Management Research: Journal of the Iberoamerican Academy of Management

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Generative artificial intelligence and academic writing: an analysis of the perceptions of researchers in training

Inteligência artificial generativa e escrita acadêmica: uma análise das percepções de pesquisadores em formação

Inteligencia artificial generativa y escritura académica: un análisis de las percepciones de los investigadores en formación

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Received 12 January 2024
Revised 26 April 2024
13 July 2024
18 July 2024
Accepted 25 July 2024

Abstract

Purpose – The purpose of this study is to analyze the relationship between academic writing and generative artificial intelligence (AI).

Design/methodology/approach – This paper is characterized as exploratory and descriptive, with a qualitative approach. Two approaches were used: the first, a narrative review of the literature with a systematic search from which a data collection stage was carried out using asynchronous interviews by means of an online questionnaire.

Findings – The results indicate that generative AI should be seen as a complementary tool for creative and critical academic writing. The data collected also highlighted issues related to academic dishonesty and the new type of plagiarism – plagiarism made possible by technologies – as well as issues of authorship and legitimacy of work carried out with AI and the loss of reflective and critical thinking and creativity.

Management Research: Journal of the Iberoamerican Academy of Management
Vol. 22 No. 4, 2024
pp. 429-450

1536-5433
DOI 10.1108/MRJIAM-01-2024-1501

Research limitations/implications – The considerable increase in resources using AI in all dimensions of human life.

Practical implications – The impact that the use of generative AIs can have on the creation of knowledge and the dissemination of scientific research.

Social implications – The impact that the use of generative AIs can have on the creation of knowledge and on the dissemination of scientific research.

Originality/value – The need for academia to anticipate the use of AI in academic writing and to incorporate its benefits into this process, especially considering researchers in training.

Keywords ChatGPT, Generative artificial intelligence, Academic writing, Artificial intelligence

Paper type Research paper

Resumen

Objetivo – El objetivo de este artículo es analizar la relación entre la escritura académica y la inteligencia artificial generativa.

Proyecto/metodología/enfoque – Este artículo se caracteriza por ser exploratorio y descriptivo, con un enfoque cualitativo. Se utilizaron dos enfoques: el primero, una revisión narrativa de la literatura con una búsqueda sistemática, a partir de la cual se llevó a cabo una etapa de recogida de datos mediante entrevistas asincrónicas a través de un cuestionario online.

Resultados – Los resultados indican que la IA generativa debe considerarse una herramienta complementaria para la escritura académica creativa y crítica. Los datos recogidos también pusieron de manifiesto cuestiones relacionadas con la deshonestidad académica y el nuevo tipo de plagio, el plagio posibilitado por las tecnologías, así como cuestiones de autoría y legitimidad del trabajo realizado con Inteligencia Artificial, la pérdida de pensamiento reflexivo y crítico y la creatividad.

Originalidade – La necesidad de que el mundo académico se anticipe al uso de la IA en la escritura académica e incorpore sus ventajas a este proceso, considerando principalmente a los investigadores en formación.

Limitaciones/implicaciones de la investigación – El considerable aumento de los recursos que utilizan la IA en todas las dimensiones de la vida humana.

Implicaciones prácticas – El impacto que puede tener el uso de las IA generativas en la creación de conocimiento y la difusión de la investigación científica.

Implicaciones sociales – El impacto que puede tener el uso de las IA generativas en la creación de conocimiento y la difusión de la investigación científica.

Palabras clave Inteligencia artificial, Escrita acadêmica, ChatGPT, Inteligencia artificial generativa

Tipo de artículo Trabajo de investigación

Resumo

Objetivo – O objetivo deste artigo é analisar a relação entre a redação acadêmica e a inteligência artificial generativa.

Projeto/metodologia/abordagem – Este artigo é caracterizado como exploratório e descritivo, com uma abordagem qualitativa. Foram usadas duas abordagens: a primeira, uma revisão narrativa da literatura com uma busca sistemática, a partir da qual foi realizada uma etapa de coleta de dados usando entrevistas assíncronas por meio de um questionário on-line.

Resultados – Os resultados indicam que a IA generativa deve ser vista como uma ferramenta complementar para a redação acadêmica criativa e crítica. Os dados coletados também destacaram questões relacionadas à desonestidade acadêmica e ao novo tipo de plágio - o plágio possibilitado pelas tecnologias, bem como questões de autoria e legitimidade do trabalho realizado com a Inteligência Artificial, a perda do pensamento reflexivo e crítico e da criatividade.

Originalidade – A necessidade de a academia antecipar o uso da IA na redação acadêmica e incorporar seus benefícios nesse processo, considerando principalmente pesquisadores em formação.

Limitações/implicações da pesquisa – O aumento considerável de recursos usando IA em todas as dimensões da vida humana.

Implicações práticas – O impacto que o uso de IAs generativas pode ter sobre a criação de conhecimento e a disseminação de pesquisas científicas.

Implicações sociais – O impacto que o uso de IAs geradoras pode ter na criação de conhecimento e na disseminação de pesquisas científicas.

Palavras-chave Inteligência artificial, Escritura académica, ChatGPT, Inteligência artificial generativa

Tipo de papel Trabalho de pesquisa

1. Introduction

Writing contributes to the development of the human being in different aspects, such as communication skills, idea organization, better understanding of contexts and, consequently, in the ability to analyze, as well as the development of creativity and cognition, improvement of memory use and representation of a certain reality (Marcuschi, 2008; Aquino and Silva Junior, 2012).

Academic writing has a very distinctive style. It has marked characteristics such as objectivity, clarity, cohesion and coherence; the use of technical and formal vocabulary; and specific formats. In addition, it is the result of studies carried out by professors or researchers who are not necessarily professional writers. Therefore, the use of resources that help researchers is always welcome, especially when you consider the pressure to publish they are under.

With the popularization of generative artificial intelligences, it is essential to understand how these resources can be used in academic research and writing processes to aid in the production of scientific knowledge. Knowing the benefits and challenges that the use of these resources will bring will help researchers to improve their own research processes.

The production and dissemination of scientific knowledge is closely dependent on academic writing (Motta-Roth and Hendges, 2010). Writing is a problematic, emotional, complex, arduous and time-consuming process (Rahimi and Zhang, 2018; Rossoni and ChatGPT, 2022), especially in the planning, structuring and organizing of ideas phases. The use of generative artificial intelligence (GAI) technologies can automate some of these activities, making the research and writing process more dynamic and accessible to more people (Grimes *et al.*, 2023; Barros *et al.*, 2023).

According to research already carried out on this subject, there are several points of view that should be considered when using generative AIs in the academic writing process. At the same time as increasing the risks of producing inadequate scientific work or work that lacks the necessary academic quality, important barriers to the democratization of this process can be overcome, such as the language barrier and the possibility of accelerating and improving the stages of synthesis and development of knowledge as such (Grimes *et al.*, 2023; Barros *et al.*, 2023).

However, although artificial intelligence brings benefits to writing, it is important to emphasize that this technology should not be seen as a substitute for creative and critical academic writing. The relationship between AI and writing deserves the attention of the academic community both because of the topicality of the subject and because of the impacts it is having on various processes, including the creation of knowledge itself.

From these perspectives, concerns arise, such as the possibility of reducing the quality of academic texts, not because of the depth of the topics but because of the element of creativity and inspiration – inherent to human beings. It is considered necessary to understand all of its possibilities and potential to more accurately design the use of these resources for the generation of knowledge. In addition, the use of GAI in academic writing can also have ethical and social implications that need to be considered and discussed.

The choice of ChatGPT as the generative AI to be considered in the study is justified by being the pioneering tool made available for free and accessible to the public in November 2022, in addition to being the most used AI among the researcher respondents of the survey. Given the above, the purpose of this article is to analyze the relationship between academic writing and GAI, taking into account the perceptions of potential users of language models like ChatGPT, to explore the benefits and challenges of its use in academic writing. The contribution of this research lies in the fact that the study was conducted in an academic environment, involving teachers and, above all, researchers in training. In this way, it will be possible to find out how these users are using these technologies and what their expectations are in the development of scientific studies.

2. Theoretical background

2.1 Artificial intelligence and ChatGPT

Intelligence is a person's ability to learn, perceive, process information, transform it into knowledge and apply it to the environment around them. It involves various processes such as memory, reasoning, problem-solving, learning and goal-directed action (Paschen *et al.*, 2019). Artificial intelligence (AI), on the other hand, is based on the idea that human minds and machines have the ability to operate with coded knowledge to make decisions (Russell and Norvig, 2016). AI is capable of imitating human cognitive tasks and acting as an intelligent agent, taking actions based on its understanding of the environment through deep, supervised and automated learning (Russell and Norvig, 2016; Ricardo *et al.*, 2021; Grimes *et al.*, 2023). For Grimes *et al.* (2023), AI is a class of machine learning technologies that have the ability to generate new content similar to that created by humans, such as images, texts, audios and videos. It is a field of computer science that seeks to develop techniques and algorithms that allow machines to perform tasks that normally require human intelligence (Ricardo *et al.*, 2021).

The historical genesis of AI dates back to the 1950s, with Alan Turing, John McCarthy and other scientists as its main exponents (Tanveer *et al.*, 2020).

Turing, in his article "Computing Machinery and Intelligence," asks the question: "Can machines think?". In this study, Turing applies a test, which bears his name, used to determine whether a machine can be considered intelligent or not (Turing, 1950). This test is a milestone in the history of AI and continues to be an important topic of discussion and debate to this day.

The evolution of machine learning algorithms and the availability of large data sets have enabled significant advances in AI, especially in areas such as natural language processing and image recognition. An example of this evolution is ChatGPT, a language model developed by OpenAI that uses advanced machine learning techniques to generate natural language text very close to human language (Boa Sorte *et al.*, 2021). It uses what is known as natural language, which means that it generates text or speech in a format similar to that of a human being (García-Peñalvo, 2023). Initially, OpenAI's GPT 2 had a not completely open access policy, being restricted to a few researchers and developers. With the launch of ChatGPT 3 in November 2022, access was opened up to the general public, representing a milestone in the popular use of this generative AI and consolidating its pioneering spirit.

For Barros *et al.* (2023), as generative AIs become more sophisticated and capable of performing tasks that were previously exclusive to human beings, an ethical and responsible attitude must be adopted in their use. Perhaps especially with regard to academic activities. This is because, despite its great capacity to create content, generative AI has no capacity for

reasoning or true comprehension, and its product is based on large linguistic models with a probabilistic foundation (García-Peñalvo *et al.*, 2023).

Generative AI can improve the efficiency and accuracy of various processes, such as decision-making, task automation and data analysis. However, ChatGPT also has significant limitations. As it was trained on large internet text data sets, it can reflect existing social inequalities and reproduce errors and biases present in the data on which it was trained to generate certain text.

2.2 Academic writing and the use of ChatGPT

Academic writing is a style, a form of textual production characterized by a set of practices and norms used to produce and disseminate scientific knowledge. It is widely used to communicate and disseminate research. This type of writing allows authors to maintain rigor in the way it is carried out, corroborating the seriousness inherent in the development of scientific research (Motta-Roth and Hendges, 2010; Thelwall, 2022). An academic text follows formalities and postures that have a profound impact on the way scientific results are perceived (Lancaster and Aull, 2014; Crompton, 1997).

Researchers, teachers, students and other professionals who use this style of writing are often affected by pressure to produce relevant scientific publications that generate impact. Intellectual productivity is currently assessed on the basis of publication output and is affected by elements such as language (Motta-Roth and Hendges, 2010; Lillis and Curry, 2010). English is the predominant language in scientific publications and affects not only the publishing market, but also the possibility of access to research funding (Lillis and Curry, 2010). It is therefore natural to look for resources that can help with the different stages of the academic writing process.

The potential of GAI, represented in this study by ChatGPT, has led the academic community to explore appropriate and productive ways of using these resources (Martín-Marchante, 2022; García-Peñalvo *et al.*, 2023; Barros *et al.*, 2023; García-Peñalvo, 2023). Even considering its strengths, it is necessary to bear in mind its limitations, such as the generalization and superficiality of the texts produced, repetition of ideas and even hallucinations (Alkaissi and McFarlane, 2023).

According to Barros *et al.* (2023) and Grimes *et al.* (2023), generative AIs can help in the academic knowledge production process, from the identification of topics, research objects and synthesis of existing knowledge to evaluation and delivery to the community through translation. In this sense, it is still necessary to know the researcher's perspective on the use of these technologies and to deepen the discussion in the academic sphere to fully incorporate these resources into the academic production process.

In their studies, García-Peñalvo *et al.* (2023) identify positive and negative aspects of using generative AI in academic writing. They highlight as positive points the ability of AI to help generate content, propose ideas, support research, improve writing and more. The challenges highlighted by the authors are related to academic authenticity and integrity. This last aspect can lead to the proliferation of inappropriate or irrelevant publications, a problem that already exists in the academic sphere but which can be amplified due to the ease provided by the use of GAIs (Barros *et al.*, 2023).

ChatGPT and other GAIs can help organize and refine information in academic texts, but it is not the same as generating knowledge (Graham, 2021; García-Peñalvo *et al.*, 2023). Authorship plays a fundamental role in academic writing, encompassing the attribution of credit and responsibility for the information presented. The use of language models such as ChatGPT has raised questions about authorship and responsibility, requiring mechanisms to

ensure proper attribution and avoid academic fraud and copyright infringement (Alves and Moura, 2017; Graham, 2021; García-Peñalvo *et al.*, 2023).

Some authors have suggested the possibility of referencing ChatGPT as a coauthor, detailing how it was used (Rossoni, 2022; ChatGPT and Zhavoronkov, 2022), but the position of editors is the opposite. Although language models such as ChatGPT offer advantages in the automation of text generation, their use must be made explicit and accompanied by care due to ethical implications (Martín-Marchante, 2022).

2.3 Initial ethical considerations

Academic writing has important implications for society. Its results affect various aspects of human life, so it is essential for researchers to behave ethically. When it comes to the use of technological resources, especially AIs, the implications are varied, such as the aforementioned concern with the veracity and rigor of what is offered in the scientific document in question (Thelwall, 2022).

The use of content generated from generative AIs without proper attribution of sources or without a critical analysis that allows for a correct understanding of the topics being researched is pointed out as a concern in the field of academic writing (García-Peñalvo *et al.*, 2023; Barros *et al.*, 2023; Alkaissi and McFarlane, 2023). Barros *et al.* (2023) suggest that it is necessary to work on educational policies but also to strengthen ethical discussions, helping students and researchers to make good use of technological resources in general.

A critical and ethically responsible approach is needed when adopting these technologies (Barros *et al.*, 2023). The production of knowledge requires rigor to avoid the proliferation of studies that are inadequate or prepared superficially and without responsibility (Motta-Roth and Hendges, 2010; Thelwall, 2022; Barros *et al.*, 2023).

On the other hand, the use of generative AI can bring more equity to the academic writing process, helping researchers who are not native English speakers to disseminate the results of their research, overcoming the language barrier imposed by the publishing market (Lillis and Curry, 2010; Barros *et al.*, 2023).

A quite critical aspect in the academic writing process is intellectual property. This is the set of legal rights that protect intellectual creations, such as literary, artistic and scientific works (Ricardo *et al.*, 2021). When it comes to academic writing generated by language models, there are concerns about how these creations are protected by copyright and what are the ethical and legal implications of this (García-Peñalvo *et al.*, 2023; Barros *et al.*, 2023).

ChatGPT does not actually create ideas. It feeds on a set of previous data and information to present answers – fluently, coherently and similar to human texts – to the questions asked. However, this does not mean the creation of new knowledge. Knowledge is not generated by the machine, but by humans first (Azuaje Pirela, 2023; Zhavoronkov, 2022; Voitovych *et al.*, 2021; Ricardo *et al.*, 2021; García-Peñalvo *et al.*, 2023).

Authorship and intellectual property are crucial in academic writing, both for taking responsibility for the content and for recognizing authorship (economic and/or social). The authorship of an academic publication takes into account the effective and ethical participation of people at different stages of the research, which is why it is important to understand the impact of this action on the preparation of a scientific text (Smissaert and Jalonen, 2018; García-Peñalvo *et al.*, 2023).

Once again, it is important to establish clear rules and regulations for the use of language models in academic writing and to ensure that these writings are protected by copyright in a fair and transparent manner (Azuaje Pirela, 2023; Voitovych *et al.*, 2021; Ricardo *et al.*, 2021). Texts generated by resources such as ChatGPT should be used with permission and

due credit, and measures should be taken to prevent copyright infringement and unauthorized commercialization. Alternatives such as licensing agreements between the companies behind these technologies and users could be considered, always bearing in mind free access to science for the inclusive development of nations. Other solutions identified could deal with the inclusion of security mechanisms to prevent unauthorized use, such as digital marking or tracking systems, or the establishment of clear standards and regulations for the commercialization of texts, which could represent a limitation on access to the generation of knowledge. Another possible action, and the most important, is to promote education and awareness of intellectual property and copyright issues (Voitovych *et al.*, 2021; Ricardo *et al.*, 2021).

3. Methodological procedures

This article is characterized as exploratory and descriptive, with a qualitative approach. The focus of this type of research is on the subjective interpretation of reality, aiming to understand the context as a whole from the perspective of the participants involved in the study (Creswell and Poth, 2018).

The research was operationalized through strategies for collecting and interpreting information about the respondents' perceptions of the use of generative AI, represented in this study by ChatGPT, in academic writing.

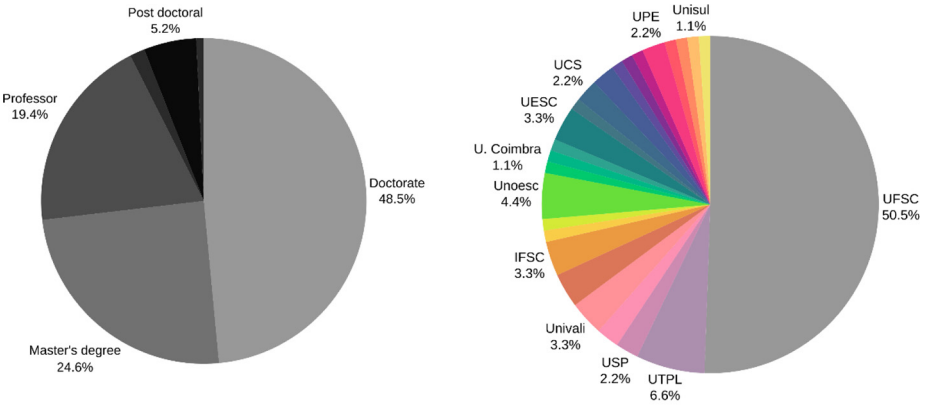
Two techniques were used in the data collection phase. The first consisted of a narrative literature review with systematic search, which is a type of review where the methodological procedures used are defined at the discretion of the reviewers (Rother, 2007). To obtain the studies, a search was carried out in the scientific databases Scopus, Web of Science, IEEE Explorer, Springerlink, Scielo and Science Direct, without time delimitation, among articles and reviews published in English and Portuguese, using the string ("Artificial Intelligence" OR "machine learning" OR "chatgpt" OR "gpt*") AND "academic writing," filtering by title, abstract and keywords.

The bibliographical research was followed by a data collection stage using asynchronous interviews via an online questionnaire (Google Forms®). As the object of the research is related to understanding the relationship between academic writing and GAI, taking into account the perceptions of potential users to explore the benefits and challenges of its use in academic writing, questions were designed to find out whether the specific audience uses ChatGPT and for what purpose; whether this technology may be able to replace critical and creative academic writing; what the ethical implications are; and how these technologies can be applied to help authors develop academic writing, among others. The questions were based on a script and are presented in their entirety as an appendix to the study.

This data collection strategy is consistent with Merriam and Tisdell (2015) suggestions that online interviews can be carried out either synchronously or asynchronously when there is a time lag, via email, online discussion groups or online questionnaires, as used in this work.

The questionnaires were shared through the internet and instant messaging groups (WhatsApp®), reaching 147 respondents from 24 higher education institutions in Brazil (UFSC, IFSC, IFC, Univali, Unisul, Unoesc, UDESC, PUCPR, Caxias do Sul University-UCS, Unicesumar, USP, UFRJ, UFBA, UESB, UESC, UFPE, UPE, UFPA, UFAM), Ecuador (UTPL), Portugal (University of Coimbra and Madeira) and Spain (UC3M), from various postgraduate programs and diverse profiles, as shown in Figure 1. Each respondent was assigned a code that identified them from R1 to R146.

The research's target audience is made up of professors, researchers and master's and doctoral students. The delimitation to this group is justified by the fact that the research is focused on the type of academic writing. The study is part of the research group of the Knowledge Engineering, Management and Media Program at the Federal University of



Source: Research data (2023)

Figure 1. Respondent profile

Santa Catarina, Brazil, which can be evidenced by the large number of people linked to this institution. From seminars held in January 2023 to discuss the use of generative AIs in academic writing, a WhatsApp® group was created to exchange information and knowledge. This group brings together around 800 researchers, professors and students, and the questionnaire was initially sent via this group, with the option of sending it to other people.

To analyze the data collected, we used the qualitative content analysis technique (Mayring, 2014), which allows us to combine positive aspects of the discovery of "natural" categories of grounded theory (Corbin and Strauss, 2015) with content analysis strategies (Krippendorff, 2018). This set of techniques allows researchers to understand meanings, themes and patterns that emerge from the texts. Texts are thus understood as bearers of meaning, not confined within themselves, but dependent on the context.

The analysis is based on the identification and interpretation of recurring patterns or significant themes. For this study, these patterns were organized into four categories, discovered from the combination of the literature review and the results obtained from the questionnaire responses (Corbin and Strauss, 2015).

The review and analysis were carried out independently by the researchers and then shared, discussed and drawn up together. The results of the discussions, data collection and analysis have been organized and will be presented in the next section.

Considering the relative novelty of the topic, it is understood that the strategies used for this research were the most appropriate to understand the benefits and barriers related to the use of generative AIs in academic writing. The perspective of general trends, theories and methods found in the specialized literature should corroborate, contradict or complement the perspective of the researchers, teachers and students participating in the study.

4. Analysis of results and discussion

The advent of ChatGPT raises questions about the future of academic research, especially the resulting writing process (Stokel-Walker, 2023). To address these concerns, it is necessary to understand both the potential and the challenges of this technology (Zhai, 2022).

Generative AI brings a set of contributions to academic writing, which were identified in this study and are materialized in Figure 2.

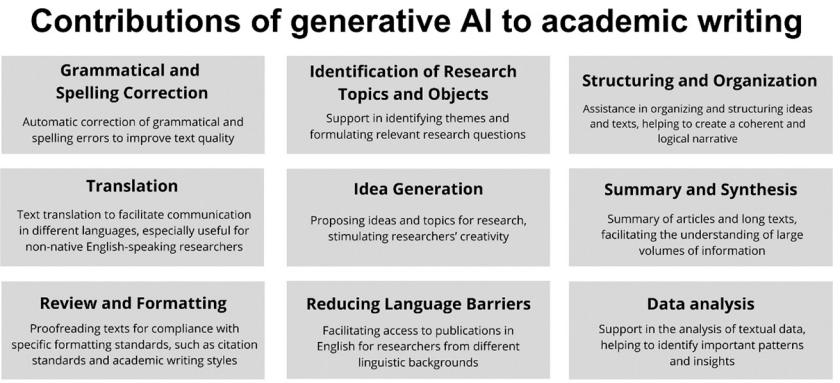
Each of these contributions represents a significant aspect of the potential of generative AI in the context of academic writing, as evidenced by the responses of participants in this study.

Furthermore, based on a theoretical framework resulting from a literature review and data collected through interviews, four categories of analysis have been defined that raise questions about: the complementarity of ChatGPT in the writing process; the limitations of ChatGPT in relation to the preparation of scientific texts; the ethical and social issues of its use in an academic context and issues of intellectual property and creativity, which will be detailed in the following subsections.

4.1 ChatGPT as a complementary tool for academic writing

ChatGPT is capable of answering follow-up questions, acknowledging mistakes, challenging incorrect premises and rejecting inappropriate queries (Zhai, 2022). The responses obtained both in the literature review stage and in the asynchronous interviews (80% of respondents) agree that generative AI is a complementary tool to support the researcher in the academic writing process. This support can be given in different ways and degrees. Those that understand a consistent type of support are identified, such as the structuring and presentation of knowledge on certain topics, "favoring the interpretation and reflective approach of humans" (R25). However, most people understand that the help is, at least currently, in more basic and automatic activities that take time, such as grammar correction, translation, adaptation of text structure (standards and formats) and other repetitive activities (R60, R66, R74, R75, R104).

When asked specifically about how the tool would help authors in the academic writing process, the answers were related to these same basic elements, considering "data mining" (R33), consultation of references and sources, "identification of authors working on the same topics" (R28), "agility in the search for theoretical foundations" (R42), "learning tool" (R33), more comprehensive research, considering possible access to scientific databases (R72), initial analysis with cross-checking of data, comparison of styles and others. The help will be "in the same way as in a traditional library." Of course, tools of this magnitude (AI)



Source: Research data (2023)

Figure 2. Main contributions of generative AI to academic writing

are more surprising because of their speed and scope" (R41). It is also important to highlight help for people who have difficulty developing or organizing ideas and thoughts when writing. ChatGPT, then, could be useful for relating and ordering topics in the construction of the text. "AI is an excellent substitute for the role of writer, but not for that of researcher" (R39), and, in the same vein, "it is a complementary resource to qualify research" (R110) and "as a human augmentation."

The interviewees' perceptions are reflected in the literature analyzed in the first stage of data collection. These studies corroborate the use of this technology as a complementary means for correcting texts in general, suggesting improvements in style and writing and adaptation to formatting standards and styles, among others (Martín-Marchante, 2022; Boa Sorte *et al.*, 2021; Graham, 2021; Tanveer *et al.*, 2020). The aspect of the possibility of translation also appears as an important resource (R74, R77, R83, R134): "For non-native English-speaking countries, generative AI is essential, whether for translating texts or for assisting in building texts in that language" (R47). The possibility of relying on AI to perform accurate translations aligns with the need to overcome language barriers in academic publishing, opening doors for researchers who are not native English speakers, for example, or for researchers who are at the beginning of their careers (Lillis and Curry, 2010; Barros *et al.*, 2023).

Four answers provide a resounding negative, understanding that generative AI cannot replace academic writing. They consider that its resources are too limited to offer significant support.

On the other hand, there was a pragmatic perspective of the limitation of generative AI surpassing human intelligence, especially in the data collected from the interviewees. For the creation and generation of new knowledge, there is a dependence on the being who knows and perceives through the senses and processes this experience. Novelty, disruptive research and discussions depend precisely on this new human perspective on life: "AI will hardly have the capacity to make [such an assessment] alone, without human analysis" (R6). Also that "the support of AI is important, but there are still limitations and questions it does not know how to deal with, for example, "how could [an AI] translate the human experience of a journey?" (R38).

The use of creative capacity and the creation of something is a characteristic trait of human beings (Marcuschi, 2008; Aquino and Silva Junior, 2012). However, when ChatGPT is asked to write a Haikai-style poem on a given topic, the feedback is something new.

The great challenge is to be able to simulate human perception in writing, such as the "journey" or the excitement in front of a novelty and discovery of elements that are proper to social interaction and the cognitive ability of the human being.

When asked about how an artificial intelligence could translate a person's perception of a fantastic or catastrophic event, ChatGPT responds as follows: "An artificial intelligence can translate a person's perception of a fantastic or catastrophic event using natural language processing and sentiment analysis techniques. It can analyze the person's text or speech and identify keywords and patterns that indicate emotions, such as fear, sadness, surprise, etc. The AI can also consider other factors, such as the person's context and tone, to determine their perception of the event. However, it is important to remember that the AI's ability to understand human perception is limited, and there may be cases where its evaluations are not accurate." (OpenAI, 2023).

The interviewees were then asked to comment on the support provided by ChatGPT in reviewing scientific articles. The results point to three types of responses:

(1) basic instrumental use;

(2) use that seeks underlying correlations; and

(3) finally, a pragmatic perception based on the limitations of the technology, but which in no way denies its possibilities.

In the first group, the answers refer to basic use, such as support in detecting plagiarism, translation, revision and organization of references, spelling corrections, questions of form, help in writing texts in terms of cohesion and coherence and elements that speed up the process in some stages of revision.

The second group deals with the support of generative AI in the process of reviewing scientific articles. This support can be found in the contextual review of a particular author's work. Another possibility is to identify the quantity and location of certain themes, related authors and their positions in the proposals they make. At this point, "the speed with which you can search for content and context on a given subject is what most impacts the use of the tool" (R10). The benefit lies in locating and organizing the underlying themes, generating consistent input so that the researcher has alternatives to complement their perspective in the construction of knowledge (R76, R110). Also, "if it [AI] does the groundwork, the researcher will be much more aware of the differential they can contribute to their research" (R11).

Depending on its constitution, access to knowledge bases and how it evolves, generative AI can help researchers and reviewers identify what is relevant and potential elements that can be complemented in the work, enriching the text. In the same way, it can be considered that generative AI identifies (or will identify) incorrect elements in different works at the same time, improving not only the review process itself but also contributing to the development of a strong and impactful science. There is no doubt that generative AI can be used as a feedback tool for researchers as part of the editorial review process (Thelwall, 2022).

The third group identifies the limitations of the tool and the need for human intervention. According to this approach, in the current version of ChatGPT, content analysis is compromised, considering the limitations experienced;

> […] The repeated use of a particular process in a scenario can saturate the research, turning production into rhetoric, [because] where is the dialectical process? the antithesis within this instrument? (R10).

Although technology helps in the revision and writing of texts, there is still the concern that the author's original idea is maintained. When ChatGPT asked whether artificial intelligence can carry out a dialectical process, the answer received was:

> Yes, artificial intelligence (AI) can be programmed to carry out a dialectical process. AI can be used to simulate dialectical thinking, seeking to understand and solve problems by analyzing data and generating new hypotheses. However, AI is still far from having the capacity to understand human nature and the complexity of society and history, as the dialectical process was originally intended to do. In addition, AI depends on the programming and training it receives, which means that its ability to carry out a dialectical process will be limited by the knowledge and perspective of its creators (OpenAI, 2023).

Although there are reservations about using ChatGPT for academic writing, the responses are positive. It is an important complementary resource that goes beyond mere spell-checking and can move on to deeper issues that help researchers construct their texts. They can help to identify concepts, contexts and relationships between authors and themes more quickly, providing a path for research (Martín-Marchante, 2022; Thelwall, 2022; Boa Sorte *et al.*, 2021; Graham, 2021; Tanveer *et al.*, 2020).

4.2 Limitations of ChatGPT use in academic writing

Although it is very clear to highlight the benefits, based on users' enthusiasm in the field of scientific writing, some limitations can be identified from their experiences. Some believe that the tool is extremely useful for organizing information and generating ideas (R71), while others highlight limitations such as the lack of adequate scientific data and the inability of AI

to generate knowledge. There are those who consider that the writing produced by ChatGPT still does not approach human performance but can be a useful tool for idea generation. There are also claims that the overly perfect writing generated by generative AI can distance individuality and the art of human writing. There is a majority opinion regarding the quality of writing generated by ChatGPT, with formatting and clarity of sentences (Martín-Marchante, 2022; Boa Sorte *et al.*, 2021; Graham, 2021; Tanveer *et al.*, 2020), although the vocabulary can be considered simple or complex, depending on the comparison, mainly due to the initial perception that the tool has a lot of "academic jargon" that generates superficial content.

The main limitation identified is the limited access to scientific knowledge bases (such as Scopus/Web of Science), as well as failures in referencing scientific articles. Furthermore, the data entered in the tool are limited in time (Boa Sorte *et al.*, 2021), restricted to the date of its last training in the GPT4 version, in April 2023. Regarding the quality of the writing itself, there is a misalignment with the use of technology. Although it is written clearly, fluidly and cohesively, there is a persistent repetition of words, which makes the text, in general, poor and without personality (R110). "It is an essay based on other texts, in the sense that it repeats ideas and does not address innovative issues." It loses style, making the writing very cold and without human characteristics, "[…] there is no art, inference, and individuality of interpretation" (R10). In addition, "ChatGPT always has generic texts on the subject. […] it is a product of the corpus of knowledge of the area used in its training" (R39).

The construction of a text, as seen above, is composed of various elements, including style, structure, formal linguistic elements, etc. (Aquino and Silva Junior, 2012; Marcuschi, 2008). But it depends on social interaction and the complexity of the relationship between people to produce meaning (Koch, 2003). A lot of cognitive effort is required, seeking specific information and knowledge from each person to produce the new and the subjectivity with which human relationships are recognized. In this sense, Motta-Roth and Hendges (2010) consider that the text presented by the researcher is the product of other more complex processes, such as the construction of arguments based on specialized reading and experimentation, observation and experience, as well as considering the interaction between people within contexts.

Further limitations were cited in relation to texts generated by AI. The lack of critical sense was highlighted by several interviewees, as exemplified by R34: "AI simply compiles information, without critically evaluating its relevance or veracity." Regarding analytical capacity, R47 noted: "AI responses seem superficial when it comes to deeper analyzes of complex concepts." Furthermore, "AIs fall short of the most brilliant human minds, as they use several other emotional and social cognitive processes to produce their knowledge", as pointed out by R71, indicating a limitation in AI's ability to perform complex analysis involving emotional and social aspects. Creativity was also mentioned as a significant limitation. R51 commented: "AI-generated texts lack originality and creative insights that we expect in high-level academic work." Coherence issues were reported by R78: "Sometimes the AI produces paragraphs that seem disconnected from each other, lacking a clear line of reasoning." Conceptual accuracy was another concern, as expressed by R93: "I noticed that the AI sometimes uses technical terms imprecisely or out of context." Finally, the lack of adequate contextualization was highlighted by R105: "The AI does not appear to fully understand the historical or cultural context in which certain concepts developed." These limitations are in line with the work of Chan and Hu (2023) who, similarly, seek to identify the perceptions, benefits and challenges of postgraduate researchers when using generative AI in their research.

Finally, it is important to highlight the difficulty of generative AIs, especially ChatGPT, in dealing with the complexity of academic ideas and concepts, as well as conceptual imprecision and factual errors.

4.3 Ethical and social implications of using ChatGPT in academic writing

ChatGPT went public in November 2022, and two months later, it reached a record 100 million users. This achievement is indicative of the extraordinary interest in ChatGPT and the benefits it will bring to various human activities. However, it is necessary to consider the reflective aspects that this technology can cause, such as the ethical and social implications of its use: issues of authorship, plagiarism, academic fraud, accountability, transparency, fair credit, regulation, quality control, diversity, inclusion and more.

At least two questions arise when considering the use of ChatGPT in academic work: will it be possible to consider ChatGPT as a coauthor of this work? How are writings generated by these language models credited? The issue of authorship is one of the main ethical concerns related to academic writing and the use of language models like ChatGPT. Authorship is the act of creating and being recognized as the creator of a work (Ricardo *et al.*, 2021). When it comes to academic writing generated by language models, there are concerns about who should be credited as the author of that work and what are the ethical and legal implications (R52, R55, R67, R82).

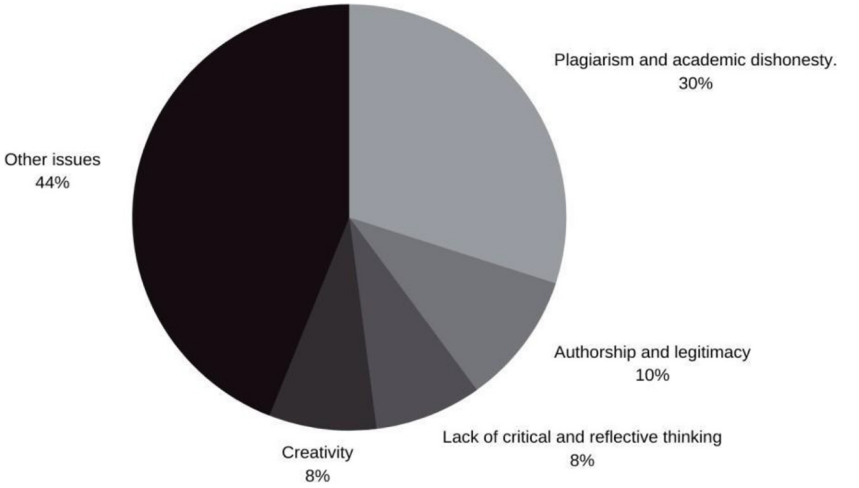
When ChatGPT was launched commercially in November 2022, some studies even included AI as a coauthor of these works (ChatGPT and Rossoni, 2022; ChatGPT Generative Pre-trained Transformer and Zhavoronkov, 2022; O'Connor and ChatGPT, 2023). However, this issue has now been settled, with the main academic publishers emphatically not considering AIs as coauthors in academic texts.

The controversy over the attribution of authorship to ChatGPT leads to another ethical issue, considering that the texts generated by generative AI could give rise to a new type of plagiarism, something like "technology-facilitated plagiarism." This theme is explicit in the interviewees' responses as the main ethical issue to be considered (see Figure 3).

There are now proven resources that detect the use of text edited by GAI, such as GPT Zero, developed by Edward Tian of Princeton University (USA). The argument that texts generated by language models can be considered plagiarized lies in the fact that they were not created by the human author. This concern reaches a higher level when one considers that these texts are used to defraud academic papers, leading to a possible discrediting and devaluation of scientific knowledge. To address these ethical issues related to authorship, it is important to establish clear rules and regulations for the use of language models in academic writing to avoid fraud and copyright infringement (R126).

ChatGPT (OpenAI, 2023) was consulted on how to solve these problems, listing the following solutions:

- transparency about the use of language models in academic writing, clearly indicating when a text has been generated by a language model. This allows readers to understand and properly evaluate the origin of the writing;
- crediting writing generated by language models in a fair and transparent way, giving credit to the human author, the language model and whoever trained the model;
- establishing clear rules and regulations for the use of language models in academic writing;
- establish quality control processes for writing generated by language models, such as peer review and expert evaluation; and



Source: Research data (2023)

Figure 3. Main ethical issues related to the use of ChatGPT in academic writing

- educate users about the correct and ethical use of language models in academic writing (OpenAI, 2023).

These suggestions are some of the ways to ensure that the writings generated by language models are credited in a fair and transparent way and seek measures to prevent academic fraud and copyright infringement.

The data from the interviews show other concerns, such as "the marginalization of academic studies and the devaluation of the researcher, which will be compromised due to the lack of trust and transparency in the conduct of this scientific research" (R^2); the generation of texts and (re)production of biased and mistaken studies (R21); lack of depth and creation of new knowledge (R16); lack of academic commitment (R19); dissemination of concepts with nonscientific interests (R21); removal of sensitivity and deep critical thinking from scientific work (R28); generation of shallow and nonhuman knowledge (R28) and difficulty in pinpointing authorship, an academic "ghostwriting" (R68). More emphatic considerations indicate that the use of ChatGPT in academic writing will be: "an insult to those who really try and dedicate part of their lives to contributing to academic writing" (R28). This statement can be countered by another, which indicates that the use of ChatGPT and other generative AIs in academia is a question of values because "if the researcher is bad and incompetent, he will pay someone to do the research for him, be it a machine, a colleague or a scientific production site" (R39).

Issues related to diversity and inclusion were also considered, especially whether the use of AI in academic work could serve as an inclusive factor and support diversity (R63). One of the points that reflects this new perspective was highlighted by one of the research participants in the following terms: "the use of ChatGPT will contribute to reducing digital exclusion […] this is noteworthy. Digital tools can serve humanity, the common good, and not just a privileged group" (R15). The results suggest that the use of ChatGPT can be beneficial in increasing inclusion and diversity in academic writing, and this can be achieved in the following ways:

- revising and translating texts;
- offering a more accessible language for people with language limitations;
- providing interdisciplinary information for researchers; and
- contributing to the formation of ideas and the structure of writing.

Specifically on accessibility, "AIs are increasingly offering assistive technology resources to people with disabilities - such as Text to Speech, [for example]" (R51).

In addition, generative AI can be a useful tool for minority groups, including people with disabilities, LGBTQIAPN+ individuals, people from different ethnic groups and the elderly, among others; people who have difficulty communicating their research findings, as well as people with low education levels and limited access to proper training on academic writing (R52, R82, R92, R101, R118, R141, R142). Obviously, it is not about equalizing everyone or trivializing the needs and expectations of each individual or group; however, it is important to consider the possibility of democratizing the production and organization of content through the inclusion of diverse and inclusive data sources in the training of language models themselves, as well as the use of GAIs to mitigate linguistic bias in academic texts.

It is also necessary to promote education about the importance of diversity and inclusion and their relationship with academic writing generated by language models. The academic community should promote the institutionalization of this discussion, seeking to create public policies that facilitate access to and use of AI for all segments of society.

When questioned about the issues of inclusion and diversity and how they could be facilitated by generative AI, ChatGPT pointed out the following suggestions:

- use a variety of data sources to train language models, including sources that represent and include minority and marginalized groups;
- regularly check training data to identify and remove biases;
- use debiasing techniques to mitigate bias present in training data;
- implement verification mechanisms to ensure representation and inclusion in writing generated by language models; and
- promote diversity and inclusion in the language model development team, including hiring individuals from different social and cultural groups.

Furthermore, it is important to pay attention to technological and social developments and to adapt policies and procedures accordingly. These ethical issues need to be carefully considered and discussed to ensure the integrity and validity of academic writing, ensuring the rights of individuals and communities are protected.

4.4 ChatGPT, intellectual property and creativity in academic writing

Intellectual property is one of the main ethical concerns related to academic writing and the use of language models like ChatGPT. Both in the literature (Azuaje Pirela, 2023; Voitovych *et al.*, 2021; Ricardo *et al.*, 2021; Alves and Moura, 2017) and in the questionnaire responses, this is an issue that generates discomfort and concern.

Respondents believe that AI cannot be held responsible for the texts produced, as the machine "is not endowed with consciousness and cannot assume responsibility for the work produced" (R1, R51). Such perception aligns with the stance of major academic publishers (Emerald, Elsevier, Clarivate, Springer, Wiley, Sage), who have settled the issue regarding artificial intelligence not being considered as a coauthor of scientific works.

To ensure a transparent process, users of ChatGPT and other AIs should explicitly declare the use of these resources, as well as the questions asked and their sources indicated (Rossini, 2022). The place to mention that part of the text was developed with AI, or what its role in the work was, is up to the guidelines of the journal, and in its absence, can be indicated in the section of authors' contributions (even though AI cannot be considered as such).

An additional concern, even highlighted in the experts' responses, is the doubts about the real sources used by ChatGPT and, linked to this, the fact that many of the references presented do not correspond to reality (R60, R64, R74, R75, R84, R126). For scientific works, rigor in sources is part of their validity, and generally, studies are based on practical or theoretical constructs already developed by other researchers.

In the same direction, or as a result of ethical issues of authorship and intellectual property, is the capacity for creativity. Creativity is the process of creating something new and original and is considered a human characteristic, a very human trait (Berg and Dandolini, 2010; Aquino and Silva Junior, 2012).

On the other hand, there are concerns that texts generated by language models may "be seen as less creative and original than human texts" (R51), which may affect the perception and value of academic writing. ChatGPT, as a main representative of GAIs, produces texts that "lack the elements of 'creativity and sensitivity' typical of human writing" (R28). The texts contain repetitions of words and ideas and, although quite clear, are relatively lacking in elaboration. "The element of creativity, or the lack thereof, is even pointed out as an ethical and social implication of using ChatGPT" (R24). There are doubts about whether the creativity considered in texts produced by these technologies could be regarded as artificial creativity and what value and impact it might have on the results of studies presented in these texts.

And, of course, the element of responsibility returns, as the texts are not written and delivered by human beings, and it is not clear at which instance the responsibility for such content will be assumed: the user, the programmers, the company, the original sources, the databases, etc.

5. Conclusions

This article sought to analyze the relationship between GAI and academic writing, considering the perception of researchers, mostly in training, who use or will use it. For this purpose, a narrative review of systematized search was developed that guided the construction of the script for conducting 147 asynchronous interviews that were applied to academics from Brazil, Ecuador, Portugal and Spain in about two dozen educational institutions in these countries. As the majority of respondents are researchers in training (master's, doctoral and postdoctoral students), it is interesting to notice how the incorporation of GAIs into the academic writing processes impacts, especially at this time, as an assistant for the production of texts.

The results point to the use of generative AI, especially ChatGPT, as a complementary tool to academic writing, particularly in structuring and presenting knowledge on certain topics in more basic, automatic and even repetitive activities that consume the researcher's time, such as grammatical correction, translation, adaptation of the text structure (considering standards and formats), consultation of references and sources and agility in searching for theoretical foundation and approximation to the topic to be researched. At this point, it is characterized that AI can even complement or replace the writer in some aspects but never the researcher, and this was evidenced in the research results. The tool is understood as a possibility to increase human capabilities, as a "human augmentation" and not a limitation of its potential. The perspective of using generative AI as support resources is representative of how researchers in training perceive this moment in the development of scientific production.

In a context of great pressure for publications, researchers seek alternatives and mechanisms to make this process easier and faster. At the same time, the same audience demonstrates a concern about the ethical aspects of the use of these technologies and how it will affect the results of scientific productions. AIs are extremely useful for organizing information and generating ideas, however, they present limitations in relation to the lack of adequate scientific data, as they have limited access to scientific knowledge bases, as well as flaws in the referencing of scientific articles, persistent repetition of words and making the text, in general, poor and without personality. Also highlighted as limitations are the lack of critical sense, analytical capacity, creativity, coherence, conceptual precision and contextualization of the texts generated by AI. These points make generative AI distance itself from the individuality and art of writing characteristic of humans.

At the same time, ethical issues are pointed out, especially the issue of authorship and intellectual property and the inadequate and irresponsible use of these tools implying academic dishonesty, incurring plagiarism enabled by AI, causing damage to human originality and creativity.

Such points deserve attention and critical reflection from researchers, requiring debates, including with regard to standardization and guidelines for the beneficial and responsible use of AIs in academic research.

Therefore, academic writing that aims to communicate ideas and share and disseminate knowledge resulting from scientific findings should have artificial intelligence as a complementary tool, and these works should be guided by academic integrity and honesty, fundamental principles in education and academic research.

The main limitation of the research concerns the rapid evolution of solutions using generative AIs in the year 2023 alone. There have been so many derivations, uses, types and improvements in the solutions applicable to academic research that it has not been possible to go any further in evaluating each one. At the same time, this limitation turns into a number of research opportunities, considering both the categories mentioned in this study and the same technologies that are emerging all the time and improving their performance.

Academic writing is essential for generating and sharing knowledge. The use of generative AI can be an ally in this process. To deepen the analysis of issues related to the use of this language model in academic writing, interviews were conducted to consider users' perceptions, exploring the benefits and challenges of its use in academia.

The results indicate that generative AI should be seen as a complementary tool to creative and critical academic writing. It has latent potential but does not yet have the capacity to develop creativity and sensitivity when compared to human writing. In addition, writing is a skill that requires constant improvement and that this evolution is only possible through practice and self-awareness, something that generative AI is not yet able to provide.

The strength of the GAI is currently found in its support tools, especially with regard to operational tasks such as grammar correction and revision, data analysis, the structure of the text, the organization of ideas and the construction of certain sections of the study, as well as contributing to the interpretation and reflexive approach of the research data.

With regard to the ethical and social implications of using ChatGPT in academic writing, issues of plagiarism and intellectual property stand out, such as the use of the tool to generate complete texts and indicate the human user as the author. In addition, there is concern about excessive trust in what generative AI produces without a thorough discussion of the content. As for the social implications, there is a fear of marginalizing academic studies and losing recognition for researchers. There is also concern that excessive use of the tool could limit critical thinking and encourage plagiarism in its new form facilitated by technology. In addition, there is the question of the relationship between the perception of scientific and

academic knowledge and the knowledge acquired by the tool and whether it really creates meaning for the user. Another concern is copyright and economic-legal issues, as well as the distortion of human perception caused by the use of generative AI. There is also the issue of academic dishonesty and intellectual laziness, as overreliance on digital tools can lead to a disregard for the importance of creating new knowledge.

Despite the potential of ChatGPT to assist in proofreading and help reduce the digital divide, it is necessary to carefully consider its ethical and social implications so that it is used responsibly and consciously.

Issues related to intellectual property and authorship of the texts generated by ChatGPT deserve attention from the academic community. There is disagreement as to whether ChatGPT can be considered the author of the texts produced, since generative AI is not conscious and cannot take responsibility for the work produced. In this case, and this was observed in the data collected, the author should clarify the use of ChatGPT, informing to what extent this use occurred in the text.

Finally, it is important to mention that Turing's reflections can be used as a model for discussions on the social impacts of using ChatGPT and other similar technologies in an academic context. In his essay on the possibility of machines thinking, the author questions whether the question we should ask is whether machines can think, or if the real potential of machines is something else, and if we are looking at peripheral or secondary things. The awe with the question and answer game is possibly a sample of the path we will be taking in the coming years, and the question should not be whether there is agreement or impact, but how scholars, researchers and universities will be participating in these definitions.

As research limitations, it is highlighted the predominance of the approach on ChatGPT and the lack of discussion regarding inclusion aspects. As a proposal for future research, it is recommended to expand the literature review, also advancing to other stages of the research process itself.

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Appendix

Below is the script used in the asynchronous interviews conducted with academics and professors in Latin America and Spain.

Generative Artificial Intelligence and Academic Writing: The Use of ChatGPT

Dear colleague,

We invite you to participate as a volunteer in the research titled "Artificial Intelligence and Academic Writing: The Use of ChatGPT". The study aims to understand the effects of using ChatGPT in academic writing and how it can be effectively utilized in this process.

If you have used ChatGPT or are interested in the relationship between AI and academic writing, this is the perfect opportunity to share your experiences and opinions.

Thank you in advance for your participation.

(1) Have you used the ChatGPT?

(2) Have you used it as a tool for assistance in academic writing?

(3) Have you used the ChatGPT for any of these functions: summarization, reviews and writing complete scientific articles, concept inquiry, identification of authors related to a certain topic? How did you use the tool?

(4) Do you believe AI should be seen as a replacement for creative and critical academic writing or as a complementary tool?

(5) What are the main ethical and social implications of using ChatGPT in academic writing?

(6) What is your opinion on the use of AI in the review of scientific papers? In what way can AI be used to improve the efficiency of the review process of these papers?

(7) How do you evaluate the quality of writings generated by ChatGPT compared to human writings? Are there limitations to the use of ChatGPT in academic writing?

(8) How do you believe AI can be applied to help authors develop their academic writing?

(9) How do you believe AI can be employed to increase diversity and inclusion in academic writing?

(10) How do you evaluate intellectual property issues when it comes to writings generated by ChatGPT?

Source: By authors

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