

REVIEW

## Training in the Field of Artificial Intelligence: Challenges and Opportunities in Health Science Education

### Formación docente en el área de la Inteligencia Artificial: Desafíos y oportunidades en la enseñanza en la ciencia de la salud

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#### ABSTRACT

**Introduction:** artificial intelligence in higher education teacher training has become an imperative that challenges teachers to update themselves to be able to use this tool to generate knowledge for their students.

**Method:** a systematic review was conducted in databases such as PUBMED, Cochrane Central Library, CINAHL, and SCIENCE DIRECT, using keywords like “health sciences,” “artificial intelligence,” and “teaching” during the period 2018-2024, following the PRISMA checklist.

**Results:** studies predominantly originated from Europe, Asia, the Middle East, and the USA, especially involving nursing and medical students. The most notable opportunities of AI include the relationship between ethics and technology, the training of academic tutors, and its contribution to professional education, clinical case management, literature searches, and student learning. However, challenges were identified, such as uncertainty about employability, limited funding for training, and the acquisition of licenses. Additionally, there is a need to promote responsible use of AI to avoid diminishing empathy and humanization in patient care.

**Conclusions:** AI is a valuable ally in health sciences education, but ethical considerations and teacher training must be taken into account for responsible use, as well as fostering critical and reflective thinking in its implementation.

**Keywords:** Teachers; Artificial Intelligence; Health Students.

#### RESUMEN

**Introducción:** la inteligencia artificial en la formación del docente de educación superior, se ha vuelto un imperativo que desafía al maestro a actualizarse para poder usar dicha herramienta al favor de la generación del conocimiento de sus estudiantes.

**Método:** se realizó una revisión sistemática en bases de datos como PUBMED, Cochrane Biblioteca Central, CINAHL y SCIENCE DIRECT, utilizando palabras clave como “ciencias de la salud”, “inteligencia artificial” y “enseñanza” durante el periodo 2018-2024, siguiendo la lista de verificación PRISMA.

**Resultados:** predominaron estudios de Europa, Asia, Medio Oriente y EE. UU., especialmente en estudiantes de enfermería y medicina. Las oportunidades más destacadas de la IA incluyen la relación entre ética y tecnología, la capacitación de tutores académicos y su contribución a la formación profesional, la gestión de casos clínicos, la búsqueda de literatura científica y el aprendizaje del estudiante. Sin embargo, se identificaron desafíos como la incertidumbre sobre la empleabilidad, el escaso financiamiento para capacitación y la adquisición de licencias. Además, se subrayó la necesidad de promover un uso responsable de la IA para evitar la disminución de la empatía y humanización en la atención al paciente.

**Conclusiones:** la IA es un aliado valioso en la educación de las ciencias de la salud, pero deben considerarse aspectos éticos y de capacitación docente para su uso responsable, así como fomentar el pensamiento crítico y reflexivo en su implementación.

**Palabras clave:** Docentes; Inteligencia Artificial; Estudiantes del Área de la Salud.

## INTRODUCTION

Marvin Minsky, a pioneer in artificial intelligence, defined it as “the science of making machines do things that would require intelligence, in such a way as if humans did them”.<sup>(1)</sup> These operations included decision-making, problem-solving, acting like a human, and thinking and acting based on data. Examples can be found in personal assistants such as Alexa®, Siri®, Google Home®, and learning applications such as Duolingo®, which are programs that allow interaction with people in a very human-like way. According to <sup>(2)</sup>, it is a tool that facilitates many processes, but at the same time creates fear and uncertainty in other situations, such as work.

To further complement this idea, AI enables machines to simulate intelligence by giving computers human-like capabilities. Obviously, as artificial intelligence, it lacks characteristics such as reasoning, feelings, or the ability to empathize with other human beings.<sup>(3)</sup> One of the most significant advantages of AI is that it is a tool that allows external data to be interpreted, generating knowledge-based decisions using computer science and mathematical calculations, which enable the objectives or orders generated by humans to be achieved.<sup>(4)</sup>

Although AI began more than five decades ago, it is a technology that has grown very quickly and is being included in all sciences, especially in health. One of the world’s leading countries in AI is Canada, which has three AI centers in its major cities, Montreal, Toronto, and Edmonton, with deep learning laboratories and funding from companies such as Google and Thomas Reuters totaling more than \$80 million for its implementation.<sup>(5)</sup>

Moving into the educational field, AI offers significant advantages in supporting university students’ learning and training. However, there is a perception among teachers and other professionals that AI could replace human educators in the next decade.<sup>(6,7)</sup> According to <sup>(8)</sup>, AI enables in-depth learning, the storage of large amounts of information, remote teaching, feedback, and innovative assessment methods, among other benefits. Given these benefits, there is a feeling that they could pose a threat to workers who could lose their jobs.

AI has been gaining significant popularity, forging divided opinions in the academic sphere regarding its use. There are positive opinions that consider it a valuable tool for the growth of science, providing speed and consistency in its responses, as well as its ability to adapt to the subject and its contexts.<sup>(9)</sup> However, it has also generated negative opinions regarding the perception that it makes things too easy for students, that using AI is “cheating,” and that it sometimes provides inaccurate or inappropriate responses to those who use it.

In addition, it is essential for university teachers to provide up-to-date, relevant education and to be trained on current technological trends in the field of health. These qualities give teachers the necessary skills to professionally train their students, making them more competent and knowledgeable about the current reality. Training refers to learning that is provided to improve job performance, while relevant and up-to-date education offers learning for life, good performance, and professional integrity. Given this <sup>(10)</sup> emphasize that Artificial Intelligence (AI) is a critical issue of great interest to educational leaders and professionals in the health field who are at the forefront of global health needs.

An interesting point to highlight is the existence of Intelligent Tutoring Systems (ITS), a platform that uses AI and natural language processing to enhance student learning. According to Rodríguez, ITS is characterized by personalizing the content that students need and adapting to each student’s learning pace, offering feedback, evaluation, and readjustment to the difficulty of the content. All of this is done using mathematical models that describe how students generate knowledge.

Above all, in this context of technological advances in artificial intelligence, the most pressing issue is teacher training and updating in these processes. Rapid technological evolution and AI tools are creating a gap between what teachers teach and what is happening in the real world, as well as in the skills required in the workplace. Another limitation is that teachers may refuse to apply AI technology in their daily teaching; some educators may feel overwhelmed by the complexity of AI or do not see it as necessary in their professional fields. Added to this problem is the lack of resources or institutional support for ongoing teacher training, since AI is not only beneficial for searching for information, but teachers must also be trained in the pedagogical and ethical aspects required by the use of this technology.

These types of tools can innovatively enhance the roles of teachers or tutors in clinical practice, who face increasing workloads, where medical care is becoming increasingly severe, scarce, complex, and demanding.

<sup>(11)</sup> AI could therefore support students in this type of adverse scenario. Given the context presented here, this systematic review aims to analyze the current state of teacher training in artificial intelligence, as well as the challenges and opportunities it presents for both teachers and students in the health sciences.

## METHOD

This was a systematic review of teacher training in the field of artificial intelligence, including the challenges and opportunities involved in its implementation. To this end, two research questions were initially formulated:

1. What is the teacher training of health science teachers about artificial intelligence?
2. What are the challenges and opportunities of artificial intelligence in the training of health science professionals?

With these two guiding questions, which are the two variables of the study, the inclusion criteria for the search were established using the following keywords:

1. “Artificial Intelligence” “Health Professions Educators” “learning” “formation.” However, these words did not yield any results in any of the databases, so the search was only carried out with “Artificial Intelligence” and “Health Professions Educators.”
1. In PUBMED, COHCRANE, and CINAHL, the terms “health sciences,” “artificial intelligence,” and “teaching” were used.
2. In SCIENCE DIRECT, the search terms “health sciences,” “artificial intelligence,” “learning,” “medical students,” and “nursing students” were used to refine the results, as many articles appeared that were not related to the criteria.
3. In BVS LILACS, the search terms “health sciences” and “teachers” were used “artificial intelligence”.

The period selected was from 2018 to September 2024, and the articles were limited to English and Spanish and available in full text for free.

Another inclusion criterion was that the articles should address topics related to the training of health science teachers in artificial intelligence, as well as the challenges and opportunities that this offers for student teaching and learning. Original articles from empirical studies were included regardless of methodology, as well as opinion articles by experts. Scope reviews or meta-analyses, trials, and conference papers were excluded.

Titles and abstracts were examined for an initial assessment of their relevance to the inclusion criteria. Those that met the criteria were selected for full-text reading, and data were then extracted using a findings matrix consisting of the following parameters: author, year, country, methodology used, challenges, and opportunities of AI. The results were reported using the PRISMA checklist.

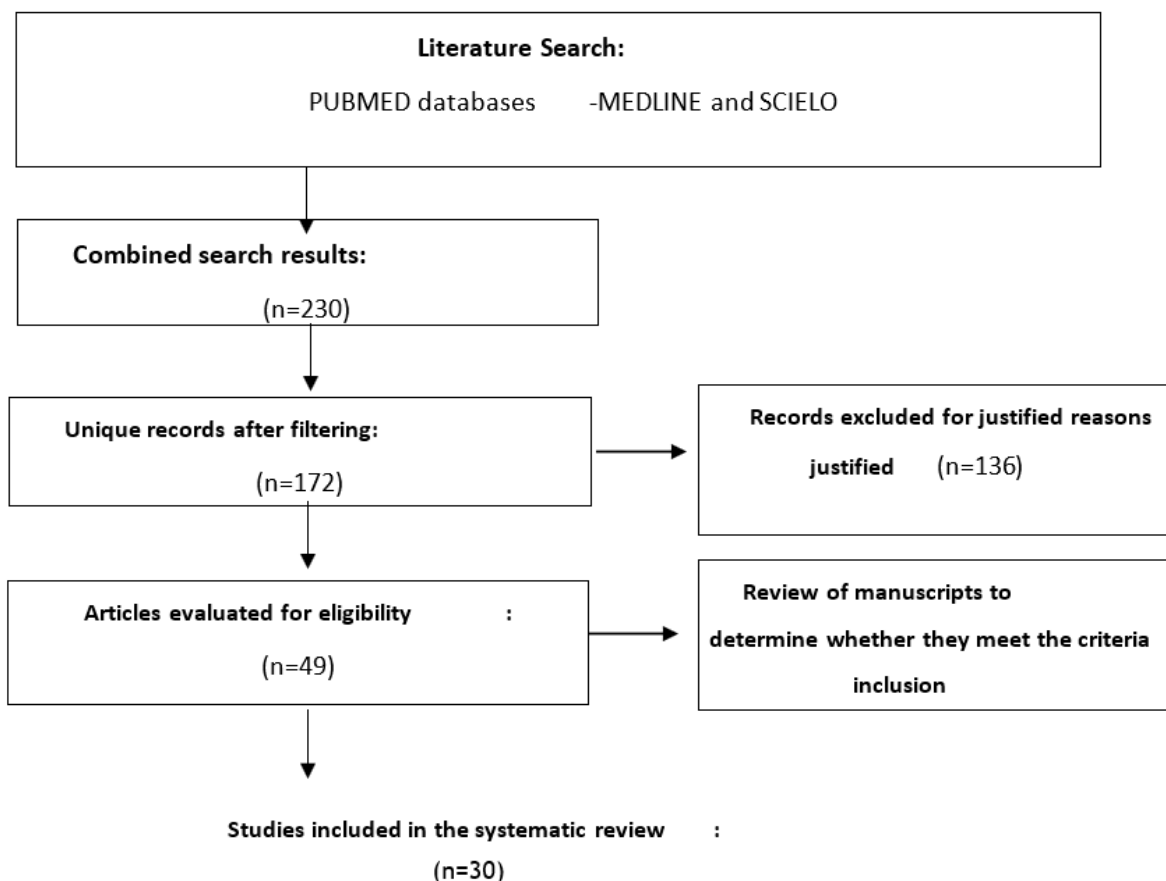


Figure 1. Study selection diagram

## RESULTS

The results of the search in the selected databases and the process carried out for this purpose are presented below:

| Table 1. Search results     |                                                                                                       |               |                                |                   |
|-----------------------------|-------------------------------------------------------------------------------------------------------|---------------|--------------------------------|-------------------|
| Database                    | Keywords                                                                                              | Total results | Articles included for analysis | Eligible articles |
| Cinhal<br>Ebsco             | “health sciences”<br>“artificial intelligence”<br>“teaching”                                          | 18            | 6                              | 1                 |
| Cochrane central<br>library | “health sciences”<br>“artificial intelligence”<br>“teaching”                                          | 3             | 1                              | 1                 |
| Science<br>Direct           | “health sciences”<br>“artificial intelligence”<br>“learning” “medical students”<br>“nursing students” | 29            | 9                              | 3                 |
| Pubmed                      | “health sciences”<br>“artificial<br>intelligence” “teaching”<br>“educator”<br>“students”              | 179           | 32                             | 24                |
| BVS                         | “teachers”<br>“artificial intelligence”<br>“health sciences”                                          | 1             | 1                              | 1                 |
| Total                       |                                                                                                       | 230           | 49                             | 30                |

The quality of these studies has not been questioned, as the scientific journals from which they were obtained are ranked highly in Web of Science and Scopus. The study population was mainly medical and nursing students, and the methodologies used were quantitative.

| Table 2. Countries where the studies were conducted |    |              |    |                |    |
|-----------------------------------------------------|----|--------------|----|----------------|----|
| Country                                             | FR | Country      | FR | Country        | FR |
| Kuwait                                              | 1  | Croatia      | 1  | Canada         | 1  |
| Germany                                             | 2  | Saudi Arabia | 2  | Australia      | 1  |
| Qatar                                               | 1  | Turkey       | 3  | Cyprus         | 1  |
| Nepal                                               | 1  | USA          | 4  | United Kingdom | 2  |
| South Africa                                        | 1  | Argentina    | 1  | China          | 1  |
| Korea                                               | 2  | Oman         | 1  | Italy          | 1  |
| Karachi                                             | 1  | Palestine    | 1  |                |    |

According to the findings of this study, research into artificial intelligence in health sciences education has been conducted mainly in European, Asian, and Middle Eastern countries, as well as in the US.

| Table 3. Research design of the studies included in the review |    |
|----------------------------------------------------------------|----|
| Type of study                                                  | Fr |
| Cross-sectional quantitative studies                           | 19 |
| Qualitative: interviews                                        | 3  |
| Quasi-experimental                                             | 1  |
| Mixed methods                                                  | 1  |
| Randomized controlled trials                                   | 1  |
| Reflection article                                             | 1  |
| Action research - participation                                | 1  |
| Historical overview                                            | 1  |
| Narrative of experience-expert opinion                         | 2  |
| Total                                                          | 30 |

Quantitative cross-sectional studies predominated in terms of frequency, with 19 studies, followed by qualitative studies using interviews. To a lesser extent, there were articles of reflection, experience reports, historical reviews, participatory action research, and mixed methods.

**Table 4.** Population of the studies

| Population               | Fr |
|--------------------------|----|
| Medical students         | 12 |
| Nursing students         | 5  |
| Academic experts         | 3  |
| Health sciences students | 4  |
| Dentistry students       | 1  |
| Not applicable           | 5  |
| Total                    | 3  |

The research was carried out mainly on medical students, followed by nursing students and others, as it was carried out on health science students from different degree programs.

**Table 5.** Summary of AI challenges and opportunities

| Challenges                                           | Opportunities                               |
|------------------------------------------------------|---------------------------------------------|
| Drastic changes in a short period of time            | Positive perception of the importance of AI |
| Need for AI instruction and training                 | Comfort level with AI                       |
| Lack of knowledge about AI                           | Accelerates processes                       |
| Inadequate courses and training available            | High willingness to use                     |
| Risks associated with unverifiable content           | Training on AI-based skills                 |
| Lack of funding                                      | Generates ideas                             |
| Job replacement                                      | Help with academic writing                  |
| Education and healthcare systems not prepared for AI | Searching for scientific literature         |
| Lack of reliability                                  | Text translation                            |
| Ethical implications                                 | Case simulation for clinical learning       |
| Promotion of responsible use                         | Methodologies teaching and learning         |
| Negative sociological impact                         | Reduces administrative burden               |

**Table 6.** Total matrix of results

| Author(s)                       | Year | Country                       | Method                                              | AI challenges                                                                                                              | Opportunities of AI                                                                 |
|---------------------------------|------|-------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Buabbas et al. <sup>(4)</sup>   | 2021 | Kuwait                        | Cross-sectional study with medical students         | AI will drastically change the medical profession; 60,1 % understand basic AI principles; 93,4 % feel comfortable with it. | 99,1 % perceive AI as important; 83,5 % consider it important for their profession. |
| Weidener et al. <sup>(12)</sup> | 2024 | Germany, Austria, Switzerland | Cross-sectional survey of medical students          | Need for instruction in AI and ethics; current offerings inadequate.                                                       | 71,7 % anticipate positive impact; 38,8 % had previous experience.                  |
| Weidener et al. <sup>(12)</sup> | 2023 | Germany and Austria           | Qualitative study with expert interviews            | Risks of interpreting results; need for ethical and statistical knowledge.                                                 | Importance of AI fundamentals, ethics, and privacy in medical education.            |
| Ahmad et al. <sup>(13)</sup>    | 2023 | Qatar                         | Cross-sectional study using an online survey        | Lack of expert mentoring, courses, and funding.                                                                            | Positive attitude, AI speeds up processes and improves diagnoses.                   |
| Jha et al. <sup>(14)</sup>      | 2022 | Nepal                         | Cross-sectional study with boarding school students | Reduction in medical jobs; unprepared healthcare system.                                                                   | High willingness to learn AI, recommendation for AI training.                       |

|                              |      |              |                                            |                                                                           |                                                                                         |
|------------------------------|------|--------------|--------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Lewis et al. <sup>(15)</sup> | 2024 | South Africa | Qualitative research with group interviews | Ethical concerns and reliability of AI.                                   | AI useful for learning, ideas, writing, translation, and medical simulation.            |
| Shin et al. <sup>(16)</sup>  | 2024 | South Korea  | Quasi-experimental with nursing students   | AI should be complemented with critical thinking and source verification. | AI promotes multiple perspectives in problem solving.                                   |
| Lukic et al. <sup>(17)</sup> | 2023 | Croatia      | Survey of nursing students                 | Practical advantages seen as unfavorable.                                 | Slightly positive attitudes; favorable in terms of benefits, willingness, and AI risks. |
| Doğaner <sup>(18)</sup>      | 2021 | Saudi Arabia | Cross-sectional study with 550 students    | AI will have negative sociological effects and generate unemployment.     | Increased treatment success and positive contribution to the medical field.             |

## DISCUSSION

Artificial intelligence in the training of students enrolled in health science programs is already a reality and is incorporated into the curriculum as a valuable tool in some areas. The findings of this study highlight specific positive and negative trends in education about AI. Firstly, ethical training for teachers and the promotion of ethics among their students should be mandatory. Students believe that the sources or results of AI applications are not entirely reliable,<sup>(16)</sup> verifiable, or accurate,<sup>(15)</sup> and therefore not very trustworthy in their application.

In light of this, Vera believes that the quality of artificial intelligence tools should be evaluated in advance, researching and selecting applications that are backed by evidence, as well as ensuring that the content is supported by scientific evidence and meets certain quality and safety standards.

Despite this initial situation, the perception of AI among health science students was positive<sup>(13,17)</sup> perceive it as very important for their training and their profession<sup>(4)</sup> and are willing to apply it.<sup>(14,19)</sup> This represents an opportunity for its implementation in higher education. Derakhshanian et al.<sup>(20)</sup> agree with this, mentioning that medical students have shown a relatively favorable attitude toward AI, but that, counterproductively, it also causes them anxiety due to the uncertainty of whether they will be replaced in their jobs by AI.<sup>(18)</sup>

Indeed, another challenging finding of this review was precisely the perception that artificial intelligence will replace workers and pose a threat to the employability of healthcare professionals.<sup>(13,14)</sup> However, AI will inevitably not replace the personalized attention and empathy that are provided in patient care.<sup>(21)</sup> Lomis et al.<sup>(22)</sup> even assert that teachers in health careers should not think that AI is a threat to these human characteristics, but rather that this situation should be used to teach with greater emphasis on empathy and the defense of patient rights. In short, AI will never replace human intelligence.<sup>(23)</sup>

Continuing with this theme, another opportunity found in the review was that artificial intelligence is a complementary tool for the training of health professionals, enabling improvements in scientific literature search processes, academic writing, and even text translation.<sup>(15)</sup> Similarly, Akutay et al.<sup>(24)</sup> mention that AI contributes to the acquisition of learning skills through the management of clinical cases. In the case of medical students, according to De Mattei et al.<sup>(23)</sup>, it allows them to analyze medical records and make differential diagnoses with the help of virtual reality and virtual patients. This gives them self-confidence, as mistakes do not cause harm to anyone, and improves their critical and reflective thinking. In academia, it has even been shown to contribute significantly to the evaluation of academic essays, serving as a technical complement to provide better input.

One challenge to implementing these benefits is undoubtedly the training of teachers in AI. Ahmad et al.<sup>(13)</sup> and Weidener et al.<sup>(12)</sup> believe that AI has multiple applications that can be useful in the health sciences. However, there is a need for mentoring by experts in the field and specific training courses funded by higher education institutions. Weidener et al.<sup>(12)</sup> agree that training in these areas is a challenge, as it requires processes of interpretation and reflection on the results provided by AI, knowledge of statistics, medical ethics, and protocols governing medical training.

One thing that was widespread in the results was the perception that artificial intelligence reduces the time spent on processes that used to be longer,<sup>(6,13,25)</sup> decreasing both administrative and operational workloads.<sup>(22)</sup> Artificial intelligence (AI) has the potential to revolutionize the way services are provided. It can contribute to improving outcomes, increasing productivity and efficiency in care, and enabling health systems to deliver higher quality care to more people by facilitating faster care, mainly by reducing the time needed for diagnoses, and helping health s manage their resources more proactively, directing them to areas where their impact is most significant.<sup>(26,27)</sup>



Although AI agents are considered autonomous, fast, and efficient, they are still regarded as unconscious machines that only fulfill special purposes and should be considered as support for humans in specific and complex tasks. Given the explosion of information accessibility today, whether on social media, websites, tutorial videos, or elsewhere, the world is finding more and more data available at the click of a button.<sup>(28)</sup> This accessible information or knowledge also extends to the health sciences, even jeopardizing the trust placed in professionals, as they are now being tested on their knowledge according to what patients have already seen or read on the web.

Shin et al.<sup>(16)</sup> found in their research that nursing students who did not use AI to solve or develop the nursing care process in a clinical case demonstrated better performance in both ethics and clinical reasoning than students who did use AI, and that, although they delivered the solved case more quickly than the others, they did not compare in terms of the quality of the results delivered. On the other hand, in the medical field, Alkhaaldi et al.<sup>(29)</sup> found that the vast majority of respondents denied having used ChatGPT, 20,4 % used it to complete written assessments, and only 9,4 % used the technology in their clinical work.

Previous experience with AI was significantly associated with a positive perception of AI in terms of improving patient care, reducing medical errors and misdiagnoses,<sup>(30)</sup> and increasing diagnostic accuracy.

In short, AI is changing and will continue to transform medical education.<sup>(4)</sup> It is even being incorporated into simulation and virtual reality programs, where scenarios are configured so that students can perform actions in a metaverse, make clinical decisions, and observe the consequences of those decisions without causing real harm to anyone.<sup>(31,32)</sup> Despite all these benefits and the need for health careers to implement them, they must first advocate for new curricula that respond to these challenges, acquire funding for equipment, and, of course, train tutors for this purpose.

According to Wartman et al.<sup>(33)</sup>, these curricula should emphasize four aspects:

- That current education should focus on knowledge acquisition rather than knowledge retention.
- That AI should be a collaborator through the management of existing applications.
- Improve understanding of probabilities and how to apply them in clinical decision-making.
- At the same time, empathy and compassion for patients should be cultivated.

Teachers should take advantage of the opportunities offered by this technology, but also learn from the challenges encountered, develop reflective and critical thinking about the results produced by artificial intelligence, making it an ally rather than an enemy. It is recommended that students should not completely trust this tool, which, although fast, provides knowledge based on data that exists on the web, which is not 100 % reliable. Reflect on the fact that human intelligence will not be replaceable and that AI is a complement.  
(34,35,36)

The advantages of AI are not limited to the field of education. However, they can also be used in other contexts such as disease diagnosis and prevention, as well as health promotion. There are virtual assistants or health promoters managed by artificial intelligence that can be found anywhere in the world, no matter how remote, thus optimizing economic, material, and other resources.<sup>(22)</sup>

Among the limitations of this study is the bias that may exist due to the use of scientific databases with global impact, which may not always include research results from developing countries. This suggests that the results obtained here may not be representative of what happens in prestigious universities and cannot be compared with those in poorer countries.<sup>(37,38,30,40)</sup>

However, the global trend toward the use of artificial intelligence is something that will continue to grow and become more prevalent worldwide in all areas, including health sciences, academia, and process management.  
(41,42,43,44,45) Future lines of research could include investigations related to the state of the art in the use or perception of artificial intelligence in health science academic programs, experimental studies with students to evaluate its use in various academic areas, and the integration of ethics in artificial intelligence in the professional training of health science students.<sup>(46,47,48,49)</sup>

## CONCLUSIONS

The integration of artificial intelligence (AI) in the training of health science students is a reality that is generating transformations and paradigm shifts, but it also poses significant challenges. This study highlights the need for integrated ethical training for teachers and students, given that many consider AI applications to be unreliable or convey to students the perception that the faster a result is generated, the better and more efficient it is. Despite this, the overall perception among students is positive, recognizing AI as a valuable tool that can improve their learning and professional preparation. However, there is also anxiety about the possible replacement of jobs by AI, which underscores the importance of maintaining personalized attention and empathy in patient care.

AI not only optimizes administrative processes but also facilitates practical learning through virtual reality simulations, management, and analysis of clinical cases. However, its practical implementation depends on

adequate training for teachers, the development of curricula that effectively integrate AI, and having the necessary funding and training. As AI continues to evolve, its role in medical education becomes crucial, promoting training that combines technical knowledge with empathy, humanization, efficiency, but also the reflective and critical thinking that are necessary in clinical practice. In conclusion, AI has the potential to revolutionize health sciences education. However, its success will depend on careful and ethical integration into curriculum projects, strategic planning by higher education institutions, and the budget allocated for this purpose.

It is recommended that academic and teaching staff, as well as institutional and government authorities, integrate the professional competencies of artificial intelligence into university funding structures, teacher training, and the acquisition of licenses for existing applications of this technology, which will continue to grow rapidly.

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The authors declare that there is no conflict of interest.

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