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Using Artificial Intelligence as an epistemic tool for academic writing: An intervention with postgraduate students

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Abstract

This study describes and assesses a pedagogical intervention that integrates GenAI into a master's course on academic writing literacy. The intervention promotes using writing as an epistemic tool, reflecting on writing processes, and exploring the potential and limitations of GenAI in academic argumentative texts. Twenty-nine postgraduate students responded to pre- and post-intervention questionnaires on their skill development, AI utility, and the relevance of the intervention. Results indicate that, while students recognised AI as useful for initiating and refining academic writing, they noted its limitations for generating complex academic arguments, specifically in terms of quality and reliability. The intervention significantly increased students' confidence in their writing skills and raised awareness of challenges related to authorial voice and intertextuality. Students appreciated learning the genre, strategies to manage the writing process more effectively, and the pros and cons of using AI for academic writing, underlining their significance for academic and professional growth. The results of this study address educators' concerns regarding the introduction of GenAI into teaching and learning processes, suggesting that when used thoughtfully, GenAI can enhance the learning experience.

Kaeywords: artificial intelligence; writing; literacy; masters degrees; teaching method innovations; persuasion

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El uso de la inteligencia artificial como herramienta epistémica para la redacción académica: una intervención con estudiantes de posgrado

Resumen

Este estudio describe y evalúa una intervención pedagógica que integra la IA generativa en un curso de maestría sobre alfabetización en escritura académica. La intervención promueve el uso de la escritura como herramienta epistémica, la reflexión sobre los procesos de escritura y la exploración del potencial y las limitaciones de la IA generativa en los textos argumentativos académicos. Veintinueve estudiantes de posgrado respondieron a cuestionarios previos y posteriores a la intervención sobre el desarrollo de sus habilidades, la utilidad de la IA y la relevancia de la intervención. Los resultados indican que, si bien los estudiantes reconocieron la utilidad de la IA para iniciar y perfeccionar la escritura académica, señalaron sus limitaciones para generar argumentos académicos complejos, específicamente en términos de calidad y confiabilidad. La intervención aumentó significativamente la confianza de los estudiantes en sus habilidades de escritura y les hizo tomar conciencia de los retos relacionados con la voz del autor y la intertextualidad. Los estudiantes apreciaron el aprendizaje del género, las estrategias para gestionar el proceso de escritura de manera más eficaz y las ventajas y desventajas del uso de la IA para la escritura académica, subrayando su importancia para el crecimiento académico y profesional. Los resultados de este estudio abordan las preocupaciones de los educadores con respecto a la introducción de la IA generativa en los procesos de enseñanza y aprendizaje, y sugieren que, cuando se utiliza de manera reflexiva, la IA generativa puede mejorar la experiencia de aprendizaje.

Palabras clave: inteligencia artificial; escritura; alfabetización; maestrías; innovaciones en métodos de enseñanza; persuasión

O uso da inteligência artificial como ferramenta epistêmica para a redação acadêmica: uma intervenção com estudantes de pós-graduação

Resumo

Este estudo descreve e avalia uma intervenção pedagógica que integra a inteligência artificial (IA) generativa em um curso de mestrado sobre letramento em escrita acadêmica. A intervenção promove o uso da escrita como ferramenta epistêmica, a reflexão sobre os processos de escrita e a exploração do potencial e das limitações da IA generativa na produção de textos argumentativos acadêmicos. Vinte e nove estudantes de pós-graduação responderam a questionários antes e depois da intervenção, abordando o desenvolvimento de suas habilidades, a utilidade da IA e a relevância da proposta formativa. Os resultados indicam que, embora os estudantes reconheçam a utilidade da IA para iniciar e aprimorar a escrita acadêmica, também apontam suas limitações para gerar argumentos acadêmicos complexos, especialmente no que se refere à qualidade e à confiabilidade. A intervenção aumentou significativamente a confiança dos estudantes em suas habilidades de escrita e promoveu maior consciência sobre os desafios relacionados à voz autoral e à intertextualidade. Os participantes valorizaram o aprendizado sobre o gênero acadêmico, as estratégias para gerir o processo de escrita de maneira mais eficaz e as vantagens e desvantagens do uso da IA na escrita acadêmica, destacando sua importância para o crescimento acadêmico e profissional. Os resultados deste estudo dialogam com as preocupações de educadores quanto à introdução da IA generativa nos processos de ensino e aprendizagem e sugerem que, quando utilizada de maneira reflexiva, essa tecnologia pode enriquecer a experiência formativa.

Palavras-chave: inteligência artificial; escrita; letramento; pós-graduação; inovações em métodos de ensino; argumentação

Introduction

Developing solid academic writing skills is essential for postgraduate students as it allows them to participate in advanced scholarly discussions, contribute original research, and communicate complex ideas effectively. Far from mere technical skills, academic writing is an epistemic practice that involves structuring arguments, critically evaluating sources, and presenting coherent, evidence-based conclusions (Bazerman, 2003; Castelló et al., 2013; Hyland & Guinda, 2012; Sala-Bubaré et al., 2021). It requires mastering a broad range of skills necessary for effective communication, from linguistic features to audience awareness and knowledge, understanding of the text genre, and in-depth expertise in the subject matter (Corcelles et al., 2017; Hyland, 2007; Swales & Feak, 2023). Therefore, academic writing has historically been one of the most challenging skills for students to learn (Negretti & Mežek, 2019; Rijlaarsdam & van den Bergh, 2006; Sala-Bubaré et al., 2018).

This challenge has driven the exploration of innovative teaching approaches, such as using Artificial Intelligence (AI) as an epistemic tool to enhance students' academic writing skills. Advances in Generative Artificial Intelligence (GenAI) promise to revolutionize many areas of human activity, including writing and learning. These tools can generate high-quality texts across various genres and disciplines (Tirado-Olivares et al., 2023), often indistinguishable from those written by humans. While concerns have been raised about the risks of plagiarism, misinformation, and exacerbating digital divides (Gallent-Torres et al., 2023; Pereira et al., 2024), GenAI also offers substantial benefits, including supporting idea generation, providing feedback, and improving text fluency and accuracy (Guo et al., 2024; Marzuki et al., 2023).

Recent studies report positive results in using GenAI to enhance writing quality and efficiency at the postgraduate level (Picciano, 2024; Rababah et al., 2024; Williams, 2024). Postgraduate students find GenAI tools, such as ChatGPT, helpful in their thesis writing process, as they are found to be useful, user-friendly, and beneficial to writing quality (Rababah et al., 2024). While some studies report that students tend to use GenAI for low cognitively demanding tasks, such as paraphrasing (Koltovskaia et al., 2024; Nugroho et al., 2024), these tools can be helpful in higher-level tasks, such as idea generation, planning, structuring texts, and peer review (Alshammri, 2024; Guo et al., 2024; McGuire et al., 2024; Picciano, 2024). The most benefits seem to come from using GenAI as writing assistants and peer-reviewers rather than replacements or sole authors of texts (Koltovskaia et al., 2024; McGuire et al., 2024).

Most studies in this field agree that GenAI can enhance text quality, but whether it also improves students' writing skills remains unclear. Some studies found no effects in this regard (Avello-Martinez et al., 2024; Ironsi & Solomon, 2024), while others suggest that it is not the use but the prolonged engagement with GenAI that promotes students' ability and self-efficacy (Bouzar et al., 2024; Ou et al., 2024).

Studies also claim that, while many students are aware of GenAI's potential downsides, including plagiarism, the need for responsible use and cross-referencing information (Alshammri, 2024; Bouzar et al., 2024; Koltovskaia et al., 2024; Ou et al., 2024), it is crucial to teach students to make safe, honest, and effective use of the technology (Guo et al., 2024; McGuire et al., 2024; Rababah et al., 2024).

As instructors and researchers in the writing field, recent advancements in GenAI have prompted us to reassess our teaching objectives to integrate these tools—such as ChatGPT—into academic writing interventions. Given the inevitable presence of AI in educational contexts and the potential risks and benefits, we believe it is essential to equip students with the skills to use these tools in an ethical and epistemic manner, ensuring their use supports students' critical thinking, knowledge construction, and responsible academic practices.

This paper presents and assesses an intervention in academic writing, where postgraduate students were encouraged to use GenAI tools, such as ChatGPT, to write a position paper and reflect on their learning experience. We provide a detailed description of the intervention tools and tasks and evaluate the impact of the intervention on students' perceptions of the utility of GenAI for academic writing, their writing skills, and their reflections on the learning outcomes achieved. Specifically, our research questions are:

- RQ1: How do postgraduate students perceive the use of AI for academic writing?
- RQ2: To what extent has the intervention changed postgraduate students' perceptions of their academic writing skills and difficulties?
- RQ3: What learning outcomes do students perceive they accomplished through the writing intervention?

Academic writing intervention

The Academic Writing intervention was part of a compulsory first-year course in a Master's program in Educational Psychology (6 ECTS). It took place between October 2023 and January 2024 and included six in-person sessions, each lasting five hours and held biweekly, for a total of 30 hours. Students were also required to complete autonomous work between sessions.

It aims to promote postgraduate students' literacy in academic writing practices through a wide range of activities and tools. Our intervention is grounded in five theoretical and pedagogical principles:

1. Explicit Genre Instruction: Learning to write academic texts requires explicitly teaching the characteristics of the genre and the specific communicative situation (Bazerman, 2009; Hyland, 2007; Swales, 1990). We provide explicit instruction on genres, which we understand as relatively stable and socially recognized forms of language characterized by specific communicative purposes, structures, and linguistic features used within a community (Bazerman, 2003; Hyland & Guinda, 2012). Our instruction focuses on two academic genres: research papers and position papers, helping students understand the purpose, content, and structure of texts.

2. Authentic Writing Practice: Argumentative writing is central to academic literacy because it promotes the construction of new knowledge and critical thinking, crucial skills for academic and professional success (Kuhn & Moore, 2015; van Eemeren et al., 2002). Students write a position paper, an argumentative text that requires them to critically review scientific literature, construct well-supported arguments to support their thesis, and establish a dialogue with other voices and texts (Bakhtin, 1981; Castelló et al., 2013; Rex et al., 2010; Su et al., 2021).

To enhance authenticity, the intervention ends with students presenting their texts in a student conference.

3. Writing as a Social Activity: The intervention emphasizes the importance of peer and teacher feedback (Hyland, 2007; Sala-Bubaré & Castelló, 2023). Receiving, discussing, and reflecting on feedback from peers and experts is crucial for writing development, particularly to help students develop their voice, genre knowledge, and regulation strategies (Corcelles et al., 2017; Ivanič, 2004; Swales & Feak, 2023).

4. Process-Oriented Approach: Writing a position paper involves effective regulation of the writing process, including idea generation, planning, drafting, and revision, which requires an awareness of communicative goals, task characteristics, and strategies that help tailor decisions to the demands of each stage (Rijlaarsdam & van den Bergh, 2006). We promote deliberate practice through metacognitive reflection to help students develop strategies for managing and regulating their writing process during the argumentative writing task (Negretti & Mežek, 2019; Sala-Bubaré & Castelló, 2023).

5. Reflection on the learning processes and use of AI: Reflection on learning processes and effective and safe use of GenAI in supporting learning is key to enhancing the epistemic potential of writing and GenAI. By doing so, students can deepen their understanding and improve the quality of their learning (Alshammri, 2024; McGuire et al., 2024). A sample of the questions used to prompt reflection about the genre, writing process, and use of GenAI is available in Appendix 1.

The intervention consists of seven activities (A) organized into four phases throughout the seven sessions (S) of the course (see Table 1).

Table 1. *Phases and activities of the writing intervention.*

Phases and activities	**Autonomous work**
Phase 1: Pre-writing activities	
A1: Reflection on previous experiences in writing and uses of AI in academic writing (before S1)	*Pre-intervention survey*
A2: Reflection on one's writing profile (S1)	
A3: Mastering research tools to participate in the research community (S2 and S3)	*Jigsaw cooperative work in teams*
A4: Explicit genre instruction and GenAI possibilities and limitations (S3)	*Analysis of research and position papers examples*
Phase 2: Writing – feedback – rewriting cycle	

A5: Writing a position paper using GenAI (S4 and S5) *First draft writing exclusively with GenAI* *Peer feedback* *Second draft; GenAI optional* *Teacher feedback* *Final draft; GenAI optional*	*Three drafts of a position paper* *Reflection on the writing process and uses of GenAI for each text submission*
Phase 3: Oral communication and conference formats	
A6: Presentation of the position paper at a student conference (S5 and S6)	*Transform text into oral communication*
Phase 4: Final reflection	
A7: Final reflection on learning outcomes (after S6)	*Post-intervention survey*

Source: own elaboration

Phase 1: Pre-writing activities

The pre-writing activities phase focuses on the following objectives:

- Collecting prior experiences in academic writing and GenAI uses.

Before S1, students responded to an initial questionnaire on prior experiences, challenges, and expectations about academic writing and using GenAI (A1).

- Analysing reading and writing processes, writing conceptions, and GenAI uses.

In S1, we discussed students' responses to the initial questionnaire about reading and writing processes, as well as their conceptions of academic writing and the use of GenAI. At the end, students reflected on their writing profile (A2).

- Mastering research tools to participate in their research community.

To prepare students to use the most frequently used research tools, we organized a cooperative activity called "jigsaw" (A3) during S2 and S3, using teams of five members (base teams). Each member of the base team specializes in a specific topic: a) Search engines and databases, b) APA style, c) Reference managers, d) Academic journals, and e) Writing resources and AI tools. Teachers guided students in searching for information and designing activities to teach their topic to their base team. This active learning activity reinforces students' knowledge about the tools they need to write their position papers and to participate in the research community.

- Explicit genres instruction.

In S3, we provide explicit genre instruction in two prominent academic genres: research papers and position papers. First, we examine the features of empirical research, focusing on its structure and reflecting on the author's voice by analysing the intertextuality and discursive resources to engage in dialogue with other authors (Hyland & Guinda, 2012).

Second, teachers introduced the genre characteristics of a position paper. Students discussed the differences between research and argumentative genres and collaboratively developed a

rubric (text rubric) (the rubric of the text is available in Appendix 2). Using a model-based instructional approach (Camps & Fontich, 2021; Macbeth, 2010), students read and analysed three position papers of varying quality and authorship (human-authored or AI-generated). They individually evaluated the quality of each text using the text rubric and reflected individually on the most likely authorship of each text. Small-group and class discussions were held to raise students' awareness of rhetorical conventions and genre characteristics and to help them identify cues for AI-generated text.

Phase 2: Writing, Feedback, & Rewriting Cycle

This second phase is the core component of the intervention. Students engage in authentic academic writing by composing a position paper on a relevant issue in Educational Psychology using GenAI (A5).

The position paper activity was designed to enhance students' abilities to construct well-supported arguments, critically engage with academic literature, and reflect on their writing processes, while encouraging thoughtful consideration of how ChatGPT and other AI tools can support their writing practices.

The activity includes three text submissions:

1. Submission 1: Before S4, students composed a first draft exclusively using ChatGPT. When they finished, they evaluated the text using the rubric and completed a survey to reflect on their experience using GenAI for academic writing. They also submitted their conversations. Then, in S4, students, in pairs, read their peers' texts and exchanged feedback on their texts and AI strategies. A class discussion was held to share their impressions about the activities and the most effective strategy for writing a position paper using GenAI. Finally, they individually reflected on the peer feedback and strategies for an effective and responsible use of AI.

2. Submission 2: Before S5, students revised their text, with GenAI use optional, evaluated it using the text rubric, and completed a second questionnaire to reflect on their writing process and experience with GenAI (if used). They submitted their draft and conversation with the AI. Teachers provide written feedback following the text rubric.

3. Submission 3: Students revise the text again and submit the final draft along with their reflection on the writing process and GenAI uses.

Phase 3: Oral communication and conference participation formats

In S6, teachers provided examples of effective oral communication, and students analysed them and discussed them, first in pairs and then in groups, about effective communication. Students transformed their written text into an oral communication and presented it at the student conference in S7 (A6).

Phase 4: Final reflection

Finally, students completed a questionnaire in which they reflected on the utility of GenAI for academic writing, revisiting their responses to the initial survey to assess their learning and

the changes resulting from the academic writing intervention (A7).

Method

Participants

The study involved 29 first-year postgraduate students in the Educational Psychology Master's program, comprising seven men and twenty-two women, aged 23 to 45. Participants were graduates in Education or Psychology with varying levels of professional experience. The cohort included local and international students, mostly from Latin American countries. Before the intervention, 20 students had no experience using GenAI for academic writing. All students were using the free version of ChatGPT available at the time (3.5).

All participants were informed about the research objectives and procedures to ensure data protection and confidentiality, and gave their written consent. The study was guided by the principles of the Helsinki Declaration and was approved by the authors' university Ethical Committee (ref.: APR-FPCEE2324/04).

Instruments

All data collection procedures and instruments are embedded into the pedagogical sequence described above. Each piece of evidence of student learning collected during the intervention constitutes a data collection instrument that explores different aspects of students' learning processes. For the present study, we used participants' answers to some of the questions in the initial (A1) and final questionnaire (A7) to identify changes in students' perceptions of their ability to write argumentative texts and the utility of GenAI in this context, and understand their assessment of the meaning and learning outcomes of the intervention. Specifically, we used the following questions for each instrument:

Table 2. *Questions in the initial and final questionnaire related to each research question of the study*

Initial	Final	Type
RQ1 Utility of AI		
To what extent do you believe AI is a useful tool for writing scientific, academic, and professional texts? (AI_pre)	*To what extent do you believe AI is a useful tool for writing scientific, academic, and professional texts? (AI_post)*	*Likert scale (1-5)*
	In what way do you believe that artificial intelligence is a good or bad tool for writing scientific, academic, and professional texts? (AI open)	*Open-ended*
RQ2. Students' writing skills		
I feel capable of writing scientific-academic texts (Capable_Pre)	*I feel capable of writing scientific-academic texts (Capable_Post)*	*Likert scale (1-5)*

What aspects do you find most difficult when writing these texts? (Difficulties_pre)	*What aspects do you find most difficult when writing these texts? (Difficulties_post)*	*Open-ended*
RQ3. Learning outcomes		
	To what extent did you find the writing intervention meaningful? (intervention meaning)	*Likert scale (1-5)*
	To what extent do you think you have learnt from the writing intervention? (intervention learning)	*Likert scale (1-5)*
	Why? Please explain (learning reasons)	*Open-ended*

Source: own elaboration

Procedure

All data was anonymized, and participants were given an alias. To analyse quantitative data regarding students' perceptions of the utility of AI tools before and after the intervention (RQ1) (*AI_pre* and *AI_post*) and their ability to write scientific and academic texts (RQ2) (*Capable_pre* and *Capable_post*), we conducted mean comparison tests for paired samples. Due to the small number of participants and the non-normal distribution of the data, we conducted non-parametric Wilcoxon rank tests. Descriptive analysis was conducted for the quantitative questions about students' perceptions of the meaning and learning of the writing intervention (RQ3) (*intervention meaning* and *intervention learning*).

On the other hand, qualitative content analysis was used to analyse the open-ended questions of the two instruments: students' assessment of the capabilities and limitations of AI (RQ1) (*AI open*), their writing difficulties before and after the intervention (RQ2) (*Difficulties_pre* and *Difficulties_post*), and their perceptions about the value of the intervention and what they learnt (RQ3) (*learning reasons*). For each question, emergent categories were established through a recursive process that involved first, reading participants' answers; second, coding each answer using low-inference codes; and third, eliminating overlaps, inconsistencies, and grouping infrequent codes into broader categories. All these steps involved thorough discussion and consensus between two of the manuscript's authors. For all the questions, participants' answers could be assigned more than one code if they mentioned several topics.

Results

Use of GenAI for academic writing (RQ1)

Before the intervention, students perceived GenAI tools as somewhat helpful in writing scientific and academic texts (see Table 2). After the intervention, their perception of GenAI's utility for academic writing was slightly reduced. Further analysis revealed that these differences were not statistically significant.

Table 2. *Students' perceptions about GenAI's utility for writing before and after the intervention*

	Mean	*Median*	*SD*	*W*	*p*
Pre	*3.25*	*3.00*	*1.143*	*103*[a]	*.194*
Post	*2.96*	*3.00*	*0.793*		

Note. Ha. μ Measure 1 - Measure 2 ≠ 0. [a]*11 pair(s) of values were tied*

Source: own elaboration

At the end of the intervention, when asked to elaborate on their responses, students reported a balanced range of positive and negative aspects of using GenAI in writing (see Table 3). Specifically, 17.2% (5/29) of students did not mention any positive or negative aspects of the use of GenAI in writing; almost half of them (44.8%, 13/29) mentioned both; 20.7% (6/29) mentioned only positive aspects; and 17.2% (5/29) of students only reported negative aspects.

Table 3. *Students' perceptions of positive and negative aspects of using GenAI for academic writing.*

Category/Code	**Definition**	**Count**
Positive aspects of GenAI		
Starting or unblocking the writing process	*GenAI helps start or unblock the writing process by providing primary or general ideas, sketching the PP, or writing first drafts.*	*10*
Composing /Writing	*GenAI helps clarify ideas and concepts, revise writing, diversify vocabulary…*	*11*
Organizing	*GenAI helps organize the sections and paragraphs of the text.*	*4*
Synthesizing information	*GenAI helps synthesize one's ideas or other texts to use to incorporate them into one's text*	*2*
Total positive aspects		*27*
Negative aspects of GenAI		
Complete text	*GenAI is unable to select and integrate information to produce a complete text using only prompts*	*9*
Depth	*GenAI is unable to provide quality and in-depth content*	*6*
Adjustment	*GenAI is unable to produce a text that meets the genre format and register criteria*	*6*
Reliability	*GenAI is unable to provide reliable and diverse sources of information*	*4*
Voice	*GenAI is unable to establish an authorial position in the text*	*4*
Intertextuality	*GenAI is unable to integrate and establish a dialogue between different points of view and authors*	*2*
Total negative aspects		*31*
Conditions to use GenAI effectively		
Prompts	*GenAI requires asking multiple questions and using appropriate prompts*	*11*
Content	*GenAI requires writers to provide specific content/information to go into the text*	*4*

Originality	*GenAI requires authors to appropriate ideas and sources to make an ethical use of the tool*	*3*
Total conditions		*18*

Source: own elaboration

Positive responses were mostly related to the usefulness of GenAI for initiating, composing and revising academic writing. The other positive aspects were less frequent and related to the use of GenAI to organize the text and synthesize information. For example, MS13 mentioned: "I think it's a good tool for structuring when properly guided. I believe we know very little about how to use it, and there are tools within it that could exponentially enhance academic writing if used correctly".

Regarding the weaknesses of GenAI as a writing tool, students' opinions focused on six aspects, the most frequent ones being the impossibility of creating a concise, coherent, and complete position paper exclusively using prompts and without providing ideas about the content. Others reported the lack of quality or depth in the content created by the AI and limitations in producing a text that meets the genre standards in terms of format and register. The remaining negative comments concerned the unreliability of the information and citations, the absence of the author's position and voice, and the lack of intertextuality in GenAI texts. Some students, like MS02, mentioned several negative aspects:

> "I think it's useful for improving the text, but I don't consider it effective for creating scientific, academic, or professional texts from scratch. I believe AI still lacks the ability to do what a researcher does to gather information, understand it, relate it, and write with their own voice, among many other aspects."

Interestingly, although not explicitly requested, several students reported conditions for GenAI to be useful and effective. Many participants highlighted the need to write good and specific prompts to obtain useful responses, while some stressed the importance of providing content and ideas and appropriating the content and sources to make ethical and effective use of the tools. MS20's answer is a good example of this type of comment:

> "I think it's a good tool if we provide the information we want to use. Asking it to do all the work is a waste of time. But if you give it specific information, it can be a very valuable tool for generating texts."

Students' academic writing skills and difficulties (RQ2)

Statistical analysis showed that students' perceptions of their writing skills significantly improved during the intervention (see Table 4). Most students finished the intervention feeling quite or very confident in their writing skills. Interestingly, variability within the group was reduced.

Table 4.*Comparison of students' perceptions of their writing skills before and after the intervention*

	Mean	*Median*	*SD*	*W*	*p*
Before	*3.14*	*3.00*	*0.891*	*0*[a]	*< .001*
After	*4.07*	*4.00*	*0.466*		

Note. Ha. μ Measure 1 - Measure 2 ≠ 0. [a] 9 pair(s) of values were tied

Source: own elaboration

Students reported difficulties in writing in nine areas. Table 5 presents the frequencies of students' difficulties before and after the intervention. At the beginning of the intervention, many students found the most challenging aspects of writing to be language tone, APA style, and the economy of language. At the end, however, very few students mentioned these difficulties. Instead, their most frequent struggles were making their voice visible, dialoguing with other texts, ensuring coherence and cohesion, and managing the writing process. A good example of the shift in students' perceptions of difficulties is MS01. At the beginning of the intervention, she described her most critical difficulties very vaguely: "*The specific and scientific language*." (MS01, PRE), and after the intervention, her response changed completely: "*Introducing the voice of the author or making it visible among citations to others*." (MS01, POST). As in the case of MS01, not only did the type of difficulties change radically after the intervention, but also the total number of participants' difficulties increased by almost 25% at the end of the intervention.

Table 5. *Most frequent difficulties reported before and after the intervention*

Dimension / Code	**Definition**	**Before**	**After**
Characteristics of the genre			
Lexicon and linguistic register	*Difficulties with the lexicon (technical-scientific vocabulary) and/or adjustment of the text to the linguistic register (formal) of the PP*	*10*	*2*
APA	*Difficulties with APA style (including citations and references)*	*7*	*3*
Intertextuality	*Difficulties integrating and contrasting diverse sources of information and/or other authors' ideas.*	*2*	*12*
Voice	*Difficulties related to the author's position in the text.*	*3*	*14*
Structure	*Difficulties understanding and creating the text structure or structuring specific sections*	*3*	*4*
Other	*Difficulties mentioning general or vague issues*	*5*	*1*
Adequacy to the formal characteristics of the discourse			
Coherence and cohesion	*Difficulties with text coherence and cohesion*	*6*	*9*
Economy	*Difficulties related to the economy of language (text clarity and concision)*	*7*	*3*
Writing process			

Process	*Difficulties in managing the writing process, including starting to write, generating schemes or first drafts, writing conclusions, selecting the topic or main ideas, among others.*	*3*	*9*
Total		*46*	*57*

Source: own elaboration

Students' learning during the writing intervention (RQ3)

Finally, we analysed participants' perceptions about the learning achieved through the writing intervention and the meaning of the tasks. Results show that students' quantitative answers were very positive regarding learning (M = 4.66, SD 0.48) and the meaningfulness of the writing intervention (M = 4.69, SD = 0.47).

To further explore the reasons for students' positive perceptions of the intervention, we analysed their responses to open-ended questions about what they learned and the meaning they attributed to the writing intervention. As depicted in Table 6, students highlighted four main aspects: learning the genre and improving the quality of their argumentative texts, refining their writing process, understanding the benefits and limitations of GenAI, and grasping the meaning of the writing task.

Table 6. *Learning outcomes and meaning attributed to the writing intervention.*

Category	**Definition**	**Count**
Learning the genre and improving text quality		
Genre	*Learning to write academic texts or the position paper genre specifically (without highlighting any specific features of the genre)*	*16*
Author's voice	*Improving the awareness and incorporation of the author's voice in their texts*	*6*
Academic style	*Improving the quality of the academic style (punctuation, lexicon, among others) and cohesion and coherence of the text*	*3*
Intertextuality	*Improving strategies and the awareness of the importance of citing other authors and diverse points of view within the text*	*3*
	Total; Learning the genre and improving text quality	*28*
Improving the writing process		
Reflection	*Improving through reflection on their writing process*	*8*
Writing strategies	*Improving through iterative revision of one's texts*	*8*
Feedback	*Improving through receiving and giving feedback*	*3*
Information	*Improving through learning how to select and review relevant information and literature*	*2*
	Total: Improving the writing process	*21*
Using GenAI in writing		
Pros and cons	*Learning and reflecting on the potentialities and limitations of GenAI for academic writing*	*4*

Getting started	*Using the AI for academic purposes for the first time, realizing its potential*	*5*
Strategies	*Learning strategies to make an effective and safe use of AI*	*3*
	Total: Using AI in writing	*12*
Attribution of meaning		
Motivation	*Meaning through increased motivation to write scientific-academic texts*	*6*
Functionality	*Meaning through the utility of acquired learning for students' professional and academic trajectories*	*5*
	Total: Attribution of meaning	*11*

Source: own elaboration

The most frequently highlighted learning outcomes by participants were related to improving the quality of their texts, particularly learning the genre to enhance text quality. The second most reported learning outcome was improving the writing process, primarily focusing on how the writing intervention helped them reflect on their writing process and strategies and learn to improve their texts through iterative revisions.

On the other hand, some students found that the utility of the writing intervention relied on the use of GenAI tools. Specifically, they emphasized that the task provided a valuable opportunity to begin using GenAI for academic purposes, highlighting the importance of understanding both the benefits and risks of these tools, as well as the strategies they developed to use them effectively. MS04's answer summarises the categories described above on learning outcomes:

> "I've learned what a position paper is, its structure, and how to write it. [...] I've become much more conscious of integrating my voice in writing along with other authors' voices. Intertextuality is something I didn't consider as much before. Additionally, the activity with ChatGPT has helped me approach AI, which I had never used before, to better understand how it works and its limitations."

Finally, several students highlighted the meaning they attributed to the writing intervention, as we can see in MS11's answer:

> "Throughout the intervention, we've been given multiple tools to evaluate our articles with discernment, guiding the process with feedback and relevant guidance that has been key in self-assessing the writing process. I also believe this will be useful for transferring all the learnings to other courses and presentation contexts, both in the master's program and professional settings."

Specifically, some participants stressed that what they learnt about writing would be helpful in their professional development, and others acknowledged that the task boosted their motivation, confidence, and positive feelings around writing argumentative texts. As MS22 expressed:

> *"I believe that the entire process we followed to create the position paper has been very relevant, and it allowed me to complete the final text without feeling discomfort when facing this type of texts."*

Discussion and conclusions

This study presents an innovative intervention using GenAI to improve the academic writing skills of postgraduate students. It also aims to evaluate the intervention's impact on students' perceptions of GenAI's usefulness, difficulties, writing skills, and learning.

On one hand, our findings indicated no significant changes in the intensity of students' perceptions of the usefulness of GenAI for academic writing. Overall, students' views were neither polarised nor absolute, acknowledging both the benefits and limitations of using GenAI tools. After the intervention, students revealed a nuanced perspective on applying GenAI in academic contexts. These mixed perceptions align with previous research, highlighting the complexity of integrating AI into educational practice and the need to understand the limitations and risks (Gallent-Torres et al., 2023; Pereira et al., 2024).

Students identified several phases and aspects of the writing process where GenAI, particularly ChatGPT, was helpful. In line with previous research (Koltovskaia et al., 2024; McGuire et al., 2024; Nugroho et al., 2024; Picciano, 2024), participants not only mentioned that GenAI helped them with low-demand tasks, such as paraphrasing and improving clarity, but highlighted its use for cognitively demanding tasks. They emphasized GenAI's role in initiating the writing process, particularly in producing first drafts and overcoming writer's block, one of the significant problems expert and novice writers face (Sala-Bubaré et al., 2018). Academic writing often requires tailored strategies to manage the writing process effectively and prevent frustration and procrastination (Castelló et al., 2013; Negretti & Mežek, 2019; Sala-Bubaré et al., 2021). Our findings suggest that GenAI can be integrated into the writing process as an assistant and epistemic tool to reduce the high cognitive and emotional demands involved in starting to write and overcoming blocks (Mahapatra, 2024).

Moreover, students developed a critical awareness of GenAI's limitations as a tool for argumentative writing. They noted challenges in producing concise, coherent, and in-depth content and meeting academic genre standards. Interestingly, they also reported limitations for genre-specific demands such as presenting a strong authorial voice, ensuring intertextuality, and verifying the reliability of information. These findings are consistent with critiques raised in previous studies (Gallent-Torres et al., 2023; Pereira et al., 2024), which highlight GenAI's limitations in authorial voice/plagiarism and misinformation. Our results also suggest that integrating GenAI into academic writing tasks may enhance students' awareness of these limitations, potentially leading to a more critical use of these tools (Koltovskaia et al., 2024; Ou et al., 2024; Picciano, 2024).

On the other hand, postgraduate students perceived a significant improvement in their academic writing skills by the end of the intervention, especially those who had lower confidence at the beginning. Interestingly, they also expressed greater awareness of the complexities involved in writing, with their difficulties shifting toward more sophisticated challenges. After the intervention, students identified more difficulties in expressing their voices, engaging with other texts, and ensuring coherence and cohesion. These difficulties are at the core of academic writing and are the most frequent struggles even for expert writers (Bazerman, 2003; Hyland

& Guinda, 2012; Rex et al., 2010; Sala-Bubaré & Castelló, 2023), which suggests an enhanced understanding of the cognitive and rhetorical skills required for academic writing and a more refined vocabulary to articulate writing challenges. As highlighted by previous studies (Castelló et al., 2013; Sala-Bubaré et al., 2021; Swales & Feak, 2023), as students became more skilled writers, they also became more attuned to the multifaceted nature of academic writing.

Overall, students' assessments of the writing intervention were very positive regarding meaningfulness and learning outcomes. They highlighted improvements in their writing process, a deeper understanding of the genre, and an increased ability to write high-quality argumentative texts. Additionally, students reported gaining valuable insights into the benefits and limitations of GenAI and stressed the value of the activity for their attitudes toward writing and professional development. Therefore, our findings suggest that integrating GenAI into the course provided students with learning experiences about the genre and academic writing skills, including self-regulation processes. More importantly, integrating GenAI did not undermine students' perceptions of their abilities and learning, but led to significant and positive results, as other authors suggested (Ironsi & Solomon Ironsi, 2024; Pereira et al., 2024).

Several practical implications can be drawn from this study. The integration of GenAI presents both ethical and pedagogical challenges, but its use in higher education seems inevitable. The results of this study address educators' concerns regarding the introduction of GenAI into teaching and learning processes, suggesting that when used thoughtfully, GenAI can enhance learning. The pedagogical debate may shift from questioning the legitimacy of GenAI tools to designing their integration in ways that align with educational goals and foster critical thinking (Koltovskaia et al., 2024; McGuire et al., 2024; Rababah et al., 2024). Educators must address authorship, ethics, and the risk of misinformation while fostering an environment that encourages students to critically engage with AI tools. Ensuring that students understand the limitations of GenAI and develop strategies for its responsible use is essential to preparing them to succeed in the digital age.

This study is not without limitations. Participants in our intervention were using ChatGPT 3.5, which constrains the scope of the results. Other GenAI tools might have had a different impact on students' perceptions. Moreover, as these tools become more sophisticated, their capabilities will change, and so will the pedagogical challenges and opportunities they present. Future iterations of the intervention will be conducted using the latest available tools. Further research is needed to track these developments and ensure that educators can leverage these tools in ways that genuinely enhance the learning process.

Furthermore, we did not investigate the direct relationship between the use of GenAI and the learning and writing development of postgraduate students. Future intervention studies could investigate whether GenAI promotes students' long-term development of writing ability to transfer them to new contexts. Increasing the sample size and diversity of participants would also provide broader insights into how GenAI supports different postgraduate student populations.

This study was one of the first attempts to integrate GenAI in a writing intervention, demonstrating how these tools can be used to improve postgraduate students' academic

writing skills and foster critical reflection on the use of GenAI.

Closing statements

Authors contributions. Anna Sala-Bubaré: Conceptualization, methodology, formal analysis, investigation, writing, reviewing, project administration, funding acquisition.

Mariona Corcelles-Seuba: Conceptualization, methodology, investigation, writing, reviewing, funding acquisition.

Andrea Miralda-Banda: Conceptualization, methodology, formal analysis, writing, reviewing.

Marina Garcia-Morante: Conceptualization, methodology, writing, reviewing.

Conflicts of interest. The authors declare that there are no conflicts of interest related to this study.

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Ethical implications. The study was conducted following ethical standards and institutional guidelines.

Data availability. The data that support the findings of this study are available from the corresponding author, ASB, upon reasonable request.

Use of artificial intelligence. ChatGPT (OpenAI) se utilizó únicamente para la corrección y la edición lingüística menor. No se realizó ninguna generación de contenido ni se introdujeron cambios sustantivos en los argumentos científicos.

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Appendix 1

Sample of questions used to prompt reflection about the genre and writing process.

Questions	Activities
About the genre	
What do you think is the purpose of scientific-academic writing?	*A1: Pre-intervention survey*
What are the strengths and weaknesses of each text? Which one do you think is better?	*A4: Analysis of examples*
What are the strengths and weaknesses of your text? How do you feel about your text now?	*A5 (submissions 1, 2 and 3)*
About the writing process	
What emotions arise when you write academic/scientific texts? Why? What resources and tools do you use to improve or facilitate the processes of scientific, academic, and/or professional writing?	*A1: Pre-intervention survey*
When you have to write a paper or assignment, do you complete it as soon as possible, or do you tend to postpone it until the last moment? Do you always plan my work before writing, or do you start writing without much prior thought and then modify it as needed?	*A2: Reflection on one's writing profile*
What was the writing process of this draft like? How did you feel while writing? What problems did you encounter when writing your text? What did you do to solve them?	*A5: Writing a position paper (submissions 1, 2 and 3)*
What did you learn revising your peer's text?	*A5: Writing a position paper (peer feedback)*
What aspects do you find most difficult when writing academic texts? To what extent do you think you have learnt from the writing intervention?	*A7: Final reflection*
About the use of AI	
If you have used AI tools before, briefly explain which software you used and for what purpose. If you have not used them, explain why.	*A1: Pre-intervention survey*
How useful were AI tools in writing this draft (if used)? What challenges did you encounter in using AI? How did you solve them?	*A5: Writing a position paper (submissions 1, 2 and 3)*
What strategies did you and your peer identified to use AI tools effectively?	*A5: Writing a position paper (peer feedback)*
In what way do you believe that artificial intelligence is a good or bad tool for writing scientific, academic, and professional texts?	*A7: Final reflection*

Source: own elaboration

Appendix 2

Rubric for the assessment of the academic argumentative text

CRITERIA	INITIAL (1)	UNDER DEVELOPMENT (2)	OPTIMAL (3)
TITLE	*There is no title or the title is inadequate, it does not allow the reader to anticipate the content of the text.*	*The title is adequate, anticipating the content of the essay, but it is too long or not very suggestive.*	*The title anticipates the content of the essay, it is suggestive and the length is adequate.*
ABSTRACT	*There is no summary or the summary is incomplete or too long.*	*It presents a synthesis of the text's content: problem, thesis, synthesis, arguments and conclusion in a maximum of 300 words but there is some imprecision.*	*It presents a clear and concise summary of the text's content: problem, position/proposition, justification and conclusion in a maximum of 300 words.*
KEYWORDS	*No keywords, not enough or not relevant to the content of the article.*	*Keywords are included but some are not relevant to the text's content or some relevant keywords are missing.*	*4-5 keywords relevant to the content of the article are identified.*
INTRODUCTION Contextualisation: Identification and description of the problem.	*There is no introduction, or no problem, or the problem is very unclear or irrelevant.*	*The introduction identifies and describes a relevant problem (or question) but it is somewhat unclear and/or its relevance is not sufficiently and/or adequately justified.*	*The introduction identifies and describes a problem, and its relevance is well justified based on evidence.*
INTRODUCTION Aim/purpose of writing	*There is no explicit mention of the purpose of the text.*	*The purpose of the text is mentioned but in a confusing way.*	*The text's purpose is clearly stated.*

INTRODUCTION Positioning. Author's proposed solution	*The author's position/proposed solution is not identified or is described in a confusing or it is not connected to the problem raised in the introduction.*	*The author's position/proposed solution is vague or unclear, but is relevant to the problem raised in the contextualisation.*	*The author's position/proposed solution is clear, concise and responds to the problem raised in the introduction.*
DEVELOPMENT Definition of key concepts	*The key concepts of the text are not defined.*	*Some but not all the key concepts are defined, and/or the definition(s) is unclear and imprecise and/or the definition(s) is too long.*	*Only the key concepts are defined. Their definition is clear, concise and timely.*
DEVELOPMENT Line of argument: Structure	*No arguments are presented to support the proposal (descriptive text) and/or it is difficult to identify the different arguments and follow the line of argument.*	*Three or more arguments are presented. The structure and/or delimitation of the arguments is not entirely clear and it is somewhat difficult to follow the line of argument.*	*Three or more arguments are presented in a clear and structured way. The arguments are well delimited and the line of argument is very clear.*
DEVELOPMENT Line of argument: Consistency of the arguments	*The arguments are not relevant and/or not well developed and their connection to the initial problem is not clear.*	*The arguments are relevant but some of them are not developed enough or clearly and/or their connection to the initial problem is not clear and explicit.*	*The arguments presented are relevant, well-developed and justified (use of examples, evidence...) and the connection with the initial problem is made explicit.*
DEVELOPMENT Line of argument: Intertextuality	*The argumentation is not based on a dialogue with other authors (there are hardly any citations and/or other authors are cited but in a monologic, not dialogic way).*	*The argumentation, in general, is based on a dialogue with other authors, although there is little variety of voices and/or in some parts of the text there is little dialogue.*	*The argumentation is based on a dialogue with a variety of voices from other authors to support the arguments.*

DEVELOPMENT Line of argument: Counter-arguments and refutation	*An alternative perspective or counterargument of the author's position is not analysed or done a very confusing way or is not refuted.*	*An alternative perspective or counterargument of the author's position is analysed and refuted, albeit vaguely, unclearly or convincingly.*	*An alternative perspective or counterargument of the author's position is respectfully and accurately analysed and is adequately refuted from the author's position.*
CONCLUSION	*There is no conclusion or the conclusion is incoherent or very confusing.*	*There is a conclusion coherent with the thesis, although a little confusing, or does not completely capture the text's main ideas or does not encourage the reader's reflection.*	*There is a clear conclusion, consistent with the author's position, it captures the text's main ideas and allows reflection on the implications.*
Level of coherence and cohesion	*There is no evidence of a logical sequence structuring the ideas. There are many breaks in the cohesion. Many connectors are missing.*	*For the most part, ideas follow a logical sequence. There are a few breaks in the cohesion. A few connectors are missing.*	*All ideas follow a logical sequence. There are no breaks in the cohesion. Sufficient and appropriate connectors are used.*
Author's voice	*The author's voice is not evident in the text (no clear positioning, use of the impersonal, excessive use of direct quotations) or its presence is excessive (inappropriate use of the first person, too much personal opinion...).*	*The author's voice is evident in some parts of the text but not in others or is too present in the text.*	*The author presents his/her voice clearly and coherently: appropriate use of discursive resources to mark his/her position and objectives (qualifiers, enhancers, attitudinal and self-referential markers), involving the reader.*

Reliability and relevance of sources of information	*Bibliographic sources not cited or are inadequate (i.e., not scientific) or insufficient. Many secondary sources are used.*	*Bibliographic sources are included. Some of the sources are irrelevant and/or unreliable and/or some secondary sources are used.*	*Bibliographic sources are cited. Sources are extensive, relevant and reliable. Primary sources are used.*
APA (7th ed) style	*Citations and references do not follow APA's style, or there are many errors. References do not include the Doi and/or the link to the references.*	*Citations and references follow APA's style but with minor errors. References include the Doi and/or the link to the references*	*Citations and references follow APA's style without errors. Include the Doi and/or the link of the references.*
Grammar and spelling	*There are many linguistic errors (spelling, punctuation, syntax...).*	*There are some minor linguistic errors*	*No linguistic errors*
Academic register	*Some expressions are too colloquial*	*The scientific-academic register is mostly used, with very few colloquial expressions or imprecisions.*	*The scientific-academic register is consistently used throughout the text.*
Extension	*The length is too long or too short*		*The length is appropriate (1500-2000 words without references).*

Source: own elaboration