The Implementation Of Artificial Intelligence In Education: Systematic Analysis

Al Bagiro[1], Anirudh Gupta[2], Gundala Samhita Priyadarsini[3], Salman Asghar[4], Mohammed Alaa H. Altemimi[5], Gul Muhammad Shaikh[6], Darrel M. Ocampo[7], Evelyn Ansah Karkkulainen[8]

[1]Ph.D, CISM, Independent Researcher, USA
Email: atbagiro@gmail.com
ORCID ID: https://orcid.org/0009-0003-2740-2405

[2]Assistant Professor, Department of Biotechnology, NIMS Institute of Allied Medical Science and Technology, NIMS University Rajasthan, India
Email: anirudh.gupta2020@gmail.com

[3]Department of Mechanical Engineering, Vigan's Foundation for Science, Technology & Research Deemed University, Guntur, Andhra Pradhesh, India, Email: spd4india@gmail.com

[4]Assistant Professor, Department of Design, Effat University, Jeddah, KSA, Saudi Arabia
Email: saasghar@effatuniversity.edu.sa

[5]Department of Information and Communication Engineering, Al-Khwarizmi College of Engineering, University of Baghdad, Baghdad, Iraq
Email: mohammed.alaa@kecbu.uobaghdad.edu.iq
ORCID ID: https://orcid.org/0009-0007-8860-3090

[6]Assistant Professor, Dental Education and Research, SIMDC Lodhran, Pakistan
Email: shaikhgul25@gmail.com

[7]Dean, College of Education, Central Bicol State University of Agriculture-Sipocot, Philippines, Email: darrel.ocampo@cbsua.edu.ph

[8]Doctoral Researcher, Department of Special Education, Educational Science Psychology, University of Eastern Finland, Email: evekarkk@uef.fi

ABSTRACT

Background: The rapid evolution of Artificial Intelligence (AI) has significantly influenced Education, demonstrating substantial potential to transform traditional teaching and learning methods. AI reshapes teacher-student interactions and the relationship with knowledge.

Objective: To analyze the potential benefits, ethical challenges, and limitations of AI in Education based on recent scientific literature, emphasizing the balance between technology and human interaction.

Methods: A documentary research approach with a descriptive focus was employed, following the PRISMA protocol for systematic reviews. The search strategy involved analyzing evidence from 18 scientific articles published within the last six years.

Results:

AI offers several advantages in Education, including:

- **Personalization:** Innovative and adaptive solutions enable individualized learning experiences.
- **Feedback:** Instant and accurate feedback facilitates improved student understanding. However, ethical challenges such as data privacy, equitable access to technology, and the role of educators persist.

Conclusions: AI holds promise as a valuable tool for modern Education, enhancing learning personalization and outcomes. However, it cannot replace educators and requires ethical considerations and equitable access. Finding a balance between AI and human interaction is essential for effective integration. Addressing these challenges will maximize AI's potential benefits in 21st-century Education.

KEYWORDS: Artificial intelligence; Education; Apprenticeship; Teaching.

Introduction

Artificial intelligence (AI) has experienced rapid advancement in recent years, transforming various areas of society and offering new opportunities in various fields. One of the fields in which AI has shown great potential is Education. The implementation of AI in teaching has opened a wide range of possibilities to improve and personalize teaching methods, as well as to enhance student learning (1).

Education is a complex process that involves the transmission of knowledge, skills, and values that, traditionally, have been determined by the interaction between teachers and students. However, this interaction can be altered due to different factors such as class size, student diversity, and time constraints. This is where AI can play a critical role in providing innovative and adaptive solutions (2).

AI applied to teaching can address different areas, from evaluating and monitoring student progress to personalizing educational content and improving feedback. AI systems can analyze large volumes of student-generated data, such as responses to questions, interactions on educational platforms, and assessment results, to identify patterns and offer personalized recommendations (3).

The ability of AI to adapt to the pace and learning style of each student allows the creation of individualized educational environments in which materials and activities are adjusted to the specific needs of each student. Additionally, AI systems can provide instant and accurate feedback, allowing students to correct errors and improve their understanding more efficiently (4).

However, the implementation of AI in teaching also raises challenges and ethical considerations. It is essential to guarantee the privacy and security of student data, as well as avoid the creation of AI systems that amplify existing inequalities in access to Education. Every technological advance requires direction that prevents tools, such as AI, from compromising rather than strengthening educational processes (5).

In short, the application of AI in teaching has the potential to transform the way we learn and teach. The adaptability, personalization, and feedback capabilities of AI systems can significantly improve the effectiveness of Education and foster more inclusive and accessible learning for all students. However, it is necessary to address ethical challenges and ensure responsible implementation of AI in the educational field (6).

Methodology

The nature of the topic addressed required the completion of a documentary research study with a descriptive approach, following the guidelines established in the PRISMA protocol for systematic reviews. The application of these methodological elements made it possible to provide and guarantee an adequate structure and development of the report. Thus, the process was outlined to carry out the proposed analysis in the most systematic way possible (7).

Regarding the search strategy and process, this systematic review was based on analyzing and synthesizing the evidence found in the scientific literature. Academic documents published in the last 6 years (2018-2023) were collected to obtain updated and relevant information for the development of the study. Thus, searches were carried out in various databases

such as Scielo, Dialnet, PubMed, and the academic search engine Google Scholar, as well as in repositories. To improve the effectiveness of the search, search engines were used using keywords in Spanish and English, such as "Intelligence Artificial / Artificial intelligence" and "Education (8) /

Education". In addition, Boolean operators such as "and/and" and the concatenation operator "+ / or" were used to broaden the search and find information both nationally and internationally. After refining the search, all publications were considered available in Spanish and English, which resulted in obtaining 18 scientific articles. Regarding the inclusion and exclusion criteria, the following parameters were established for data selection (Table 1) (9):

Table 1

Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
a) Document type: Scientific articles. b) Time: Last six years (2018 – 2023). c) Language: Spanish and English. d) Publications with the text complete.	a) Articles in languages other than Spanish and English. b) Other studies with the topic not related to the study. c) Theses or dissertations (bachelor's, master's, or doctorate)

Population and Sample of Scientific Literature

The total set of scientific articles considered in this research consisted of 156 documents obtained from the data repository and academic search engine. After carrying out an exhaustive analysis of the search in the collected records, the sample that finally made up the main set was made up of 18 publications of a scientific nature, which were selected after applying the corresponding filtering criteria (Graph 1) (10).

Graphic 1.

Flow chart of the bibliographic selection process.
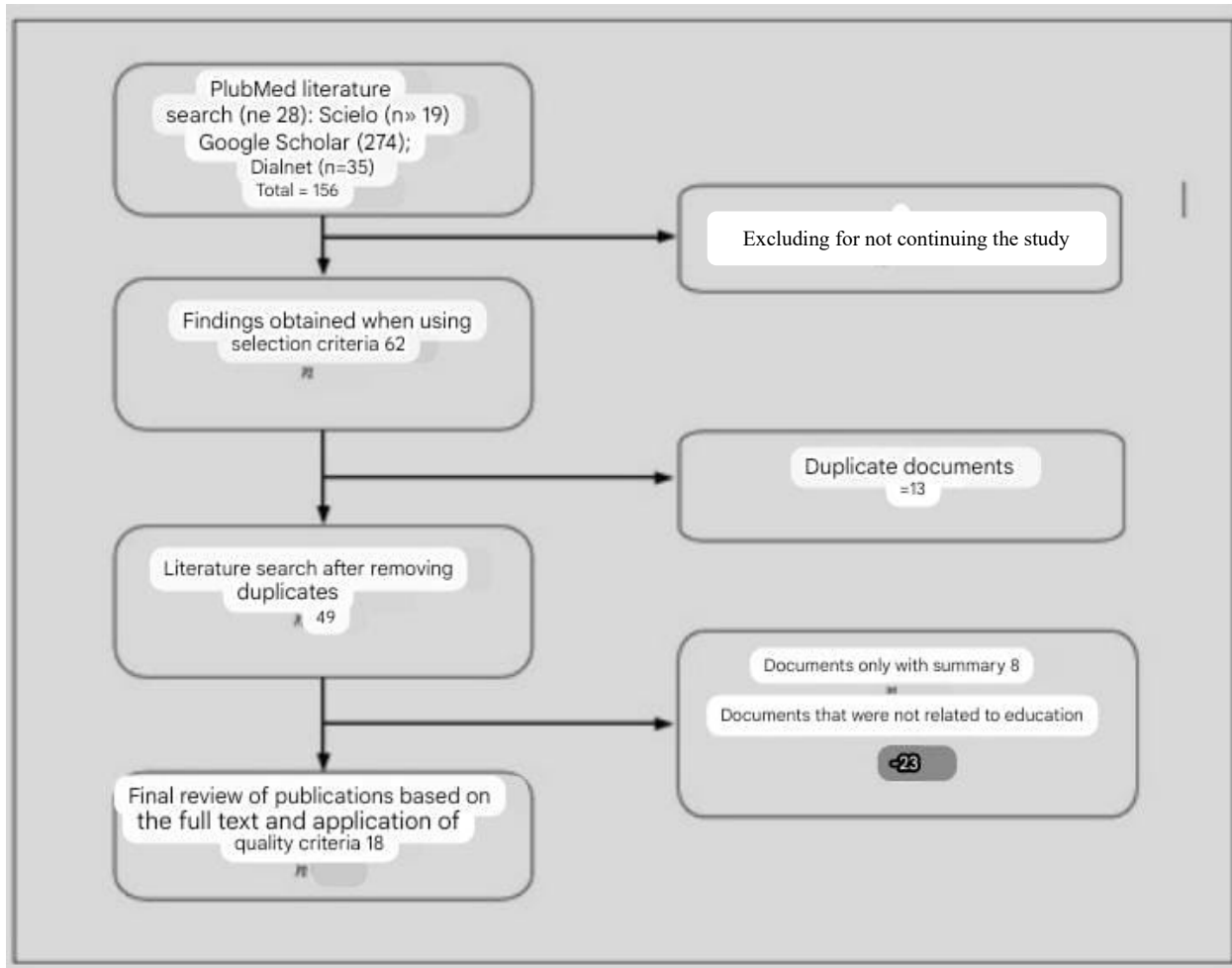
The research was developed following the procedure and search strategy established to carry out this systematic review, during which information was collected from various databases. For the extraction phase, the following coding was applied: the first element corresponds to the reference number, the second to the authorship, the third to the year of publication, the fourth to the journal, the fifth to the country, and the sixth to the conclusions. This led to the identification of 18 scientific research articles that address the topic of the application of artificial intelligence in Education, which were carried out in the period from 2018 to 2023. The details of this extraction are summarized in Table 2 of the study (11).

Table 2

Characteristics of the articles analyzed

Magazine	Conclusions
Company Games & Business Simulation Academic Journal	The need to develop strategies that promote the effective integration of AI in teaching is highlighted to improve the quality of educational service and provide immediate feedback to students. This study offers valuable insights into the design of policies and practices for implementing AI in Higher Education for the benefit of both individuals and society at large.
Latin Science Magazine Scientific Multidisciplinary	AI tools are very useful and serve as a strategy to reinforce and facilitate student learning.
Curriculum: Magazine of Theory, Research and Educational Practice	AI has become a valuable tool to improve teaching and learning. AI can be used to personalize each student's learning experience, tailor content and activities to their learning needs, and provide personalized feedback.
Technological Magazine-Educational Teachers 2.0	To date, there is a lack of sufficient information about AI in Education.
RevistaG-ner@ndo	AI can improve student learning and performance; it represents a challenge for teachers who have to adapt to new technologies and teaching methods. AI can be useful in personalizing learning and adapting to individual student needs, which is especially beneficial in online learning environments. However, it is important to address ethical and privacy issues related to its use in higher Education. Additionally, student data collected through AI must be used responsibly and appropriately protected. AI is a valuable tool in higher Education, but responsible implementation and adequate training are required to harness its potential effectively.
Communicate: Magazine Communication and Education Scientist	Students are the ones who have received the greatest impact from AI, positioning it as the main element of contemporary Education. Teachers play a fundamental role in this process through their methodologies and the use of these technologies. Likewise, there are educational curricula through which decision-making is established in colleges and universities that are betting on new educational technological models.
UPSE Scientific and Technological Magazine	The fields of knowledge with the most publications are those related to electronics, mechatronics, and software technologies. In that sense, the field of application of AI is very varied without showing any specific trend. The most used techniques are machine learning and neural networks.
Magazine Academic Research Without Borders	AI cannot completely replace the role of teachers, and a balance is necessary between the use of technology and the human approach in Education. It is necessary to consider the digital divide and inequality in access to technology responsibly and ethically. Despite these challenges, AI has the potential to revolutionize Education and offer unprecedented opportunities to improve student learning and performance. With a responsible and ethical approach, AI can be a valuable tool to foster lifelong learning and success.

Edutec: Electronic magazine of educational technology	AI is one of the fields of strategic innovation and technological development that exist today. This is evident not only from the processes of change that characterize the digital era—contemporary capitalism and the respective sociotechnical ecosystem in which the most important companies in the global order compete—but also in the objectification of an educational agenda. That is energized by the frenetic process of technical innovation that contemporary society is experiencing.
Venezuelan Management Magazine	The integration of technology has driven the progress of virtual Education, becoming a complementary tool in training processes. The incorporation of AI in the training process of law students would prioritize digital literacy and enhance their academic development.
Revised Method: Research Applied to Sciences Biological	It is important to set goals for the implementation of AI in curricula and the introduction of educational programs that represent this technology. Furthermore, the need to generate trust in all areas of the Health System in computer systems is highlighted, particularly in deep learning, not only because of the precise and objective information obtained from it but
	Also, its ability to predict future events provides high certainty in the diagnosis and treatment of diseases.
Academia Med.	Despite the abundant existing literature, there is still little consensus regarding what and how to teach AI in undergraduate medical Education (UME). More research is needed to address these discrepancies and establish a standardized competency framework that facilitates greater adoption and implementation of an AI curriculum in EMU.
Venezuelan Management Magazine	The application of AI demands high levels of flexibility, cohesion, adaptability, and constant transformation. AI generates new forms of social interactions, as well as the incursion of new virtual actors into teaching-learning environments. The use of these tools demands constant updating by the actors involved.
Institute of Transhumanist Studies	In today's synchronous online Education, human teachers are key. They adapt study programs according to the needs of students thanks to their pedagogical experience, offering a personalized approach. Although pedagogical observations have limitations in scope and processing, they guide mentoring. Although AI cannot yet fully direct Education, the technological foundations are being laid.
Mastery of Sciences	AI is a technology with incalculable value in the market, both in the present and in the future, not only when referring to the monetary value but rather to the value it has for the optimization of non-commercial processes, such as the education sector. AI is and will be a turning point in the changes of traditional educational paradigms.
Electronic magazine Interuniversity of Teacher training	Emerging technologies are a scientific agent that is characterized by being constantly evolving, and in recent years, they have become one of the most developed trends in the educational field. AI has not reached its state of maturity, and there are no studies that relate it to the development of critical thinking.
Purposes and representations	The challenge of the university in this new millennium is the need to plan, design, develop, and implement digital skills to train better professionals capable of understanding and developing the technological environment based on their needs, as well as implementing the universalization of a digital language. Supported by programs developed under AI formats.

Cuban Journal of Medical Informatics	The results of the analysis show the complex relationships when using each of the AI techniques studied, highlighting Case-Based Reasoning as the most promising and with the greatest perspective. Likewise, AI appears to be a promising tool in teaching, so it is essential to promote its development in this field.

Discussion

By analyzing the different texts provided, a consensus can be seen about the significant role of AI in Education and its potential to revolutionize traditional paradigms. Several authors have highlighted how AI not only has a monetary value in the market but also an intrinsic value in the optimization of non-commercial educational processes (García-Peña et al., 2020; González and Silveira, 2022). Furthermore, the importance of planning and developing digital skills in the training of professionals is highlighted (Pegalajar-Palomino and Rodríguez-Torres, 2023; Rodríguez et al., 2023), using programs based on artificial intelligence to promote digital literacy and language technological (11).

While the potential of AI to improve learning and teaching is recognized, there are also significant challenges. The relationship between technology and teachers emerges as a critical point, as it is stressed that AI cannot completely replace the role of teachers. The need to balance the use of technology with the human approach and address ethical issues and equitable access to technology is considered crucial. Likewise, the importance of teachers adapting to new technologies and teaching methods is highlighted while educational institutions provide adequate support and training (12).

Implementation challenges are also linked to the diversity of knowledge fields that AI encompasses. From applications in the health sector to legal Education, there is a need to establish trust in computer technologies and deep learning, guaranteeing the accuracy of diagnoses, models, and methodologies that help students. Educational professionalization scenarios demand a closer approach to specific situations that can be emulated thanks to AI (13).

In addition to the challenges, there are promising results. The personalization of learning through AI is one of the most notable aspects, allowing content and activities to be adapted according to the individual needs of students. However, the critical need to ethically use data collected through artificial intelligence is highlighted, ensuring its adequate protection and privacy. On the other hand, the current lack of information about this new phenomenon stands out, which establishes the importance of carefully considering the relevance of the topic in the educational field. In that sense, the need to venture into its analysis and research is also established (14).

The learning and training systems of the future must ensure that people acquire basic skills in AI, understanding data manipulation and protection. Education leaders must anticipate these changes, providing the necessary skills to adapt to a world dominated by AI without compromising social sustainability. Educational centres must prepare people to live and work in harmony with AI through planning, incorporating new technologies, forming communities of teachers, and promoting the innovative use of AI tools (15).

To ensure the effective implementation of AI in Education, it is essential to provide adequate training to teachers. This implies previously addressing issues related to the introduction of AI in the educational field to develop the necessary capabilities to use digital technologies and AI pedagogically. This training will not only train teachers but will also allow them to focus their time on teaching activities and offer individual tutoring to students, which will enhance their teaching

and empowerment as educators (16).

In summary, AI is being widely recognized as a valuable tool in contemporary Education at different levels of training despite challenges ranging from the relationship between teachers and technology to ethics in data collection. However, its potential to improve learning and teaching is undeniable and is changing the way we approach Education in the 21st century (17).

Conclusions

In conclusion, the exhaustive review of the texts provided highlights a consensus on the significant value that AI brings to the educational field, with the potential to transform its traditional paradigms. The ability of AI to optimize educational processes and personalize learning to the individual needs of students is considered a crucial evolution. Despite the promises that AI offers in improving teaching and learning, it is undeniable that significant challenges arise. The relationship between technology and educators is highlighted as a critical aspect, emphasizing that AI cannot completely replace the role of education professionals. In this sense, finding a balance between the implementation of technology and Human interaction is essential, as is addressing ethical issues and ensuring equitable access to these tools.

In this context, the implementation of AI in educational settings can occur in a wide range of disciplines and areas of knowledge, from medicine to law, which underlines the importance of trusting underlying technologies and deep learning models. Furthermore, among the promising results, the personalization of the learning process through AI stands out, which allows content and teaching methods to be adapted according to the unique needs of each student. However, this approach is offset by the pressing need to address the ethical implications of the collection and use of data generated by AI.

AI is emerging as a tool with great potential in modern Education, although it is not exempt from challenges and ethical questions. How these challenges are addressed will ultimately determine the extent of the benefits that AI can bring to Education in the 21st century. Teacher training is essential for the effective implementation of AI in Education. This will allow them to use digital technologies and AI pedagogically, focus on teaching, and provide personalized tutoring to students, thus strengthening their teaching practice.

REFERENCES:

1.   Forero-Corba W, Bennasar FN. Techniques and applications of Machine Learning and Artificial Intelligence in Education: a systematic review. RIED-Revista Iberoamericana de Educación a Distancia. 2024;27(1).

2.   Bond M, Khosravi H, De Laat M, Bergdahl N, Negrea V, Oxley E, et al. A meta systematic review of artificial intelligence in higher education: a call for increased ethics, collaboration, and rigour. International Journal of Educational Technology in Higher Education. 2024;21(1):4.

3.   Zhang P, Tur G. A systematic review of ChatGPT use in K-12 education. European Journal of Education. 2024;59(2):e12599.

4.   Khosravi M, Zare Z, Mojtabaeian SM, Izadi R. Artificial intelligence and decision-making in healthcare: a thematic analysis of a systematic review of reviews. Health services research and managerial epidemiology. 2024;11:23333928241234863.

5.   Zhan Z, Tong Y, Lan X, Zhong B. A systematic literature review of game-based learning in Artificial Intelligence education. Interactive Learning Environments. 2024;32(3):1137-58.

6.   Galindo-Domínguez H, Delgado N, Losada D, Etxabe J-M. An analysis of the use of artificial intelligence in Education in Spain: The in-service teacher's perspective. Journal of Digital Learning in Teacher Education. 2024;40(1):41-56.

7.   Park W, Kwon H. Implementing artificial intelligence education for middle school technology education in the Republic of Korea. International journal of technology and design education. 2024;34(1):109-35.

8.   Wardat Y, Tashtoush M, Ali R, Saleh S. Artificial intelligence in Education: mathematics teachers' perspectives, practices, and challenges. Iraqi Journal for Computer Science and Mathematics. 2024;5(1):60-77.

9.   Udegbe FC, Ebulue OR, Ebulue CC, Ekesiobi CS. The role of artificial intelligence in healthcare: A systematic review of applications and challenges. International Medical Science Research Journal. 2024;4(4):500-8.

10.   Jafari F, Keykha A. Identifying the opportunities and challenges of artificial intelligence in higher education: a qualitative study. Journal of Applied Research in Higher Education. 2024;16(4):1228-45.

11.   Airaj M. Ethical artificial intelligence for teaching-learning in Higher Education. Education and Information Technologies. 2024:1-23.

12.   Kurniawan MH, Handiyani H, Nuraini T, Hariyati RTS, Sutrisno S. A systematic review of artificial intelligence-powered (AI-powered) chatbot intervention for managing chronic illness. Annals of Medicine. 2024;56(1):2302980.

13.   Lagrange J-B, Richard PR, Vélez MP, Van Vaerenbergh S. Artificial intelligence techniques in software design for mathematics education. Handbook of digital resources in mathematics education: Springer; 2024. p. 969-99.

14.   Stojanov A, Daniel BK. A decade of research into the application of big data and analytics in higher Education: A systematic review of the literature. Education and Information Technologies. 2024;29(5):5807-31.

15.   Khreisat MN, Khilani D, Rusho MA, Karkkulainen EA, Tabuena AC, Uberas AD. Ethical Implications Of AI Integration In Educational Decision Making: Systematic Review. Educational Administration: Theory and Practice. 2024;30(5):8521-7.

16.   Boal MW, Anastasiou D, Tesfai F, Ghamrawi W, Mazomenos E, Curtis N, et al. Evaluation of objective tools and artificial intelligence in robotic surgery technical skills assessment: a systematic review. British Journal of Surgery. 2024;111(1):znad331.

17.   Licardo JT, Domjan M, Orehovački T. Intelligent robotics—A systematic review of emerging technologies and trends. Electronics. 2024;13(3):542.