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Scientific articles

El impacto de ChatGPT en la formación y producción académica: que no cunda el pánico

The impact of ChatGPT on academic training and production: don't panic

O impacto do ChatGPT na formação e produção acadêmica: não entre em pânico

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Resumen

El avance de la Inteligencia Artificial (IA) en las últimas tres décadas puede impactar de manera positiva o negativa en el desarrollo de las sociedades. A principios del año 2023, en el ámbito de la educación superior comienza a tener eco esta disciplina con la evolución del ChatGPT. Por tanto, esta investigación tiene dos propósitos concretos: por un lado, poner a prueba esta tecnología mediante la introducción de una serie de cuestionamientos en su línea de captura de texto relacionados con la originalidad de sus productos y el plagio académico para posteriormente ser examinado. Segundo, analizar y discutir sobre su efecto en el proceso de formación y producción académica en el ámbito de la educación superior. Como parte de los resultados obtenidos, se logró constatar que esta tecnología no está exenta de errores, por lo que se recomienda usarla con cautela. Asimismo, se concluye que su impacto negativo puede ser neutralizado si se logra fomentar una formación crítica, reflexiva y de valores en el estudiantado con el fin de promover la consciencia para usar este tipo de tecnologías a su favor sin perjuicio alguno. Por último, el resultado de esta investigación tiene sus implicaciones para que las universidades logren transformar sus modelos educativos y académicos según las demandas actuales de las sociedades del conocimiento.

Palabras clave: ChatGPT, ética, inteligencia artificial, plagio académico, producción científica, universidad.

Abstract

The advance of Artificial Intelligence (AI) in the last three decades can positively or negatively impact the development of societies. At the beginning of 2023, in the field of higher education, this discipline began to resonate with the evolution of ChatGPT. This research has two purposes in particular, on the one hand, to test this technology by exposing a series of questions about a specific topic and examining its results. Second, analyze and discuss its effect on the process of training and academic production in the field of higher education. As part of the results obtained, it was confirmed that this technology cannot be error-free, so it is recommended to use it with caution. Likewise, it is concluded that its negative impact can be neutralized if it is possible to promote critical, reflective, and values training in the student body in order to promote awareness to use this type of technology in their favor without any harm. Finally, the result of this research has implications for universities to transform their educational and academic models in accordance with the current demands of knowledge societies.

Keywords: ChatGPT, ethics, artificial intelligence, academic plagiarism, scientific production, university.

Resumo

O avanço da Inteligência Artificial (IA) nas últimas três décadas pode impactar positiva ou negativamente o desenvolvimento das sociedades. No início de 2023, esta disciplina começa a repercutir no campo do ensino superior com a evolução do ChatGPT. Portanto, esta pesquisa tem dois propósitos específicos: por um lado, testar esta tecnologia introduzindo uma série de questões em sua linha de captura de texto relacionadas à originalidade de seus produtos e ao plágio acadêmico para serem posteriormente examinadas. Em segundo lugar, analisar e discutir o seu efeito no processo de formação e produção acadêmica no campo do ensino superior. Como parte dos resultados obtidos constatou-se que esta tecnologia não está isenta de erros, pelo que se recomenda utilizá-la com cautela. Da mesma forma, conclui-se que o seu impacto negativo pode ser neutralizado se for possível promover uma formação crítica, reflexiva e de valores no corpo discente de forma a promover a sensibilização para utilizar este tipo de tecnologias a seu favor sem qualquer prejuízo. Por fim, o resultado desta pesquisa tem implicações para que as universidades transformem seus modelos educacionais e acadêmicos de acordo com as demandas atuais das sociedades do conhecimento.

Palavras-chave: ChatGPT, ética, inteligência artificial, plágio acadêmico, produção científica, universidade.

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Introduction

The development and evolution of societies are influenced by a variety of factors, such as the advancement of science, economic policies and the type of political regime established. In particular, in the educational field, the integration of information and communication technologies (ICT) has had a significant impact, which is not only gaining prominence in the discourse of public universities as a strategy to increase enrollment capacity, but is also promoted in the context of quality education. It is argued that the development of ICT skills can enhance both personal and professional growth.

In fact, in the last three decades, exact and technological sciences have led the development of the field of artificial intelligence (AI), which is a discipline within the field of computer systems that encompasses various subdisciplines and focuses on the design and development of solutions using sophisticated algorithms to simulate human thought and action. According to Russell and Norvig (2004), AI is related to the creation of intelligent agents capable of making decisions in various situations, implying the development of algorithms, systems or automata with abilities to understand, construct, process and carry out activities, similar to human beings.

AI, however, cannot be considered a neutral technology as it has a significant impact on people's lives. For this reason, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2022) points out that the rapid increase in the use of ICT and AI poses challenges for countries, underlining the need to develop information literacy in the population.

In this context, ChatGPT has emerged as a notable object of study due to its diverse and promising functions, which include a wide spectrum of applications, hence it has surprised many with its functionality and has led some authors to identify it as a “black swan” in the field of technological innovation (García-Peñalvo, 2023).

This highly sophisticated *chatbot*¹ (Lund and Wang, 2023), of course, is not the only one in the field of artificial intelligence, which is why some people see them as a threat. For example, Chávarry *et al.* (2023) interviewed teachers from different institutions in Ecuador and Peru about whether they believed that artificial intelligence would surpass human intelligence in the next 27

¹“Computer program that uses artificial intelligence (AI) and natural language processing (NLP) to understand customer questions and automate responses, simulating a human conversation” (IBM, n.d., p. 1).

years. The results revealed a divided opinion, with 38.6% in favor of this possibility and 38.4% against.

In the case of higher education and research, much of the debate around these technologies has focused on detecting the opportunities and risks they may have (García-Peñalvo, 2023). An experiment by Lund and Wang (2023), for example, tested AI with the following question: “How can this technology be used to improve research and academic production?” As a result, they found that ChatGPT can contribute in various aspects, such as assistance in literature review, text generation, data analysis, translation between languages, creation of summaries or synthesis, almost instant response to questions and quick understanding of concepts.

Similarly, in the experiment conducted by McGee (2023), ChatGPT was asked to write a short story about what the United States of America would look like in the year 2050. Initially, the AI excused itself by stating that, as an AI model, it could not predict the future with certainty, but it could develop a brief speculative history based on current events and trends.

Having explained the above, the purpose of this work is to reflect on how this technological advance impacts the field of higher education and how it could contribute to academic development. Furthermore, it is intended to outline the implications for academic training and scientific production and, finally, offer recommendations to university decision makers with the aim of promoting the potential it represents for the development of teaching and counteracting its possible negative effects. in the academic field. To guide this research, the following question was asked: What are the effects (positive/negative) of the emergence of ChatGPT in the field of scientific training and production?

Chatbots: products of artificial intelligence

To better understand the technological advancement of ChatGPT and particularly the group of chatbots, it is necessary to briefly describe the purposes pursued by the AI discipline. According to Russell and Norvig (2004), this was recognized as a science or discipline from 1987, although it was Warren McCulloch and Walter Pitts who in 1943 carried out the first work categorized as artificial intelligence, a field of research that has been applied since then. in various fields, from medical diagnosis to logistics planning, robotics and games (Russell and Norvig, 2004).

Today, AI mainly focuses on intelligent agents and their ability to take rational actions. While an intelligent agent has the ability to perceive its environment through sensors and act in it using actuators, a rational agent is “one that acts with the intention of achieving the best result or, when there is uncertainty, the best expected result” (Russell and Norvig, 2004, p. 5).

In the field of medicine, the potential that AI offers can be observed, especially for monitoring the effectiveness of treatments and rehabilitation situations (Hamet and Tremblay, 2017). However, as Buchanan (2005) points out, “the history of AI is a history of fantasies, possibilities, demonstrations and promises” (p. 5). Furthermore, although achieving AI to its full potential may be achieved in the future, the current success of this advancement requires greater responsibility to consider its social implications (Buchanan, 2005).

Chatbots are a product of the progress achieved by AI and had their rise in different areas of application in the first decade of the 21st century. As Brandtzaeg and Følstad (2017) note, “Current interest in chatbots is likely related to substantial advances in computer technology and the wide adoption of mobile messaging applications” (p. 379). These automated agents serve as user interfaces used by product and service providers to offer efficient assistance or information to users (Brandtzaeg and Følstad, 2017). In this sense, by 2017, Facebook had already incorporated more than 30,000 chatbots into its Facebook Messenger system (Brandtzaeg and Følstad, 2017). Added to this, the exponential growth of the mobile device market has also been a factor that has contributed to the proliferation of the use of these chatbots (Smutny and Schreiberova, 2020).

Chatbots are computer programs that interact with users using natural language (Abu Shawar and Atwell, 2007; Dale, 2016). The main idea driving the development of this resource is based on the principle that the best way to offer a real experience to the user is to allow them to express their interests, desires or queries directly and in natural language (Zadrozny *et al.*, 2000). In the words of Jain *et al.* (2018), chatbots are “text-based, turn-based, task-performing programs regularly integrated into existing platforms” (p. 904).

The ELIZA project marked a milestone in the development of this type of technology around 1960. It was a project developed at MIT (Massachusetts Institute of Technology) through a programming language based on list structures (Weizenbaum, 1966). This *chatbot* had the purpose of simulating a psychological help session between a patient and a psychoanalyst (García Brustenga *et al.*, 2018).

Today, chatbots have a wide range of applications. For example, according to Brandtzaeg and Følstad (2017), they can serve as virtual assistants, help users perform specific tasks, facilitate the exploration of online content or services, act as first contact tools for customer service, provide support social and emotional, offer academic entertainment or serve as intermediaries to connect the user with other people or machines.

Thanks to these possibilities, more and more homes are equipped with smart personal devices that interact naturally with human beings. Some of the most common are Siri, Google Assistant, and Alexa, although evaluating their capabilities is not so easy.

The research by Jain *et al.* (2018), for example, revealed that users who were asked to evaluate and experience a conversation with eight developed chatbots were disappointed because these message-based conversational agents—i.e., chatbots—did not have the ability to maintain the context of the conversation. Therefore, the challenge for developers of this technology is that their products “understand and maintain the context of the conversation” (Jain *et al.*, 2018, p. 895).

In fact, and according to Quiroga Pérez *et al.* (2020), the proliferation in the use of chatbots, especially in the educational field, is not free of failures and problems, hence the biggest challenge is overcoming the complexity of their training. Another challenge for this technology is to develop intelligence capabilities to interpret the emotions that people who interact with it may experience.

Even so, regarding the educational field, the application of chatbots could contribute as academic service assistants or as educational agents (Quiroga Pérez *et al.*, 2020). In the words of García *et al.* (March 1, 2018), “there are bots that can act as virtual assistants to improve productivity or to resolve frequently asked questions, but they are also created so that they can act as tutors that accompany the learning process” (p. 4).

The potential contained in the evolution of this technology in education ranges from its ability to resolve similarities or differences between concepts, help in the learning of a second language, to the incorporation of artificial intelligence that accompanies the student's learning process. It could even function as a customer service available 24 hours a day to assist in teaching and administrative tasks by answering repetitive and easy-to-answer questions (García Brustenga *et al.*, 2018).

In line with this idea, Georgescu (2018) explains that the effects of bots in the educational field could allow the development of functionalities that complement traditional methods, such as developing new student evaluation schemes, providing feedback and monitoring courses. In this regard, similar studies have indicated that they can also be very useful to reinforce repetitive tasks and alleviate the teacher's workload (Quiroga Pérez *et al.*, 2020).

An example of this is the case of Georgia Tech, where a group of students taking online classes led by Ashok Goel developed a chatbot to answer the most common and everyday questions from students to support the teaching process, while the tutor was in charge of answering the most complex doubts (Molnár and Szüts, 2018), which shows that the progress of AI and all its manifestations represent an opportunity for educational systems. For example, in the administrative

area, they could identify students' learning habits and preferences with the purpose of projecting a teaching plan according to their particular needs (Chen *et al.*, 2020). Logically, the application of chatbots in education is not limited only to formal or schooling, but also represents a potential for informal and non-formal education as part of lifelong education.

In the case of ChatGPT, Surameery and Shakor (2023) highlight its potential as part of a set of solutions for debugging and identifying errors in systems programming in a very effective way (Thorp, 2023). This tool was launched on the market by OpenAI, a company dedicated to the research and implementation of AI committed to the development and benefit of humanity (OpenAI, n.d.). In November 2022, they launched their first version of ChatGPT, which, in less than seven days, had more than one million users (ChatGPT, 2023). Then, in March 2023, the plus version called ChatGPT-4 was released, which contains superior features than the other models GPT-3 and GPT3.5 (ChatGPT, 2023).

According to Patel and Lam (2023), “ChatGPT [...] is trained with human-written Internet data, including conversations. [It has] broad capabilities that range from the composition of poems, the writing of essays, the resolution of coding problems and the explanation of complex concepts” (p. 1), hence its acceptance by a large part of the student body (Strzelecki, 2023). However, it should be noted that the challenge related to the reliability of its results still persists (Lo, 2023) and its inability to achieve high-level critical thinking (Hill-Yardin *et al.*, 2023). Still, researchers are excited, and at the same time concerned, about how resources like ChatGPT could transform science and society (Chatterjee and Dethlefs, 2023).

Indeed, the ethical implications around generative artificial intelligence, such as ChatGPT, for editorial development (Liebrenz *et al.*, 2023) are still under open debate. Even so, we believe that this scheme can become a new business model and be a starting point for the development of new micro-businesses related to manuscript editing.

In this new scenario, ChatGPT today represents a substantial advance technology in the field of competition in artificial intelligence to simulate human behavior as closely as possible. However, this is just another advance, so it would not be surprising if in the coming decades new technologies appear with characteristics superior to those we know today.

Making an analogy, let us remember the evolution of music when the popular NAPSTER² *software appeared* in 1999, which, despite its demands and conflicting opinions about its legality,

²Its original version was a project created in 1999 by Sean Parker and Shawn Fanning (Wikipedia, sf). This *software* consisted of being a service for exchanging and distributing music files mainly in mp3 format. This way of exchanging music sparked controversies and legal lawsuits filed mainly by the world's record companies. According to Arango (2016), the digitization of information and technological advances at that time caused record labels to “think they were losing control of record sales” (p. 34).

marked the beginning of a new era in the digitalization of music, large investments in telecommunications and the growth of the internet cloud.

This situation could be repeated in the case of ChatGPT, editorial policies and academic and scientific production, since said chatbot has the potential to formulate academic essays and articles based on thousands of sources contained in the Internet cloud. You can even include the number of reference references that the user requests (Liebrenz *et al.*, 2023). Therefore, according to Liebrenz (2023), the disruption of this technology would force publishers to review their policies and implement guidelines for authors on the use of AI in academic and scientific publications, since aspects such as copyright, plagiarism, and authorship are crucial when AI produces texts. Therefore, work must be done on digital methods and techniques that allow content written by generative AI such as ChatGPT to be detected (Hammad, 2023).

Finally, the novelty that this technology represents should not distract us from continuing to investigate the impacts that it will have, including on the environment, ecosystems, and people's lives (UNESCO, 2022). Therefore, Torrance and Tomlinson (2023) explain that “the question of how humans and AI can work together for the mutual benefit of all is complex and requires a comprehensive and holistic approach” (p. 20), since the objective The main goal is to align AI systems with human values. In this regard, Jarrahi (2018) points out:

Although AI capabilities help humans overcome complexity through the superior analytical approach of machines, the role of human decision makers and their intuition in dealing with uncertainty, and especially the ambiguity of decision-making decisions, remains unquestionable (p. 10).

The idea of recognizing the relationship between humans and AI as a symbiosis (Jarrahi, 2018) is increasingly gaining acceptance. Therefore, it is important to incorporate governance in this matter, in addition to promoting organizational and substantial changes in educational institutions, especially in educational, academic and curricular models. It is very promising that this technology attracts more benefits than harm in the teaching, research and administrative management process of educational institutions. However, to achieve this, it is necessary to insist on the development of standards, regulations, and the promotion of principles that guarantee greater security for people and protect their right to privacy and confidentiality of their personal data.

Method

This research was developed through a combination of methodologies that took place in two stages. Firstly, a series of questions related to the originality of the texts and plagiarism were introduced in the ChatGPT text capture line. These questions, integrated into the core of questions directed at artificial intelligence, included the following:

- Q1. How can I verify the originality of a text written by artificial intelligence like ChatGPT?
- Q2. How can I verify the originality of a text that was not written by artificial intelligence like ChatGPT?
- Q3. Could texts produced by artificial intelligence like ChatGPT be considered plagiarism?
- Q4. In relation to the above, could you provide me with a series of recommendations for requesting a manuscript from ChatGPT without incurring plagiarism?

It should be noted that the version used for this research was GPT-3.5, which is freely accessible.

Secondly, a bibliographic review was carried out to identify the various existing positions on the emergence and use of this artificial intelligence in the academic field. The aim was to analyze whether there were coincidences with the answers provided by ChatGPT. Based on this purpose, the following question was formulated: What are the effects (positive/negative) of the emergence of ChatGPT on higher education?

The methodology used for this second stage was documentary (bibliographic) in nature. A search was conducted in various databases to identify coincidences, consensus and discrepancies regarding the impact of ChatGPT on the academic performance of university students, particularly in writing school summaries or essays (in the case of postgraduate studies). Since the phenomenon of ChatGPT is relatively recent, the sample selected was *ad hoc*, for convenience, during the period between November 2022 and June 2023.

Results

The first objective of this research was to introduce a series of questions related to the originality of the texts generated by ChatGPT. Each question was entered individually in the capture line of this chatbot.

Regarding the first question (How can I verify the originality of a text written by artificial intelligence like ChatGPT?), ChatGPT offered the following answer:

To verify the originality of a text generated by artificial intelligence like ChatGPT, you can use several tools and methods:

1. Plagiarism Checker Tools: There are several online tools that can compare text generated by ChatGPT with other sources to determine if there are similarities or plagiarism. Examples of these tools include Turnitin, Plagiarism Checker, Grammarly, and Quetext, among others.
2. Comparison with training sources: ChatGPT is trained on large text datasets, so it is possible to verify the originality of a text generated by ChatGPT by comparing it with the training sources used to train the model. You can review the training sources used by the model and look for similarities or matches in the generated text.
3. Manual analysis: Although it is a more laborious method, it is possible to perform a manual analysis of the generated text to determine its originality. This may include comparing the text with other relevant sources and reviewing the quality and accuracy of the generated content.

It is important to keep in mind that the originality of a text does not always mean that there are no similarities or coincidences with other sources. It is common for similar ideas or phrases to be shared in academic or technical texts, so it is important to properly cite all sources used in the work. Also, remember that if you use text generated by ChatGPT in your work, you must always properly cite the source to avoid plagiarism problems (answer provided by ChatGPT on February 21, 2023).

Subsequently, a question similar to the first was asked (How can I verify the originality of a text that is NOT written by artificial intelligence like ChatGPT?), but with a slight variation, as a denial was added. The answer was the following:

Additionally, it is important to mention that these tools [PlagScan, DupliChecker or Grammarly and Turnitin] can only detect similarities between your text and other texts published online. If you want to verify the originality of a text that is not found online, you can use manual verification techniques, such as comparing writing style, sentence structure, and word choice with other texts written by the same person. You can also use tools like Google Scholar to search for academic articles related to the topic and compare the information with the text you want to verify (answer provided by ChatGPT on February 21, 2023).

According to the previous answer, the process of verifying the originality of texts is not limited only to comparing similarities between parts of a text with others. That is, actions must be expanded to increase confidence in the process of verifying the originality of manuscripts.

Then, in the third question (Could writings obtained by artificial intelligence like ChatGPT be considered plagiarism?), the following answer was obtained:

Using an AI-trained language model, such as ChatGPT, to generate text is common and accepted practice in many fields, including research and report writing. However, it is important to note that the use of any source of information, including generative language models, must be properly cited to avoid plagiarism.

Therefore, if you use text generated by ChatGPT in a work or project, you must properly cite the source. This may include providing information about the source of the data used to train the language model, such as the dataset used, as well as information about the specific language model that was used to generate the text.

It is important to remember that plagiarism refers to the unauthorized or inappropriate use of another person's work, and this includes the use of generative language models. Therefore, if you use text generated by ChatGPT without properly citing the source, you would be at risk of committing plagiarism.

In summary, the use of generative language models like ChatGPT is not considered plagiarism in itself, but it is important to properly cite the source to avoid any possible plagiarism problems (answer provided by ChatGPT on February 21, 2023).

From the previous paragraphs it can be inferred that currently the figure of the thesis editor or director is very important, as well as the plagiarism detection tools available to determine if the submitted manuscript is original to the person who signs it. To this end, the fillers that some people usually use when writing also represent an auxiliary mechanism to verify the originality of the texts.

Finally, regarding the fourth request made to ChatGPT (Describe a series of recommendations to me when I ask ChatGPT for a manuscript, without falling into plagiarism), the response obtained was the following:

If you plan to use a manuscript generated by ChatGPT in your work or project, it is important to take into account some recommendations to ensure that you do not fall into plagiarism:

1. Make sure you have a solid understanding of the topic you want to cover before asking ChatGPT to generate the manuscript. This will allow you to identify key ideas and ensure that the generated manuscript is relevant and accurate.
2. Always cite sources appropriately. If you use any information or ideas from another source in your manuscript, be sure to cite it correctly. This includes the information used to train the ChatGPT language model.
3. Edit and review the manuscript generated by ChatGPT before using it in your work. Although ChatGPT can produce a high-quality manuscript, it is important to review and edit it to ensure the content is relevant and accurate.
4. Use the manuscript as a supporting tool rather than a substitute for your own work. Use the manuscript generated by ChatGPT as a supporting tool for your ideas and arguments, and not as a substitute for your own work. Make sure that the majority of the content in your work is original and based on your own research and knowledge.
5. Always check your institution's or professor's policies on using generative language models like ChatGPT in academic work. Your institution may have specific policies about the use of generative language models and how they should be properly cited.

By following these recommendations, you can use the manuscript generated by ChatGPT as a useful tool for your work without falling into plagiarism (answer provided by ChatGPT on February 21, 2023).

The previous response confirms the need for students to develop the competencies and skills required not only in the field of knowledge of a discipline or topic that interests them, but also other skills such as their critical and reflective capacity.

Discussion

By the mouth dies the fish³

The result of this research showed that the evolution of ChatGPT does not represent an infallible tool that should generate uncertainty in its application in the field of training and academic production. As it turns out, this AI recognizes its weaknesses and admits that its products cannot be considered error-free.

On the other hand, despite its unattractive interface, its use is very intuitive, so it does not require people to undergo any special training to use it. This experience is supported by the results of Brandtzaeg and Folstad (2017), who revealed that 42% of respondents use chatbots due to the simplicity, ease, and convenience they offer obtaining help or information. Similarly, 41% talked about the ease of using chatbots to obtain help and information.

The results of this research highlight that despite the evolution of AI in terms of training and academic production, it cannot be entirely delegated to algorithms. Human beings, therefore, continue to be necessary entities due to their capacities for critical and reflective thinking, common sense, abilities to maintain a line of argument, and their potential to maintain a conversation in context. Similar research supports this idea, such as the experiment carried out by Pardos and Bhandari (2023), in which ChatGPT and a group of people were tested in the development of a mathematical calculation. In this study, it was found that the product obtained by humans was of better quality than that generated by artificial intelligence.

However, the argument made here should not be considered a definitive defeat for AI. On the contrary, it represents another challenge for this discipline in its purpose of getting closer to human reasoning. Furthermore, this should not set off alarms, as there is still a long way to go in the development of artificial intelligence, despite the advances observed so far.

In this sense, it must be recognized that not only the educational process and academic research have benefited from the advances of AI, but also other fields such as neurosciences, psychology, medicine, sociology, and administration, etc.

An important finding of this research, confirmed with the introduction of statement Q4, is that ChatGPT had the potential to maintain the context of the conversation in accordance with the first three questions previously introduced (Q1, Q2, and Q3). This discovery is significant because it highlights the evolution that ChatGPT represents compared to other previously developed

³ This phrase is common in the context of Mexico, alluding to the acknowledgment by ChatGPT itself that its produced manuscripts should be considered with caution. A similar or equivalent expression could be: silence is golden.

message-based conversational agent prototypes, which are often regularly applied in *marketing* or on commercial or service sites. This result confirms the argument of Jain *et al.* (2018), who revealed that the group of people invited to interact with eight chatbots ended up disappointed.

Building a symbiosis⁴ between the skills developed by people and the development of artificial intelligence in the academic context

According to Noam Chomsky (2023), the real challenge of education is not to prohibit the use of technology as part of school learning, but to make the subject or topic that is intended to be taught attractive to students. Furthermore, he states that if students resort to these technologies, it is a sign that the educational process is failing. Regarding ChatGPT, Chomsky claims that this tool is high-tech plagiarism, since it adds no value to language understanding or cognition.

As mentioned above, the evolution of ChatGPT has generated encounters and disagreements in the field of training and academic production. Despite the potential it represents, its application requires moderate and prudent use. Additionally, ChatGPT “has access to an immense database of written text. Imitates what he reads, from children's books to judicial opinions. Through this imitation, he can communicate widely published ideas and knowledge. But he cannot think critically” (Bishop, 2023, p. 16).

Therefore, the need arises to return to the question posed by Bishop (2023): “How can we know the difference between the chat manuscript and the human one?” (p. 16). According to the response obtained by ChatGPT, the use of *software* is recommended anti-plagiarism to determine the level of similarity with other sources. However, this answer does not clearly address the question posed by Bishop (2023), who suggests that a reading of the content and not just the style be carried out for the purpose of identifying critical thinking in the manuscript in question.

In fact, the questionable result obtained by ChatGPT in response to question Q1 posed in this research finds deficiency similarities with other experiments carried out. For example, King (2023) asked this technology to compile a list of references on chatbots, AI, and plagiarism, and as a result produced a text with historical biases.

Another significant experiment was developed by Cahan and Treutlein (2023), who subjected the chatbot to a series of questions related to the role of biology computational systems applied to stem cell research. As a result, they had to discard some conversational threads due to their repetitiveness. Additionally, they found that many responses lacked context and depth. These

⁴The idea raised by Jarrahi is taken up (2018).

data reinforce the idea that the use of ChatGPT must be accompanied by a solid and explicit theoretical foundation.

For all this, higher education institutions, both public and private, must review their methodologies regarding the use of AI, so that education that contributes to the sustainable development of countries is promoted. To achieve this objective, an exhaustive review of the educational and academic models, as well as the university curriculum, is required in order to be prepared to reorient the most convenient methodologies.

Regarding the skills that students must develop to counteract bad practices in the use of AI, it is essential to strengthen training in principles, values and ethics to act for the benefit without harming others. Finally, the topic of digital skills must be incorporated into the curriculum to guarantee adequate access, use and appropriation of ICT.

Ethical implications of the use of AI in training and academic production

The second part of this research focused on exploring the positive and negative effects caused by the emergence of ChatGPT in the field of scientific training and production. In this regard, there is no doubt that the arrival of ChatGPT has had implications in the process of academic training and production, hence Okaibdi (2023) points out that when someone generates a manuscript using AI without attributing the use of this technology, they would be violating the principle of academic honesty. Furthermore, texts written by this technology may lack understanding of context (Baidoo-Anu and Owusu Ansah, 2023).

Holden Thorp (Thorp, 2023), chief editor of *Science Journals*, put this technology to the test by asking him to develop an essay. Although the technology was able to generate factual answers, some deficiencies were found in the writing. In another experiment, Thorp sent a set of summaries to several reviewers who collaborated with the publisher and only 63% of them could detect that the texts had been prepared with AI. As a result, *Science* publishing house established a policy whereby each author must certify the original authorship of their work and that any content created with AI is not considered part of the work under review.

Another research by Khalil and Er (2023) tested the potential of ChatGPT. The authors generated 50 essays using this AI and then presented them to the technology with the following question “Was this text generated by a chatbot?” In this regard, ChatGPT responded, with surprising precision, that 46 of those essays were plagiarized.

On the other hand, Zhai (2022) considers ChatGPT to be a technology that could drive changes in learning objectives, practices, and assessment schemes. Concurring with this idea,

Rudolph *et al.* (2023) suggest that this evolution could mean converting traditional higher education assessments into personalized or interactive game-based tests, with virtual assistants that would help students solve problems using natural language (Cotton *et al.*, 2023).

From the perspective of García-Peñalvo (2023), the evolution of this technology would transform the role of teachers, as it would go from being the main provider of information to becoming a mentor who guides students in the effective use of this resource for the learning.

However, Lo (2023) states that “immediate steps must be taken to update assessment methods and institutional policies in schools and universities. [In addition], instructor training and student education are also essential to respond to the impact of ChatGPT on the educational environment” (p. 1). For this reason, the review and update of academic integrity policies and honor codes have been proposed to include the use of AI, which should be extended to publishing houses (Gordijn and Have , 2023). Regarding this last case, the publisher Lancet Digital (2023) warns the following: “ChatGPT came to change the rules of the game, but we are not ready to play yet” (p. 1).

Even so, authors like van Dis *et al.* (2023) suggest that the development of AI in research and publication could be seen as an opportunity, since it would serve to accelerate the innovation process, reduce publication time and facilitate writing. Regarding this idea, Jarrahi (2018) argues that AI systems should be designed with the intention of enhancing, and not replacing, human contributions. In the medical field, for example, Patel and Lam (2023) suggest that ChatGPT could assist in the patient discharge process by allowing doctors to enter specific information that needs to be included.

In summary, Okaibedi (2023) explains that the evolution of ChatGPT as an AI tool invites academic institutions, research institutions and academic publishers to rethink its use, and not to prohibit, reject or discard it, since this technology offers opportunities to all fields of knowledge.

Clues that can help teachers identify manuscripts generated with AI

Cotton *et al.* (2023) propose a series of points that could help in the process of identifying manuscripts written by AI, such as searching for patterns or irregularities in the language, verifying citations and sources, checking the originality of the idea. or topic developed, the detection of factual errors, the review of grammar and spelling, and the use of tools developed by third parties that can analyze whether a writing is a product of AI.

In addition, teachers could look for inaccuracies in aspects such as the way in which textual citations were made and access to the references used according to the conditions of each country

or region. They could also verify that the sources are mainly primary and look for the presence of authors recognized as experts in the disciplinary field. Finally, keep in mind that human writing tends to be more context-aware and must adapt to the needs of the audience, while AI-generated writing tends to be more generic. Therefore, the writing should reflect a *flow*⁵, that is, a natural flow that reveals the personality and style of the people in relation to the topic covered.

Conclusions

It is undeniable that the processes of academic training and production cannot be limited to discussing the legality and acceptance of manuscripts generated by artificial intelligence. This situation, therefore, requires that we recognize the inevitable association between intelligent machines and people, hence it is time to generate changes in educational methodologies and approaches.

AI is a technology in constant evolution, so it is up to each institution, field of knowledge and person to take advantage of the potential it offers to facilitate and speed up the preparation of manuscripts and reports. However, it is crucial to understand that each product generated by this technology must be thoroughly reviewed, modified and adapted. Furthermore, its use demands responsibility and commitment on the part of the user, who must grant the necessary credits according to the sources of information used, which also serves as support to raise an essential question: will the products obtained with these technologies be considered as creations of the AI or the person who formulated the input data?

In short, although we cannot yet fully measure the potential that AI has to support the performance of organizations and, in particular, the development of academic training, it is important to be aware that a new era in the study and production of Science is here to stay.

Future lines of research

Future research could take up the questions raised in these studies to replicate them in other languages and even using more updated versions of ChatGPT. The objective would be to analyze whether there are significant differences in the results obtained compared to those of this study. Additionally, further research could focus on analyzing the attitudes that may emerge among a group of researchers using AI-assisted academic writing.

⁵Term used by Murray-Tortarolo (2019) to refer to the almost original forms that a person adopts in their writing.

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