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Scientific articles

Influencia de la inteligencia artificial en la educación media y superior

Influence of artificial intelligence in secondary and higher education

Influência da inteligência artificial no ensino secundário e superior

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Resumen

El objetivo general del ensayo es analizar las concepciones teóricas de la inteligencia artificial (IA) con la finalidad de determinar sus beneficios y desafíos para docentes y estudiantes de la educación media y superior. Para ello, se ha efectuado una investigación documental de informes y artículos con un enfoque interpretativo. Específicamente, se procuró determinar cómo se puede integrar la IA en la educación para optimizar el desempeño de maestros y estudiantes. Los resultados y conclusiones obtenidos buscan incidir en aspectos como la actualización pedagógica, la equidad en el acceso a la tecnología y las consideraciones éticas, entre otros, que deben ser tenidos en cuenta en la implementación de la IA en el ámbito educativo.

Palabras clave: educación, formación del profesorado, inteligencia artificial, estudiante.

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Abstract

The general objective of the essay is to analyze the theoretical conceptions of artificial intelligence (AI) in order to determine its benefits and challenges for teachers and students of secondary and higher education. To this end, a documentary investigation of reports and articles has been carried out with an interpretive approach. Specifically, it was sought to determine how AI can be integrated into education to optimize teacher and student performance. The results and conclusions obtained seek to influence aspects such as pedagogical updating, equity in access to technology and ethical considerations, among others, that must be taken into account in the implementation of AI in the educational field.

Key words: Education, teacher training, artificial intelligence, student

Resumo

O objetivo geral do ensaio é analisar as concepções teóricas de inteligência artificial (IA) a fim de determinar seus benefícios e desafios para professores e alunos do ensino médio e superior. Para tanto, foi realizada uma investigação documental de reportagens e artigos com abordagem interpretativa. Especificamente, procuramos determinar como a IA pode ser integrada na educação para otimizar o desempenho de professores e alunos. Os resultados e conclusões obtidos procuram influenciar aspectos como a atualização pedagógica, a equidade no acesso à tecnologia e as considerações éticas, entre outros, que devem ser levados em conta na implementação da IA no campo educacional.

Palavras-chave: educação, formação de professores, inteligência artificial, aluno.

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Introduction

The general objective of this essay is to analyze the theoretical conceptions that have emerged around artificial intelligence (AI) in order to determine its benefits and challenges in higher education, specifically with regard to its implementation by teachers and students.

Traditionally, the concept *of intelligence* has been associated with abilities, qualities or characteristics exclusive to human beings, such as reasoning, problem solving, decision making, understanding of natural language and computer vision. However, today, technological advances have exceeded human expectations, such is the case of AI, a field of computing that focuses on the creation of systems and programs capable of performing tasks, thinking and learning.

In the specific case of education, Alonso de Castro and García-Peñalvo (2022) point out that AI has become a potential tool that is experiencing significant expansion and has caused an unusual revolution (Flores- Vívar and García-Peñalvo, 2023 *et al* ., 2019). According to UNESCO (2021), AI systems are information processing technologies that incorporate models and algorithms capable of learning and carrying out cognitive tasks, allowing them to make predictions that influence decision-making.

For Cabanelas (2019), AI refers to the capacity and ability of a computer, network of computers or network of robots controlled by computers to perform tasks that are commonly associated with human intelligence, while for Ricardo *et al* . (2021) AI is considered a computer science discipline whose objective is to develop machines and systems capable of fulfilling tasks that require human intelligence.

Kaplan and Haenlein (2019) define AI as "the ability of a system to correctly interpret external data, to learn from that data, and to use that knowledge to achieve specific tasks and goals through flexible adaptation" (p.15) . In fact, for Rouhiainen (2018) AI has two main objectives: one technological, which consists of carrying out useful actions, and another scientific, which involves using AI concepts and models to address both human issues and those related to other living beings. As examples of the technological use of AI to carry out useful actions, we can mention everyday applications such as voice assistants, geolocation systems, online shopping and virtual assistants, among others; while examples of scientific use include its application in the diagnosis and treatment of diseases, as well as in agriculture, where data is processed to improve crop yields, calculate soil moisture and manage irrigation, among other functions.

Based on all of the above , it can be stated that AI allows machines to perform tasks and make decisions based on patterns through the use of mathematical models and algorithms. Furthermore, it focuses on the imitation of various functionalities of human intelligence, such as perception, learning, reasoning, problem solving, language interaction and even creative production (Unesco, 2023).

Ultimately, the exponential growth of AI is due to two fundamental reasons: technological advancement and the wide availability of data on networks. As a result, AI is on track to spread further and generate new innovations that will continue to transform various aspects of the economy, politics, and society as a whole.

Implications of AI in the educational field

As with any technological advance in its initial stages, resistance, fears and mistrust arise. However, over time, as it becomes more widely used, the advantages that the technology offers, as well as its limitations and challenges, become evident in practical experience. In the case of AI, this is a relatively recent technology, as we are just beginning to recognize its access to the general population through everyday tools and applications.

In fact, in the educational field, students seem to be using AI to solve school tasks without teachers being aware of the applications or being up to date in the use of the technology, which serves as support to formulate the following questions: What is the role of the teacher in the use of technology and AI? How can we ensure that students use AI in meaningful ways and not just to solve schoolwork? How do we guarantee effective learning? What competencies should be developed in students in relation to AI? What ethical considerations should be taken into account?

In addition to reflecting on the motivations behind students' use of AI, it is also important to consider the administrative tasks that teachers face and how the integration of technology can support planning, personalization and visualization to facilitate these tasks, as well as in the learning process itself. Simply put, while AI can play several roles in education to support teacher functions, such as employing new resources and pedagogical models, approaching AI ethically also involves challenges that must be addressed, as illustrated in table 1.

Table 1. Roles of artificial intelligence

Role	Description	Challenges
Access	AI can make classrooms available to everyone, including different languages, disabilities, visual, hearing, etc.	Teacher training in the use of new educational resources.
Intelligent tutoring systems	Tutoring can depend on the difficulties that students have, so there is individualized attention.	Of an ethical nature that entails addressing the design of AI, verifying the type of responses to avoid falling into biases or prejudices.
Virtual facilitators	They are used to create realistic, virtual interactions and characters such as robots, 3D games, and computer animations.	Design new pedagogical models and integrate innovative strategies that integrate immersive reality.
Smart content	Content can be created from digitized guides, personalized interfaces and digital resumes.	Ethical and legal challenge of intellectual property rights.
Collaboration between teachers	Teachers can work collegially to obtain better educational results.	Development of digital literacy plans.
Content analysis	Information about student progress can be obtained through intelligent analysis.	Ethics of processing student data and information. Personalized monitoring of students.
Tutoring support outside the classroom	How to support students effectively with homework, study and exam preparation.	Paradigm of machine-human interaction
Automate administration tasks	Systems can grade multiple choice questions.	Resource Optimization

Source: Adaptation by Flores- Vívar and García-Peñalvo (2023)

Generally speaking, AI is beginning to have a significant impact on various areas of the teaching-learning process, such as planning, personalization, assessment and monitoring, although its most notable and direct impact is seen in students who face academic difficulties. Faced with this technology, the role of the teacher continues to be that of companion and guide in the training process.

The 2019 Beijing AI Conference, organized by UNESCO, addressed the following aspects that governments should consider in relation to the potential and risks of using AI in the teaching and learning process:

- Anticipate skills and their development to live in the age of AI.
- Sharing AI trends and how they help shape education.

- Strengthen international cooperation and alliances to promote the equitable, inclusive and transparent use of AI in education.

Within the Beijing Consensus, a crucial aspect in the educational field was highlighted: the affirmation that human interaction must remain at the core of education, since machines cannot replace teachers. From this premise, various implications arise from the integration of AI, which poses several challenges in the 21st century, ranging from the promotion of comprehensive training to the promotion of digital literacy as a fundamental component in education. But what role can AI play in education? In this regard, Padilla (2019) proposes three approaches on what it can do:

1. *Intelligent conversational software agents (chatbot)*

They are conversations that act as a tutor to answer students' queries through statements or questions. These systems assist in class activities, searching for information on recent topics, and are also used to generate conversations and evaluations. Thanks to *machine learning* (automatic, automated machine or computational learning), these interactions facilitate learning in a personalized way.

2. *Creating online platforms for self-learning*

Among the platforms that are beginning to proliferate, some of the best known are Chat GPT, Siri, Alexa and Google Assistant, platforms designed to collect and analyze data due to the volume of queries they receive. With these, AI generates predictive behavior patterns, which could be considered a useful tool to diagnose the needs of students and analyze the tasks for which they were used.

3. *Educational robotics*

There are countries that have had successful experiences in the use of educational robotics, such as Argentina, Finland, France, the United States and England. These nations agree that the development of simple machines with basic thinking, adapted to the needs of students, offers various advantages , such as the promotion of collaborative work, the integration of study plans and programs in the technological area, learning based on problems and projects, the result of a multidisciplinary and interdisciplinary process. In addition, educational robotics contributes to the development of soft skills and abilities, such as creativity, leadership, innovation and the promotion of positive attitudes and values.

In addition to what was stated in the three previous approaches, Williams *et al* . (2019) suggest that robotics helps young children learn about AI through building, programming, training, and interacting with social networks and robots, as well as through toys and

computationally curated educational and entertainment content. However, it should be noted that in some cases robotics is limited at basic levels of education to the assembly of commercial devices.

In the educational field, AI is used in various ways, whether in the development of computer-assisted teaching systems to build intelligent systems or in the use of existing applications, which offers advantages such as the following:

- Personalization of learning. With AI, you can analyze student progress, identify areas of opportunity and strengths, and adapt content to fit the learning pace of each individual. This is achieved by collecting and analyzing data on students' academic performance, learning style, preferences, and interests (Gómez, 2023).
- Open educational resources. AI is considered an open resource due to its accessibility and the information can be modified according to the objectives and specific context of each situation. Additionally, these resources can be downloaded to different devices, even when applications change or versions are updated.
- Automation of manual administrative tasks. This includes managing emails with filters and autoresponders, organizing schedules and tasks, sending reminders, and automatically paying for goods and services through banking, known as *payment redirection* .
- Virtual tutorials. These are facilitated by *chatbots* and virtual assistants available at any time of the day. These tools offer support for self-directed, autonomous and self-managed learning . Indeed, AI-based virtual tutoring involves the use of intelligent systems that interact with students in a similar way as a human tutor would. However, this modality has a disadvantage: human interaction is essential for the development of students' social, emotional and communication skills. Therefore, it is crucial to find a balance between virtual tutoring and in-person tutoring (Gómez, 2023).

As can be seen, from a computer it is possible to create interactive learning models known as intelligent tutoring systems (ITS) through the use of AI, adapted to different disciplines and academic levels. Examples of STIs are presented in Table 2.

Table 2. Intelligent tutoring models

Denomination	Discipline	Academic level
ActiveMath	Math	Secondary
Beetle II System	Programming	Secondary
EER-Tutor	Computing	Superior
MATHia	Math	Secondary and upper secondary
SHERLOCK	Electrical sciences and engineering	Technicians or specialties in air force
The AutoTuto	Computing	Secondary
Why2-Atlas	Physical	Superior
COMET	Medicine	Superior
VIPER	Medicine	Superior

Chassignol adaptation *et al* . (2021)

On the other hand, it can be stated that AI, used responsibly to interpret large sets of data (*big data*), allows us to anticipate trends and search patterns and interests. This translates into the ability to assist in decision-making related to educational policies, the restructuring or updating of study plans and programs, academic performance, school dropout prevention, among other aspects.

Now, although access to AI is closer to us than we could imagine, its implementation is a complex task that requires a series of competencies, skills, values and attitudes related not only to technology, but also to reasoning. criticism, research, continuous learning and ethics.

Therefore , it can be stated that AI has enormous potential to contribute to social well-being and to promote the achievement of the sustainable development goals (SDGs), although this potential will only be realized if it is used in a way that benefits humanity. in harmony with peace and development (Flogie and Abersek , 2021).

Skills for using AI

A competency can be understood as the ability to solve problems or perform tasks in a specific context, using knowledge, skills and attitudes comprehensively to carry out a function successfully. In other words, to use AI responsibly, it is necessary to master technical and basic competencies, as well as soft skills. Additionally, depending on the level of involvement and the type of work to be performed, specific prior and disciplinary knowledge is needed. For example, if AI is used to program, it is necessary to have mathematical and statistical bases to develop algorithms; and if used in application development, knowledge of language processing, neural networks, and databases is needed to store and access data sets.

Regarding soft skills in the use of AI, the following can be mentioned: 1) collaborative work to achieve interdisciplinarity; 2) communicate in different ways and languages; 3) critical thinking necessary to verify whether the information provided by the AI is valid, reliable and the intent for which it is provided; 4) problem solving, based on the identification of user needs, concerns and tendencies, to evaluate and address the challenges that arise in development and implementation, and 5) values and attitudes, closely related to ethics to avoid plagiarism and biases in information, etc.

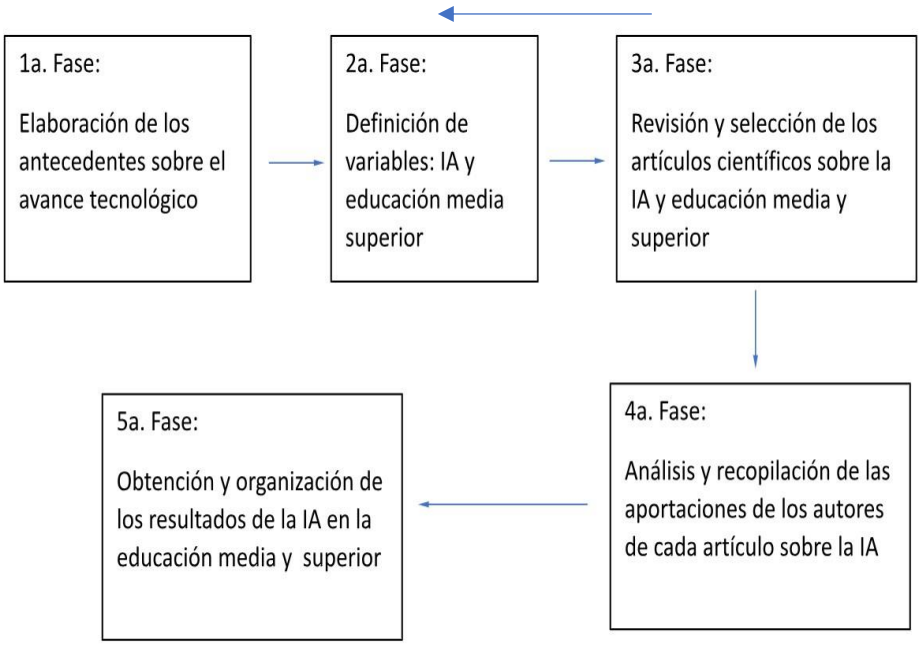
Based on the above, UNESCO (2023) is currently working on a competency framework for both teachers and students in the use of AI. In the case of teachers, this framework will define the knowledge, skills and attitudes necessary to understand the functions of AI and use it practically in the classroom; while for students knowledge, skills and attitudes will be established mainly for the safe and meaningful use of AI both in the educational field and in other contexts. Both frameworks will be guided by human rights principles, thereby protecting human dignity, privacy and strengthening human intelligence.

Now, the challenge in secondary and higher education institutions in the implementation of AI-based systems does not lie so much in acquiring or using them, but in how to develop and adapt them to the diverse realities of multivariable environments, although Ocaña -Fernández *et al.* (2019) emphasize the digital-technological gap that exists between countries and between public and private universities. Likewise, it is important to keep in mind that it is not necessary to be an expert in all areas and applications of AI, since these arise from the need for its use and skills and competencies develop as challenges are faced in different contexts.

Materials and method

The main objective of this work was to analyze the theoretical conceptions around AI in order to determine its benefits and challenges for teachers and students of secondary and higher education. To achieve this objective, a methodology was used that is detailed in the methodological description in Figure 1.

Figure 1. Methodological description



Source: self made

Specifically, the research was based on a documentary process, with an interpretive approach, focused on exploring the integration of AI in education, as well as the implications for the roles of teachers and students, along with the opportunities and challenges in secondary and higher education.

The two main variables that constituted the axes of the documentary review were AI and secondary and higher education. From this, the assumption of the study was that there is an influence of AI in secondary and higher education.

The methodology consisted of a review of primary sources on the development of AI and its influence in the educational field, with special emphasis on its implementation and the factors that affect educational actors (teachers and students). Specifically, relevant articles

in English and Spanish on AI were consulted, as well as resources classified on the topic of secondary and higher education.

Study objectives

The particular objectives that guide this work were the following:

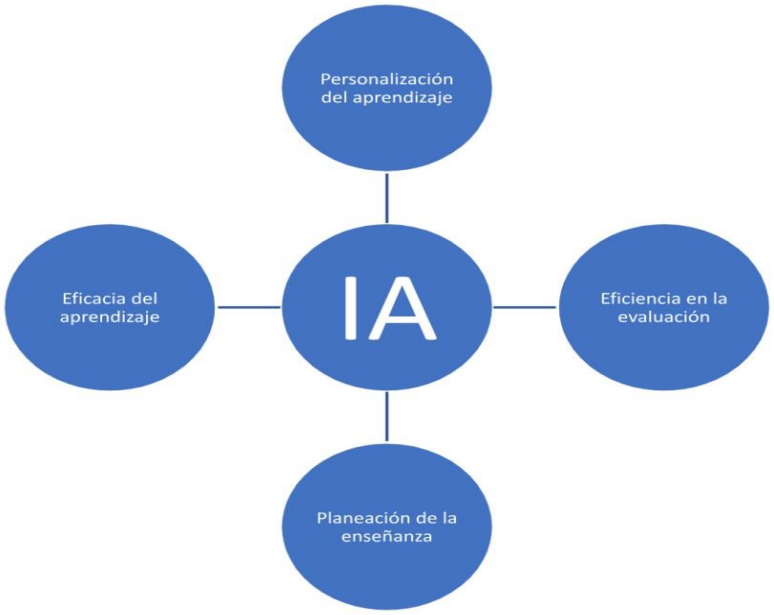
1. Interpret what AI is.
2. The impact of AI in higher education.
3. Describe how AI can be integrated into the classroom.

Results

Benefits of AI in secondary and higher education

The main benefits of AI in education are varied, in the case of the student it can be personalized and make learning more efficient, in the case of the teacher it is useful for planning and evaluation. These benefits are shown in Figure 2.

Figure 2. AI and its benefits



Source: Own elaboration based on Cañete (2023)

From figure 2, the main benefits of AI are described:

- Personalization of learning: Adaptation of learning according to the needs and rhythms of each student, which positively influences both their motivation and their training experience. In this way, through the use of algorithms, AI allows the dynamic adaptation of teaching resources, feedback and evaluation. In addition, it helps teachers to more effectively detect the individual difficulties of each student to carry out specific intervention.
- Greater efficiency in evaluation and feedback: AI makes it possible to automate both formal tests and other activities in order to identify errors and provide review more efficiently, as well as focus on areas of higher priority for each student.
- Improving learning effectiveness: By providing individualized support of teaching materials, AI encourages the achievement of learning objectives, which influences an improvement in the academic achievement of each student. Likewise, these support resources are diversified (videos, animations, games or interactive activities) that adapt to the style of each student.
- Improvement in teaching planning and resource management: AI identifies patterns and trends that provide information about the most appropriate type of resources to use in teaching to achieve objectives.

Now, despite the multiple benefits that AI has, it also presents a series of concerns and challenges to harnessing its potential and ensuring its ethical use as a tool in education. From the point of view of the reviewed authors, the challenges are the following:

1. As with technological tools in education, there is a serious problem with inequality and equitable access to devices and connections to internet networks. This results in a gap that limits students' access to materials, exercises, and learning opportunities.
2. Cybersecurity. Students may be exposed to online privacy security risks, for which it is necessary to establish ethical standards for the use of AI as a protection measure
3. Biases. Algorithms can be programmed with tendencies and intentions of ideological, cultural, social and political preferences, for which a critical review of the information is essential.
4. Ethics. It should be considered as a main point to take care of that ranges from copyright to the monitoring and validation of student performances versus the delivery and review of products (research works, project development, proposals, tasks, etc.). These performances have a close relationship with the authenticity of the

learning evaluation that cannot always be evaluated either with products or algorithms.

5. Personal contact. Although there are so-called *chatbots* and virtual assistants, human warmth and interpersonal contact for the exchange of ideas and feelings are essential.

In addition, it is crucial to assess the impact of AI in the pedagogical field, which will involve measuring the effectiveness of the use of AI in learning through monitoring and evaluation through research. In terms of teaching, it is essential to provide training to teachers so that they can use AI effectively in the classroom, which will ensure that its applications and tools are used to the maximum, without teachers feeling that they lose control over the contents, evidence of learning and the future of teaching. In summary, it must be ensured that the use of technology is ethical and has a positive pedagogical impact for the benefit of the student.

Discussion

Students often use technological tools such as AI unethically due to academic pressure to obtain good grades, fear of not meeting expectations, fear of failure, lack of time due to work hours, extracurricular activities, and excessive of tasks. Faced with these daily realities, it is crucial that teachers reflect on what is the core of the student's training and what is their true role as guides and mentors in the comprehensive development of the student, which requires reinforcing and developing technical competencies, informational skills and soft, as well as promoting authentic learning.

Furthermore, teachers must be aware that technology, especially AI, has become a fundamental element of everyday life, as long as it is used appropriately. Therefore, it is essential to understand that creating this path towards a better society requires a solid education (Carbonell -García *et al.* , 2023).

On the other hand, it must be considered that future professionals will face the growing challenge of unemployment due to work automation and the replacement of roles by intelligent machines, which will lead to a significant decrease in jobs. This situation will generate an increasing need for people to undergo professional re-education (Porcelli , 2020).

However, in areas such as robotics, Estrada Carrera *et al.* (2022) point out that, despite the autonomy sought in robotic technology, robots still depend on humans to carry out their functions. That is, they require specific programming for each activity in some cases and supervision in many others, which makes them vulnerable to initial misconfiguration or a

change in their programming. In fact, in educational settings, it must be kept in mind that AI cannot replace intangible human experiences such as intuition and empathy. Simply put, AI cannot replace the fundamental human training activity that every individual needs to become an informed citizen, capable of participating in building a sustainable world.

Conclusions

AI is having a profound and positive impact on education, as it provides valuable tools to improve and personalize the learning process, automate administrative tasks, monitor through virtual tutoring, and improve educational decision making. However, it also presents significant challenges, such as the need to ensure data privacy and adequate training of educators to use these technologies effectively.

For this reason, education faces the challenge of regulating the implementation of AI so that it can be used successfully in the academic training of students. This implies the updating, training and teacher training necessary to achieve a successful integration of these technologies. In this sense, this essay provides relevant information about the influence of AI in education, both at the secondary and higher levels, aimed at key educational actors (teachers and students). Therefore, the general objective of the test is achieved and the established assumption is met.

The future of education will undoubtedly be increasingly integrated and influenced by AI, so it is imperative that we continue to investigate how to make the most of technological advances and innovations to deliver quality education that is accessible and inclusive to all. . Collaboration between educators, technology developers and policy makers will be crucial to ensure that AI in education benefits everyday, academic and professional life, so that it becomes a potentially effective, adaptive and preparatory resource for the future that is already here.

In short, it can be said that AI has the potential to transform education in multiple aspects, from personalizing learning to improving efficiency and accessibility. However, its successful implementation will require careful planning, investment in technological development and continued consideration of the ethical and social implications.

Future lines of research

Based on the information presented and the teaching experience, the proposals to carry out future studies can focus on the following: 1) the use of AI in education: tutorials, personalized content, new areas of knowledge or study topics; 2) AI as an educational digital resource in the classroom; 3) inequalities or gaps for those who do not have access to technology, opportunities and challenges; and 4) strategies to promote the ethical use of AI.

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