makes my life easier.
P2. highlight the errors that you have corrected.		
Grammar and language Revision levels 1 and 5	Automation	AI-augmented output

were correct. In this scenario, the AI tool was not merely a passive provider of corrections but served as an educational resource that helped activate and build upon the student's preexisting knowledge.

In general, students reported using AI tools primarily for grammatical checks, which served to both automate routine tasks and activate their preexisting knowledge. This dual function highlights the potential of AI tools not only as time-savers but also as educational aids that activate students' preexisting knowledge. This approach aligns with the observation made by student S31, who remarked, "AI tools are as good as you are." The effectiveness of AI tools greatly depends on the user's existing understanding of the matter investigated.

Integrated intelligence episode 6 (Table 10) shows one of the few prompts that asked for revisions for publishing conventions. S50 hypothesized that she would publish the manuscript in the *Journal of Biochemistry* to test whether the AI tool can help with the task. The student even uploaded the journal's guidelines to ChatGPT 3.5 and asked it to check the paragraph against

Table 9. Integrated intelligence episode 5.

What and How (process)	Why	How (structure)
P1. Highlight the grammatical errors in the text	ChatGPT is good at grammar revision, which can provide us with polished text. However, I was surprised that I can use it to refresh my memory about text structure and grammar.	AI can be fully trusted with grammar. It uses this large data and grammar there is correct.
P2. Provide examples of the correct form.		
P3. Explain the grammatical rule for each of the errors you highlighted.		
Grammar and language Revision levels 1 and 5	Activating preexisting knowledge	AI-augmented output

Table 10. Integrated intelligence episode 6.

What and How (process)	Why	How (structure)
P1. I want to publish the following paragraph in the journal of biochemistry. Here are the guidelines for the introduction section. What am I missing?	It would be so cool if this tool can check whether the submission matches the guidelines of the journal. The problem is we cannot upload the whole text but maybe soon. This will help spot things we sometimes oversee and also automate this horrendous task. This can save us lots of time and effort.	The use of AI to double-check submissions can be really helpful.
P2. Can you write me the reference list for this paragraph?		
Journal Guidelines Compliance Revision levels 2 and 1	Automation + activation of preexisting knowledge	AI-augmented output

the guidelines. S50 was rather satisfied with the output. Regardless of the satisfying result, the student remained aware of the ethical issues around uploading one's text to ChatGPT 3.5. This shows that a satisfying AI output is not necessarily a usable one, which limits the collaboration between AI and human intelligence. The student reported in case the ethical issues are cleared, AI tools can be used for the automation of publishing conventions.

This episode underscores the benefits of using AI tools to automate parts of the publishing process, particularly in reducing human error and improving efficiency in initial submission checks. By automating routine tasks, these tools can enhance the efficiency and accuracy of the revision workflow, ensuring that submissions meet required standards before they are even sent for peer review.

In summary, students used AI tools to address various aspects of academic writing, including disciplinary conventions, argument support, research positioning, detail adequacy, grammar and language, and publishing conventions. Students primarily utilized intermediate prompts (levels 2 and 3), which promote a more engaged and critical interaction with the AI tools, particularly for disciplinary conventions like argument support and research positioning. On the other hand, the less critical revision levels were used to address issues of writing and publishing conventions. Table 11 below summarizes the findings in this section.

In the concluding part of the findings section, the usefulness of the pedagogical framework is assessed through the lens of students' reflections. Students were asked to comment on the effectiveness of the revision heuristic provided during the course.

Students' reflections on the pedagogical intervention

The heuristic approach adopted in this study was shown to be useful in three aspects: (1) exposing students to different ways of interacting with AI tools, (2) providing students with the terminology needed to interact effectively with AI tools, and (3) sensitizing the students towards what constitute disciplinary voice and ways to monitor it when using AI tools. Being exposed to the revision heuristic and the different levels of revision not only clarified how students could tailor their requests to obtain optimal results but also illuminated the diverse methods by which they

Table 11. Summary of integrated intelligence episodes.

Area of revision	Level of revision	Key takeaways
Disciplinary conventions	Levels 2 and 3: educational revision and critical engagement	- AI prompts critical engagement and helps students identify gaps from a reader's perspective. - Supports students in refining arguments by highlighting missing details. - Effective as an intermediate step; human input remains essential for final disciplinary revisions.
Writing conventions	Levels 1, 4, and 5: immediate correction, interactive learning, and self-test	- Highly effective for grammar, spelling, and linguistic corrections. - Encourages active learning through interactive revision processes. - Levels 4 and 5 activities support students' self-testing and reinforcement of grammar and writing skills.
Publishing conventions	Levels 1, 4, and 5: immediate correction and interactive learning	- Useful for automating checks of formatting and journal guidelines. - Raises ethical and data privacy concerns, limiting its current full implementation. - Students recognize strong future potential with appropriate safeguards.

could solicit revisions from the AI tools. The exposure to this variety often surprised students, revealing to them the extensive range of queries and modifications they could propose. While the heuristic offered a broad framework for engagement, it was sufficiently flexible to accommodate different interpretations and applications of the tasks and tools, fostering a deeper understanding, and a more personalized approach to using AI in academic writing. The comments from students reveal a nuanced understanding of both the potentials and limitations of this technology, emphasizing the importance of structured interactions and specific prompting to achieve meaningful outcomes.

Student S14 illustrated the challenge of achieving desired results with general prompts:

Although I had this knowledge, my first prompt asking AI to make my text more persuasive did not result in my intended results... This wording to me feels highly artificial and does not follow my expectations from reading a scientific abstract.

This experience led S14 to refine their approach, using class discussions to generate more targeted prompts, ultimately enhancing the effectiveness of their interactions with AI. Similarly, S27 highlighted the unexpected utility of AI beyond basic tasks:

Its usefulness for levels 1, 2, and 5 is not surprising... However, levels 3 and 4 were particularly surprising to me, because they require a deeper understanding of the text and of the context surrounding the text itself.

This comment points to the evolving capabilities of AI tools in handling complex writing tasks, though it also cautions that such tools require thoughtful engagement.

The iterative process of refining prompts was further discussed by S28, who described their method of interaction with AI, highlighting the importance of being equipped with the language to do this task:

I like to start with a basic prompt. I then read the text produced from the basic prompt and potentially revise my text or the idea of what I am looking for. I then continue with more specific prompts where I iterate until I get something I find satisfactory. The lecture provided me with language to describe what I want AI to use.

Similarly, S31's experience using AI to position a study within a research field shows the benefits of specific guidelines: "Level 4 prompt can be useful in positioning one's study in their respective research fields... The guidelines provided were really helpful in that sense." This shows the importance of passing academic writing experts' knowledge to the students to foster more effective interaction with AI tools.

The diverse uses of the heuristic were also evident in student experiences. S21 preferred to start with a general request and then fine-tune the output, while S19 directly inserted the heuristic into ChatGPT. S53 found that "merely having a starting point for interacting with it was good" suggesting that even a starting framework can significantly impact the writing process.

Students also reflected on how these tools sensitized them and helped them notice what they already knew and what constitutes their disciplinary voice. S40 reflected on the broader implications of using AI tools effectively: "Through this experience, I have learned that the effectiveness of these tools largely depends on the user's knowledge and the guidance provided." Meanwhile, S45, initially skeptical, recognized the potential after more experience:

Having gone into the course with little experience in using AI for writing purposes, I was skeptical on the overall benefit and use of AI... It has potential to be useful in all areas of revision and can be incorporated in generating ideas, but you cannot trust what is being said fully.

S54 reflected thoroughly on how initially asking the AI tools to overwrite research positioning made the student feel “unsettled”:

At the beginning, I asked ChatGPT to change the research positioning of the text. The results looked fine but made me feel very uncomfortable: first I don't know and cannot judge whether the results are accurate and second I don't want ChatGPT to do that. It is the writer's task to do that. We spend so much time in our discipline being exposed to different ways to position our research to finally be able to judge what is suitable for the context and there is no way ChatGPT can do that.

S16 went further to say that:

I now view writing differently. I now know writing includes so many aspects and can be revised in so many ways. Some of these aspects are crucial to who I am as an engineer and I am the only one who should judge their accuracy.

By this S16 reflects on how the AI tool and the revision heuristic helped raise her awareness of her disciplinary voice.

These testimonials from students, summarized in Table 12, highlight the usefulness of the pedagogical approach that highlights human-machine interaction between human intelligence and artificial capabilities. They underscore the importance of careful, critical engagement with AI tools to maximize their pedagogical value in academic writing environments.

Discussion

The findings of this study highlight the potential of feedback-seeking as a pedagogical strategy to enhance students' disciplinary voice in AI-assisted writing for publication. Teaching feedback-seeking through the revision heuristic (Khuder 2025) enabled students to explicitly reflect on their engagement with AI tools, critically integrating AI-generated input with their own disciplinary perspectives. The structured approach to revision allowed students to recognize when and how to assert control over their writing, ensuring that AI-assisted revisions did not overwrite but rather supported their disciplinary voice.

Students reported using AI tools primarily with levels 2 and 3 prompts (educational revisions and critical engagement) when revising disciplinary conventions, indicating a preference for engaging critically with AI rather than allowing it to dictate content. This approach helped maintain disciplinary integrity, ensuring that key academic markers remained intact. In contrast, AI was readily used for automating grammatical checks and reinforcing preexisting

Table 12. Summary of students' reflections on the pedagogical intervention.

Reflection area	Key insights
Exposure to different ways of interacting with AI tools	- Students explored various strategies for engaging with AI. - The heuristic approach revealed a broader range of revision methods.
Providing terminology to interact effectively with AI tools	- Clear terminology helped students refine prompts iteratively. - Structured engagement led to more precise and effective human-AI interactions.
Sensitizing students to disciplinary voice and monitoring it	- Increased awareness of disciplinary voice and its role in writing. - Students recognized the importance of maintaining authorial control over disciplinary content.

linguistic knowledge, streamlining the writing process while reinforcing rather than introducing new knowledge.

A key distinction emerging from the findings is that students preferred human feedback for disciplinary conventions, favoring insights from their disciplinary community over AI-generated input, reinforcing the importance of discipline-specific human oversight. Conversely, writing conventions—such as grammar, clarity, and coherence—were more open to AI-generated suggestions or external expertise. This demonstrates that feedback-seeking serves as a mechanism for regulating the extent to which external input—whether from AI or human reviewers—can alter a writer's disciplinary voice. By actively engaging in structured feedback-seeking, students maintained greater control over their academic identity and disciplinary positioning, mitigating the risk of disciplinary voice erosion observed in [Prior's \(1998\)](#) study. This reinforces that feedback-seeking is a crucial skill not only for AI-assisted writing but also for human-human academic interactions.

Beyond disciplinary concerns, the use of AI tools in automating parts of the publishing process presents a compelling case for their integration in academic writing workflows. Automating tasks such as reference formatting and consistency checks saved time and reduced human error, enabling writers to focus on substantive revisions.

The flexible design of the heuristic used in this study, as recommended by [Sadler \(1989\)](#), significantly influenced how students interacted with AI tools. This flexibility and the resultant autonomy allowed students to tailor AI interactions to their specific needs, fostering a more productive and personalized writing process. Nevertheless, the provided revision heuristic is structured at an appropriate level to allow for creating structured opportunities for monitoring one's writing ([Nicol and MacFarlane-Dick 2006](#); [Khuder 2025](#)), as such structures enable students to critically engage with their work, enhancing both the writing and learning processes.

Overall, the findings underscore that feedback-seeking is vital for navigating both AI-generated and human feedback in academic writing. Structured feedback-seeking practices enhance students' ability to interact meaningfully with AI tools while also improving engagement with supervisors, peers, and journal reviewers. This study reinforces that developing feedback-seeking strategies is central to academic literacy, extending beyond AI-assisted writing to shape students' broader writing and revision practices.

Conclusion

This study contributes to ongoing discussions on how pedagogical interventions can bridge the gap between human intelligence and AI in academic writing. Feedback-seeking, as demonstrated here, not only equips students with the strategies to engage productively with AI tools but also reinforces their ability to navigate disciplinary discourse critically. Future research should examine how different feedback-seeking strategies impact student engagement with AI-assisted writing, particularly through longitudinal studies that track skill development over time.

While integrating AI tools into academic writing instruction may initially seem complex, this study demonstrates that educators do not need advanced technical expertise to guide students in using these tools effectively. By drawing on existing pedagogical knowledge—particularly in feedback-seeking and revision strategies—teachers can help students develop AI literacy while preserving disciplinary voice. As AI tools continue to evolve, the challenge is not simply adapting to new technologies but rather ensuring that academic writing pedagogy evolves in ways that enhance student agency and disciplinary engagement. While we may not be AI experts, our expertise as educators remains critical in shaping how these tools are integrated into meaningful, reflective, and discipline-specific learning practices.

Supplementary data

Supplementary data is available at *Applied Linguistics* online

Notes on contributors

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References

- Agbaje, O. J. (2023) 'Enhancing Classroom Learning Outcomes: The Power of Immediate Feedback Strategy', *International Journal of Disabilities Sports and Health Sciences*, 6: 453–65. <https://doi.org/10.33438/IJDSHS.1323080>
- Ayers, J. W., et al. (2023) 'Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum', *JAMA Internal Medicine*, 183: 589–96. <https://doi.org/10.1001/jamainternmed.2023.1838>
- Borg, S. (2010) 'Language Teacher Research Engagement', *Language Teaching*, 43: 391–429. <https://doi.org/10.1017/s0261444810000170>
- Campbell, T. D., et al. (2018) 'Ways of Knowing as a Framework for Developing Reflective Practice Among Nursing Students', *International Journal of Nursing Education Scholarship*, 15: 2017–0043. <https://doi.org/10.1515/IJNES>
- Casal, J. E., and Kessler, M. (2023) 'Can Linguists Distinguish Between ChatGPT/AI and Human Writing?: A Study of Research Ethics and Academic Publishing', *Research Methods in Applied Linguistics*, 2: 100068. <https://doi.org/10.1016/j.rmal.2023.100068>
- Denis, C., Colet, N. R., and Lison, C. (2019) 'Doctoral Supervision in North America: Perception and Challenges of Supervisor and Supervisee', *Higher Education Studies*, 9: 30–9. <https://doi.org/10.5539/hes.v9n1p30>
- Else, H. (2023) 'Abstracts Written by ChatGPT Fool Scientists', *Nature*, 613: 423. <https://doi.org/10.1038/d41586-023-00056-7>
- Eyres, S. J., et al. (2001) 'Doctoral Students' Responses to Writing Critique: Messages for Teachers', *Journal of Nursing Education*, 40: 149–55. <https://doi.org/10.3928/0148-4834-20010401-04>
- Hyland, K. (2008) 'Disciplinary Voices: Interactions in Research Writing', *English Text Construction*, 1: 5–22. <https://doi.org/10.1075/etc.1.1.03hyl>
- Ivanič, R. (1998) *Writing and Identity. Studies in Written Language and Literacy*, Vol. 5. Amsterdam: John Benjamins Publishing Company. <https://doi.org/10.1075/SWLL.5>
- Khuder, B. (2025) 'Feedback-Seeking Behaviour as a Self-Regulation Strategy in Higher Education: A Pedagogical Approach', *Assessment & Evaluation in Higher Education*, 1–15. <https://doi.org/10.1080/02602938.2025.2476621>
- Khuder, B., and Petrić, B. (2022) 'Academic Texts in Motion: A Text History Study of Co-authorship Interactions in Writing for Publication', *Journal of English for Research Publication Purposes*, 3: 51–77. <https://doi.org/10.1075/erpp.22001.khu>
- Kuteeva, M., and Andersson, M. (2024) 'Diversity and Standards in Writing for Publication in the Age of AI—Between a Rock and a Hard Place', *Applied Linguistics*, 45: 561–7. <https://doi.org/10.1093/applin/amae025>
- Liu, M., et al. (2023) 'Future of Education in the Era of Generative Artificial Intelligence: Consensus Among Chinese Scholars on Applications of ChatGPT in Schools', *Future in Educational Research*, 1: 72–101. <https://doi.org/10.1002/fer3.10>
- Marzuki, Widiati, U., Rusdin, D., DarwinIndrawati, I. (2023) 'The Impact of AI Writing Tools on the Content and Organization of Students' Writing: EFL Teachers' Perspective', *Cogent Education*, 10: 1–17. <https://doi.org/10.1080/2331186X.2023.2236469>
- Mitrović, S., Andreoletti, D., and Ayoub, O. (2023) 'ChatGPT or Human? Detect and Explain. Explaining Decisions of Machine Learning Model for Detecting Short ChatGPT-generated Text,' *arXiv preprint*, arXiv:2301.13852.

- Nicol, D., and MacFarlane-Dick, D. (2006) 'Formative Assessment and Self-regulated Learning: A Model and Seven Principles of Good Feedback Practice', *Studies in Higher Education*, 31: 199–218. <https://doi.org/10.1080/03075070600572090>
- Orenstrakh, M. S., Karnalim, O., Suarez, C. A., and Liut, M. 2023. 'Detecting LLM-Generated Text in Computing Education: A Comparative Study for ChatGPT Cases,' *arXiv preprint*, arXiv:2307.07411.
- Ou, A. W., et al. (2024) 'Conceptualising and Cultivating Critical GAI Literacy in Doctoral Academic Writing', *Journal of Second Language Writing*, 66: 101156. <https://doi.org/10.1016/j.jslw.2024.101156>
- Pfau, A., Polio, C., and Xu, Y. (2023) 'Exploring the Potential of ChatGPT in Assessing L2 Writing Accuracy for Research Purposes', *Research Methods in Applied Linguistics*, 2: 100083. <https://doi.org/10.1016/j.rmal.2023.100083>
- Prior, P. A. (1998). *Writing/Disciplinarity: A Sociohistoric Account of Literate Activity in the Academy*. Mahwah: Lawrence Erlbaum Associates.
- Rose, H. (2019). 'Diaries and Journals: Collecting Insider Perspectives in Second Language Research,' in J. McKinley and H. Rose (eds.), *The Routledge Handbook of Research Methods in Applied Linguistics*, pp. 348–59. NY: Routledge. <https://doi.org/10.4324/9780367824471-30>
- Sadler, D. R. (1989) 'Formative Assessment and the Design of Instructional Systems', *Instructional Science*, 18: 119–44. <https://doi.org/10.1007/bf00117714>
- Sasaki, M., Mizumoto, A., and Matsuda, P. K. (2024) 'Machine Translation as a Form of Feedback on L2 Writing', *IRAL—International Review of Applied Linguistics in Language Teaching*, <https://doi.org/10.1515/IRAL-2023-0223>
- Schmuckler, M. A. (2001) 'What is Ecological Validity? A Dimensional Analysis', *Infancy*, 2: 419–36. https://doi.org/10.1207/S15327078IN0204_02
- Siemens, G., Marmolejo-Ramos, F., Gabriel, F., Medeiros, K., Marrone, R., Joksimovic, S., and de Laat, M. (2022) 'Human and artificial cognition', *Computers and Education: Artificial Intelligence*, 3: 100107. <https://doi.org/10.1016/J.CAEAI.2022.100107>
- Stevenson, M., and Phakiti, A. (2014) 'The Effects of Computer-Generated Feedback on the Quality of Writing', *Assessing Writing*, 19: 51–65. <https://doi.org/10.1016/j.asw.2013.11.007>
- Tardy, C. M. (2009) *Building Genre Knowledge*. Brackenberry: Parlor Press.
- Tian, C. (2024) 'The Influence of Generative AI Technologies on Academic Writing in EFL Education', *Journal of Education, Humanities and Social Sciences*, 28: 575–84. <https://doi.org/10.54097/xv0rbq11>
- Vygotsky, L. S. (1987) *Mind in Society: Development of Higher Psychological Processes*. Harvard: Harvard University Press. <https://doi.org/10.2307/J.CTVJF9VZ4>