

CURRENT OVERVIEW OF ARTIFICIAL INTELLIGENCE. A REVIEW OF THE STATE OF THE ART IN THE EDUCATIONAL CONTEXT

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Abstract-- The objective of this research is to review the state of the art of Artificial Intelligence (AI), a technology that has significantly transformed various sectors of society. In recent years, especially since 2020, the evolution of AI-based technologies in education has been a phenomenon that has intensified due to global challenges that have driven the digitization of education. Interest in this area has grown as evidenced by an increase in academic publications, as shown by bibliometric findings, demonstrating the need to understand and analyze the impact of these technologies on educational processes. This paper analyzes the literature available in educational contexts during the period 2020-2025, with the aim of identifying future lines of research and contributing to knowledge that can guide teachers, researchers, and decision-makers in the implementation of AI technology in educational environments.

Keywords-- Artificial Intelligence, Education, Teachers.

Abstract-- The present research aims to review the state of the art of Artificial Intelligence (AI), which is a technology that has significantly transformed various sectors of society. In recent years, especially since 2020, the evolution of AI-based technologies in education has been a phenomenon intensified by global challenges that have driven the digitalization of education. This interest stems from an increase in academic publications, as evidenced by bibliometric findings, demonstrating the need to understand and analyze the impact of these technologies on educational processes. This work analyzes the available literature in educational contexts during the period 2020-2025, with the aim of identifying future lines of research and contributing to the knowledge base that can guide teachers, researchers, and decision-makers in the implementation of AI technology in educational settings.

Keywords-- Artificial Intelligence, Education, Teachers.

INTRODUCTION

At the dawn of the third decade of the 21st century, education is undergoing an unprecedented transformation, driven by technological advances that are redefining the frontiers of learning and teaching. Among these innovations, Artificial Intelligence (AI) is emerging as a disruptive force with the potential to radically reshape traditional educational paradigms. From personalized tutoring systems to automated assessment tools, AI is leaving an increasingly deep mark on classrooms and learning processes globally (Gnadlinger et al., 2024).

In this dynamic and constantly evolving context, it is imperative to conduct a comprehensive review of the current state of the art in the application of AI within the educational field, in order to understand its scope, challenges, and future directions that promise to shape the pedagogical landscape.

The integration of AI into education is not a recent phenomenon; however, the sophistication of algorithms, the exponential increase in processing power, and the availability of large volumes of data have catapulted its potential to new dimensions. Initially conceived as a tool for automating administrative tasks and providing adaptive learning resources, AI has evolved to offer more complex and personalized solutions. Today, its capabilities are being actively explored to foster critical thinking, stimulate creativity, facilitate collaboration, and ultimately optimize the learning experience for each student (Mosqueda, 2024).

However, the promise of AI in education is not without questions and challenges. Ethical issues related to data privacy, algorithmic bias, and equity in access to these technologies demand rigorous attention. Likewise, the need to train educators in the effective use of these tools and to adapt curricula to the new realities imposed by AI are crucial aspects that must be addressed comprehensively. Critical reflection on the impact of AI on the pedagogical relationship and on the development of social-emotional skills is also an essential component of this debate (Flores-Martínez et al., 2020).

In Mexico, the adoption of AI in education presents a diverse landscape, marked by emerging initiatives, pilot projects, and a growing awareness of its transformative potential. Researchers and educators in the country have begun to explore the applications of AI at different educational levels, from basic to higher education, adapting solutions to the particularities of the local context and seeking strategies to overcome existing digital divides. As evidenced in recent studies, interest in educational AI has manifested itself in various cities and approaches. For example, research conducted in Guadalajara, Mexico (2023) has explored "High school students' perspectives on the use of generative artificial intelligence in their learning," while in Mexico City (2023), research has been conducted on "Generative artificial intelligence to strengthen higher education." These early examples illustrate the growing attention to the applications of generative AI in Mexican educational contexts. Analysis of these experiences

and identifying best practices becomes essential to promoting the effective and equitable integration of AI into the national education system (Barcia et al., 2024).

This article delves into a comprehensive review of the state of the art in Artificial Intelligence in the educational context, with the main objective of offering a panoramic and updated view of the most relevant research, applications, and debates in this field. It will explore the various ways in which AI is being implemented and is projected to be implemented in the future of education. Both the technological advances and the pedagogical implications that accompany this growing integration will be analyzed.

To achieve the overall objective, the following specific objectives have been defined:

- Identify and analyze the main lines of research in the field of AI applied to education, both internationally and in the Mexican context, highlighting emerging trends and predominant approaches. This review will consider studies such as the one conducted in Ecuador (2023) in Guayaquil on "Challenges and opportunities of artificial intelligence in higher education in Ecuador," which will allow for a comparative overview with national research.
- Describe and categorize the various AI research projects in the field of education, including intelligent tutoring systems, automated assessment tools, adaptive learning platforms, virtual assistants for students and teachers, and applications for educational management. Examples such as the analysis of the "Impact of Artificial Intelligence on Education" studied in Spain (2023) in Cadiz will be explored.
- Examine the potential benefits of AI in education, such as personalization of learning, improved teaching efficiency, early identification of learning difficulties, and promotion of educational inclusion. Research such as that conducted in Puebla, Mexico (2023) on "Artificial Intelligence and the Future of Higher Education" provides valuable insights on this point.
- A detailed conceptualization of Artificial Intelligence and its main branches relevant to the field of education will be offered, establishing a common theoretical framework for discussion. Next, a review of the most significant international scientific literature will be conducted, identifying the authors and research that have laid the foundations for the development of this field. Subsequently, attention will be focused on the Mexican context,

analyzing the research and initiatives being carried out in the country, highlighting specific characteristics and challenges, as has begun to be observed in studies in Guadalajara and Mexico City.

- A section is proposed for the critical analysis of the benefits and challenges associated with the implementation of AI in education, where the opportunities offered by this technology to improve educational quality and equity will be discussed, as well as the risks and ethical concerns that must be addressed proactively. In this section, the reflections of Mexican authors who have contributed to the debate on the implications of technology in education will be revisited.

Finally, some reflections will be offered on the future prospects of AI in education, identifying emerging trends and areas of research that promise to be relevant in the coming years. The importance of an interdisciplinary and collaborative approach to ensure the ethical and effective integration of AI into the education system will be highlighted.

Justification

Artificial Intelligence (AI) is one of the forces of technology that is changing everything. The impact of Artificial Intelligence (AI) reaches almost all sectors of society. The education sector receives many of the innovations of Artificial Intelligence (AI). Authors Yu and Lu (2021) have already pointed out the importance of introducing Artificial Intelligence (AI) into education. The integration of these tools into teaching and learning processes not only optimizes academic management, but also promises to personalize the educational experience, improve the efficiency of feedback, and redefine the role of the teacher, as analyzed by Zamora Varela and Mendoza Encinas (2023) in their study of the future of higher education. Consequently, the significance of this issue requires rigorous and up-to-date analysis.

We need a review that brings together information published recently, between 2020 and 2025, which is the period of change. The authors of existing studies focus on niches or do not define the time frame and location. This research fills that gap by offering an analysis of scientific output. This analysis helps identify emerging trends. This analysis helps identify the most commonly used methodologies. This analysis helps identify the geographical areas that are underrepresented. The analysis fills the gap in the information that has already been gathered on the current changes in the field.

The relevance of the article lies in the fact that it offers the academic community, researchers, and education policymakers an overview of the state of the art. The review shows the current state of knowledge. The review helps to define research on AI. The review provides a basis for decisions on the transformation of education through technology. In this way, the study contributes significantly to the consolidation of the theoretical and practical framework of Artificial Intelligence in the sector.

DEVELOPMENT

This article, dedicated to reviewing the state of the art in Artificial Intelligence (AI) in the educational context, is based on a documentary research methodology, an approach considered ideal for synthesizing and analyzing existing knowledge in a multidisciplinary and rapidly evolving field such as AI applied to education (Sánchez et al., 2024). The literature review is a systematic strategy for identifying, selecting, analyzing, and synthesizing relevant academic literature on a specific topic, thus providing a comprehensive and up-to-date overview of the field of study (Forero-Corba & Negre, 2024).

Type of research

The design of this research falls within the framework of a systematic literature review study and is characterized by the application of explicit and transparent criteria for the search, selection, evaluation, and synthesis of relevant literature (Ramos & García, 2024). The main objective of the design is to minimize bias and ensure comprehensive and representative coverage of the current state of knowledge at the intersection of artificial intelligence and education.

Search and selection procedure

The review was structured in two main search phases, carried out at different times to capture recent developments in the field. The first search phase was conducted during the second half of 2024. This initial stage focused on identifying the main trends, theoretical approaches, and emerging applications of AI in education. The second search phase was completed in the first half of 2025, with the aim of updating the information collected and ensuring the inclusion of the most recent and relevant publications in the period of interest. This two-stage search strategy allowed us to cover a significant time span and reflect the dynamics of the field of study.

In a literature review, the "participants" are the primary and secondary sources of information that are analyzed to construct the synthesis of knowledge. In the present study, the main sources of information included:

Scientific articles published in specialized journals: Peer-reviewed articles were prioritized to ensure the quality and validity of the information.

Book chapters: Chapters from edited books offering theoretical perspectives or comprehensive reviews on specific topics related to AI in education were included.

Books: Textbooks and monographs that comprehensively addressed artificial intelligence and its applications in education were considered.

The selection of these sources was based on their relevance to the research topic, their academic rigor, and their contribution to understanding the state of the art of AI in education. In turn, the main tool used in this research was a previously defined literature search and selection protocol. This protocol included the following elements:

The search terms were identified and combined using relevant keywords in Spanish and English, such as "artificial intelligence," "AI," "education," "machine learning," "adaptive learning," "intelligent tutoring," "automated assessment," "educational technology," "artificial intelligence," "AI," "education," "adaptive learning," "intelligent tutoring," and "automated assessment." Boolean operators (AND, OR, NOT) were used to refine searches and increase the accuracy of results.

Inclusion and exclusion criteria

The selection of the most relevant publications for this review was defined using the following inclusion criteria. First, the publication period was considered, covering the years 2020 to 2025, with the aim of analyzing the most recent literature in the field of AI. Second, publications in Spanish and English were included, recognizing the importance of scientific production in both languages.

A fundamental criterion was thematic relevance, selecting only those publications that directly addressed the application of artificial intelligence in the educational context. In turn, the type of publication was considered, including scientific articles, book chapters, and books that demonstrated academic rigor.

Complementarily, exclusion criteria were established to ensure the relevance of the sources analyzed, excluding publications outside the period of interest (prior to 2020 or after 2025). Likewise, publications in languages other than Spanish and English were discarded. Another exclusion criterion was the subject matter, omitting those publications that addressed AI in non-educational contexts.

To systematize the information obtained from each selected publication, a data extraction template was designed in Excel, allowing key elements such as the author(s), year of publication, publication title, source (journal, book, etc.), keywords used by the authors, main findings of the study, methodologies used in the research, and conclusions relevant to this review. This template facilitated the organization and comparison of information between different sources.

The literature search was conducted by exhaustively searching various sources and exploring virtual university libraries, such as those of the Autonomous University of Sinaloa and the National Autonomous University of Mexico, with the aim of identifying research in the Mexican and Latin American context. As Girola (2019) points out, these libraries are crucial for the dissemination of national knowledge. Google Scholar was also used as a general academic search engine to identify relevant literature at the global level. In addition, ScienceDirect, a database specializing in science and technology, was explored to identify cutting-edge research in the field of AI. The use of multiple databases, as suggested by Gregorio-Chaviano et al. (2022), minimizes bias and broadens the retrieval of relevant studies.

The identified publications were evaluated according to the previously defined inclusion and exclusion criteria, and an initial review of titles and abstracts was conducted to exclude those that were not relevant. Subsequently, a complete reading was carried out to confirm their relevance and quality. For this rigorous process, it was ensured that the 42 final publications were directly relevant to the review, including 10 in English to incorporate international perspectives. For each of the 42 publications, relevant information was extracted using the designed template. This stage allowed for the organization and comparison of the approaches, findings, and conclusions of the reviewed studies. As Navarro and Centurión (2024) state, systematization is crucial for identifying patterns and gaps in the literature. The extracted information was analyzed qualitatively, identifying recurring themes, trends, and debates through a narrative synthesis of the main findings, organized according to the research objectives.

research objectives. In this process, the different theoretical and methodological perspectives present in the literature were considered. According to Barreto and Lezcano (2023), qualitative analysis allows for a deep understanding of the phenomenon.

Finally, this article was written, presenting the results of the bibliographic analysis in a structured manner and highlighting the applications of AI in education, the benefits and challenges, future trends, and the contributions of Mexican authors. Throughout the process, transparency and scientific rigor were maintained. Although a literature review has limitations, the systematic approach adopted sought to minimize bias and offer a comprehensive and objective view of the state of the art, as concluded by Beltrán & Montalvo (2024).

DISCUSSION AND ANALYSIS OF RESULTS

Table 1. *Distribution of publications by year.*

Year	Number of publications
2020	1
2021	2
2022	2
2023	12
2024	13
2025	12
Total	42

Note: Own elaboration based on the bibliometric analysis of the articles collected.

The quantitative analysis of scientific output related to artificial intelligence in education during the period between 2020 and 2025 reveals a significant upward trend. Table 1 clearly illustrates this progression over time. During the initial three-year period, covering the years 2020 to 2022, a relatively low volume of publications was observed. Specifically, 2020 recorded the lowest number of publications, with only one document identified in the databases consulted. This is confirmed by authors Mena-Guacas et al. (2024), who note that in 2021 and 2022, production remained modest, although slightly higher than in 2020.

It can be seen that in 2020, academic production on artificial intelligence in Mexico was very low or incipient, which could be related to the beginning of interest in the subject or the impact of the COVID-19 pandemic (Medina & Torres, 2025).

A notable deviation from this trend occurred in 2023, when there was a substantial increase in the number of publications, reaching a total of 12 documents. This increase represents a significant change in the dynamics of research on artificial intelligence in education, demonstrating a growing interest in this field on the part of the academic community (Huerta-Presa & Zavala-Ramírez, 2023).

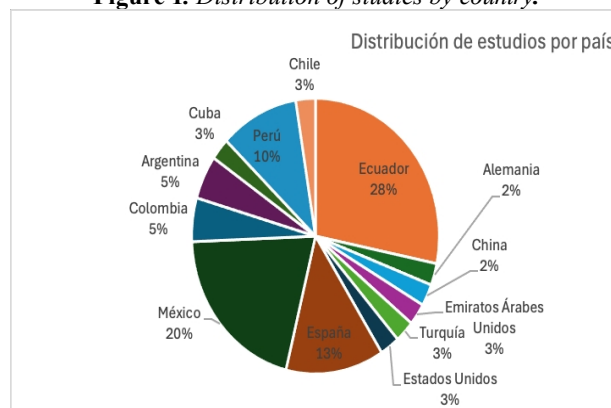
This upward trend was consolidated in 2024, with a slight increase in scientific output, reaching 13 publications. The maintenance of a high volume of output in this year suggests continued interest and research activity in this area of the field investigated.

Preliminary data for 2025 indicate that this trend is continuing, and in the first stage of the literature search for this year, 12 relevant publications have been identified. It is important to note that these 2025 publications explore a variety of aspects within the application of artificial intelligence in education, suggesting a deepening and expansion of research areas. The expansion of these programs demonstrates that AI is already a reality in Mexican higher education, with an impact that will continue to grow in the coming years (ANUIES, 2025).

The upward trend in scientific output on artificial intelligence in education suggests a growing recognition of this technology's potential to transform teaching and learning processes. The turning point observed in 2023 and the continued high volume of publications in subsequent years indicate a maturing field of research and sustained interest in exploring its various applications and implications. The low initial output in 2020 could reflect an early stage of exploration or the impact of external events that diverted research attention. However, the subsequent marked acceleration confirms the growing importance of AI as a key area of research in education.

On the other hand, Figures 1 and 2 show the distribution of studies by country. According to the information obtained, the distribution shows a predominance of publications from Ecuador (28%), Mexico (20%), and Spain (13%), reflecting an interest in educational AI in the Spanish-American sphere, particularly in these three countries. Likewise, the presence of publications from countries on different continents, such as America, Europe, Asia, and the Middle East, suggests its global relevance.

Figure 1. Distribution of studies by country.



Note: Prepared by the author based on the bibliometric analysis of the articles compiled.

Figure 2. Distribution map of studies by country.



Note: Prepared by the author based on bibliometric analysis of the articles compiled.

Table 2. Study methodology.

Methodology	Number
Qualitative	11
Systematic review of the literature	11
Mixed	10
Quantitative	5
Document review	4
Review	1
Total	42

Note: Own elaboration based on the bibliometric analysis of the articles compiled.

In Table 2, regarding the methodology used, the results show that most of the research is predominantly qualitative and systematic literature reviews, each representing 26.2%, constituting more than half (52.4%) of the studies analyzed. This indicates that

Research on AI in education focuses both on gaining a deep understanding of specific phenomena (qualitative) and on systematizing existing knowledge (systematic reviews). On the other hand, with 10 studies (23.8%), mixed methods account for almost a quarter of the research, showing an increase in the combination of qualitative and quantitative approaches. Quantitative methods represent a smaller percentage with 5 studies (11.9%), and reviews represent only 2.4%. This methodological distribution reflects a developing disciplinary field, where qualitative and mixed approaches and systematic reviews predominate over purely quantitative studies. It is a field where solid theoretical frameworks are being established and empirical and conceptual evidence is being built.

On the other hand, an analysis was carried out based on the keywords of the studies reviewed, which allowed us to identify the main themes and trends in this field (Figure 3, Table 3).

Figure 3. Word cloud: Artificial Intelligence in Education.



Note: Own elaboration based on the analysis of keywords from research on AI in education 2020-2025.

Table 3. Analysis of Artificial Intelligence keywords.

Keywords	Frequency analysis
Artificial Intelligence	37 (35.92%)
Higher education	12 (11.65%)
Education	11 (10.68%)
Learning	7 (6.80%)
Educational technology	7 (6.80%)
Teaching	6 (5.83%)
Automotive	4 (3.88%)
Teacher training	4 (3.88%)
ChatGpt	4 (3.88%)
Personalized learning	3 (2.91%)
Educational innovation	3 (2.91%)
Ethics	3 (2.91%)

Educational transformation	2 (1.95%)
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Note: Prepared by the author based on an analysis of keywords from research on AI in education 2020-2025.

Dominant terms and their relevance

The results show that the term "artificial intelligence" is the conceptual axis of all research. Likewise, "higher education" reveals that it is an educational level where the implementation of AI technologies is leading, possibly due to better technological infrastructure compared to other educational levels. The terms "learning and teaching" highlight the pedagogical processes being researched in relation to AI.

Technological aspects and their applications

The presence of the concept of "educational technology" shows how AI is being conceptualized in the field of education. For its part, the term "automatic" and its relationship to machine learning suggest an interest in the scientific foundations and mechanisms that enable these applications to function.

The results show that "ChatGPT" stands out as the only specific AI system that appears frequently in the research analyzed. This shows the remarkable impact that this AI technology has had on the education sector in a relatively short period since its launch, thus becoming a focus of research.

Dimensions of innovation and humanity

"Personalized learning" is emerging as a pedagogical trend of growing importance at the intersection of AI and education. The concepts of "educational innovation" and "educational transformation" emphasize that AI is not being studied as a technological tool, but as a change reflected in educational practices and paradigms. The presence of the term "teacher training" reflects the need to prepare teachers for the effective implementation of AI. However, the concept of "ethics," although it appears less frequently, indicates a beginning in the analysis of the ethical implications of the use of AI in educational contexts.

An in-depth analysis of Table 3, predominant keywords in the research literature on Artificial Intelligence (AI) in the educational context, covering the period from 2020 to 2025, bibliometric analysis is crucial for identifying emerging trends, areas of greatest research concentration, and possible gaps in the state of the art of AI applied to education.

The keyword frequency table reveals a fascinating picture of AI research in education, and as expected, "Artificial Intelligence" (35.92%) dominates the field, acting as the most imposing term, under which most studies are grouped. This underscores that AI is the central focus of this research, which centers on exploring its various facets and applications in the field of education.

The terms "Higher education" (11.65%) and "Education" (10.68%) occupy the next places in frequency, indicating that a significant part of the research has focused on the impact of AI at university levels and on the education system in general. The strong presence of "Higher education" suggests that university institutions are currently fertile ground for experimentation and analysis of AI research.

This is reflected in the study by Duque et al. (2025), which rates the presence of AI in basic education as "low" and "moderate" in higher education. In addition to this, this disparity is not only evident between educational levels, but also geographically, as established by Basantes et al. (2025): "teachers working in urban institutions are 47% more likely to have access to AI tools than those working in rural areas (p. 1559).

Fundamental concepts such as "Learning" (6.80%) and "Teaching" (5.83%) also feature prominently, demonstrating that research focuses not only on the technology itself, but also on how it interacts with and transforms teaching-learning processes. The coincidence of terms with "Artificial Intelligence" suggests that studies are exploring how AI can optimize knowledge acquisition and instructional design in education.

"Educational technology" (6.80%) is another important keyword, positioning AI as a tool within the broader technological ecosystem of learning. This invites us to consider AI not in isolation, but as part of a set of technological tools and approaches that can complement each other.

The emergence of ChatGPT (3.88%), despite being a more recent phenomenon, with a notable frequency, highlights the rapid evolution of the field and the prompt reaction of the research community to the emergence of new generative tools, indicating a growing interest in how new language models can influence student teaching and learning (Pack, 2023).

The concept of "personalized learning" appears with 2.91%, which is highly significant and reflects an interest in how AI can adapt content and methodology to the individual needs of students. The presence of the keyword "Teacher training" accounts for 3.88%, which is a crucial indicator, signaling that the research community recognizes the need to prepare educators to effectively integrate and use AI tools. Without adequate teacher training, the implementation of AI in education could face significant barriers (Van Den Berg & Du Plessis, 2023).

Keywords such as "Educational innovation" (2.91%), "Ethics" (2.91%), and "Educational transformation" (1.95%), although less frequent, are extremely important. "Educational innovation" frames AI as a driver of change in teaching practices. The inclusion of "Ethics" is vital, as it highlights awareness of the challenges and responsibilities inherent in the use of AI, such as data privacy, algorithmic bias, and equity in access (Flores-Vivar & García-Peñalvo, 2023). Finally, "Educational Transformation" indicates that AI is not seen merely as a complement, but as a catalyst for structural and profound changes in the education system.

Keyword analysis for the 2020-2025 period in AI research in education reveals a vibrant and rapidly evolving field, with research strongly focused on Artificial Intelligence as a catalyst for higher education, with a clear emphasis on how this technology can improve learning and teaching.

The growing prominence of specific tools such as ChatGPT and the focus on personalized learning confirm the trend toward adaptive solutions. However, attention to teacher training and ethics underscores the maturity of the field, recognizing that successful AI implementation is not merely technological, but also pedagogical and responsible. These findings provide a robust and current framework for understanding the state of the art of AI in the educational context.

Based on the information obtained, attention was drawn to the Latin American literature, where "the lack of technological infrastructure and connectivity in remote areas and surrounding urban areas has a negative impact on access to and quality of higher education" (Tobar et al., 2023, p. 869).

Some of the benefits of using AI in the educational context focus on the automation of administrative, pedagogical, and support tasks for teachers and students (López-Regalado et al., 2024),

as well as the possibility for inclusive education, highlighting people with special abilities (García-Peña, 2020). Therefore, it is necessary to develop inclusive educational policies that address technological and social aspects, encouraging critical thinking among students and promoting the ethical and pedagogical integration of new technologies that respect diversity and human dignity (Basantes et al., 2025).

Tobar et al. (2023) explain that training in technology and digital skills is essential for the implementation of AI in an educational context. This must be combined with the correct use of ethics and respect for ethical standards. The authors propose a number of strategies, including the following: 1) teacher training and education, 2) communication and transparency in the use of teacher and student data, as well as the privacy of both, 3) balance between human interaction and technology, with the intention of avoiding the replacement of AI in educational teaching.

CONCLUSIONS

Education in the 21st century is characterized by rapid technological transformation, which brings challenges and opportunities in the educational context. This study shows a field with a notable increase in scientific production since 2023, making AI a priority area of educational research.

The bibliometric analysis shows that research on AI in education is predominantly concentrated in Ecuador (28%), Mexico (20%), and Spain (13%), indicating that the topic is being studied in the Spanish-speaking world. The geographical distribution reveals one of the objectives of this research: to analyze regional academic production, highlighting the emergence of specific AI knowledge hubs in Latin American educational contexts.

On the other hand, methodologically, there is a clear predominance of qualitative approaches and systematic reviews (52.4%), indicating that the field is in theoretical and conceptual construction, seeking to understand the pedagogical implications of emerging technologies.

Analysis of research trends shows that AI is no longer considered solely as a technological tool, but rather as a catalyst for profound educational transformation, requiring not only technological infrastructure but also a review of existing pedagogical paradigms. This study helps to understand the current state of AI in education, especially in a Latin American context, where teacher training and ethics in the field are becoming necessary.

use of data. In this regard, some bases for future research are those that delve into ethical, pedagogical, and educational inclusion aspects, without forgetting the human-centered approach. For research to advance in a meaningful way, it is crucial that future studies focus on sensitive but essential issues, thoroughly explore how to use educational data in an ethical and responsible manner, and investigate new ways of teaching and learning with artificial intelligence. We cannot forget to analyze whether these technologies really help make education more fair and inclusive for everyone. And, of course, throughout this process, we must not lose sight of the fact that the student is at the center of everything. Artificial intelligence has the capacity to completely change education, but for this to be positive, it is necessary to conduct serious research and always consider the ethical implications.

FUTURE WORK

- **Ethical Aspects of AI in Education:** Deepen the ethical and responsible use of educational data, and address concerns about algorithmic bias and equity in access to AI technologies.
- **Pedagogical Impact and Teacher Training:** Investigate new pedagogical strategies and models for teaching and learning with AI, as well as the need to design teacher training programs in digital skills and the effective use of these tools.
- **Inclusion and Educational Equity:** Analyze whether AI technologies help make education more equitable and inclusive. Analyze AI technologies for people with special needs and analyze how to mitigate the digital divide in the Latin American context.
- **Student-Centered Approach:** Develop studies that maintain a human-centered approach, ensuring that the implementation of AI optimizes the individual learning experience without detracting from human interaction in the pedagogical relationship.

REFERENCES

ANUIES. (2025, March 3). *Artificial intelligence in higher education in Mexico*. Ceneval Recognition. <https://reconocimiento.ceneval.edu.mx/2025/03/03/la-inteligencia-artificial-en-la-educacion-superior-en-mexico/>

- Alpizar Garrido, L. O., & Martínez Ruiz, H. (2024). High school students' perspectives on the use of generative artificial intelligence in their learning. *RIDE Ibero-American Journal for Educational Research and Development*, 14(28). <https://doi.org/10.23913/ride.v14i28.1830>
- Azap, S. (2025). The role of artificial intelligence in language teacher education: EFL learners' views on the concept of "ChatGPT" through metaphorical analysis. *Social Sciences & Humanities Open*, 11, 101394. <https://doi.org/10.1016/j.ssaho.2025.101394>
- Barcia Cedeño, E. I., Tambaco Quintero, A. R., Angulo Quiñónez, O. G., Prado Zamora, M. E., & Valverde Prado, N. G. (2024). Analysis of trends and the future of Artificial Intelligence in Higher Education: Perspectives and challenges. *Ciencia Latina Multidisciplinary Scientific Journal*, 8(1), 3061–3076. https://doi.org/10.37811/cl_rcm.v8i1.9637
- Baltazar, C. (2023). AI tools applicable to education. *Technology Rain Journal*, 2(2), e15.
- Barreto Ascona, J. I., & Lezcano Mencia, A. (2023). Analysis and rationale of research designs: Exploring quantitative, qualitative, and mixed approaches based on Creswell & Creswell (2018). *Revista UNIDA Científica*, 7(2), 110–117. <https://revistacientifica.unida.edu.py/publicaciones/index.php/cientifica/article/view/179>
- Basantes Ortega, M. M., Miranda Castillo, A. M., Lara Luzuriaga, E. E., Zamora Altamirano, H. C., & Corozo Nazareno, M. M. (2025). Challenges of artificial intelligence in Ecuadorian education: A view from teaching and the role of the teacher. *Arandu UTIC*, 12(1), 1551–1566. <https://doi.org/10.69639/arandu.v12i1.694>
- Beltrán, P. A. C., & Montalvo, A. P. B. (2024). Exploring cultural biases in generative artificial intelligence (GAI): A focus on Latin American architecture and chair design. *Journal of the Center for Studies in Design and Communication. Essays* (225), 71–80.
- Bobula, M. (2024). Generative artificial intelligence (AI) in higher education: A comprehensive review of challenges, opportunities, and implications. *Journal of Learning Development in Higher Education*, (30).
- Borja López, Y. A., Gutiérrez Constante, G. F., Zapata Achig, V. H., & Salinas Montemayor, A. D. (2025). Towards more adaptive and efficient teaching in higher education: the impact of artificial intelligence on the transformation of teaching strategies and personalized learning. *Reincisol.*, 4(7), 1221–1244. [https://doi.org/10.59282/reincisol.V4\(7\)1221-1244](https://doi.org/10.59282/reincisol.V4(7)1221-1244)
- Chávez Solís, M. E., Labrada Martínez, E., Carbajal Degante, E., Pineda Godoy, E., & Alatrastre Martínez, Y. (2023). Generative artificial intelligence to strengthen higher education: Generative artificial intelligence

to boost higher education. *LATAM Revista Latinoamericana De Ciencias Sociales Y Humanidades*, 4(3), 767–784.

<https://doi.org/10.56712/latam.v4i3.1113>

Carbajal-Degante, E. (2025). From UNESCO to UNAM: adaptation of a framework of teaching competencies in artificial intelligence for education. *Revista Mexicana de Bachillerato a Distancia*, 17(33).

Casanova Pistón, A., & Martínez Domínguez, M. (2024). Scientific production on artificial intelligence and education: a scientometric analysis. *Hachetetepe. Scientific Journal of Education and Communication*, (28), 1102.

<https://doi.org/10.25267/Hachetetepe.2024.i28.1102>

Cercado-Basurto, D. A., Mera-Holguín, J. T., Ramírez-Gutiérrez, C. V., & Martínez-Pérez, O. (2025). Strengthening the use of applications that include artificial intelligence for teachers in the teaching-learning process.

MQRInvestigar, 9(1), e171. <https://doi.org/10.56048/MQR20225.9.1.2025.e171>

Cheah, Y. H., Lu, J., & Kim, J. (2025, June). Integrating generative artificial intelligence in K-12 education: Examining teachers' preparedness, practices, and barriers. *Computers and Education: Artificial Intelligence*, 8, 100363.

<https://doi.org/10.1016/j.caeai.2025.100363>

Cotrina-Aliaga, J. C., Vera-Flores, M. Angel, Ortiz-Cotrina, W. C., & Sosa-Celi, P. (2021). Use of Artificial Intelligence (AI) as a strategy in higher education. *Revista Iberoamericana De educación*.

<https://doi.org/10.31876/ie.vi.81>

Farfán Pimentel, D. E., Valdez Asto, J. L., Manchego Villarreal, J. L., Farfán Pimentel, J. F., Fuertes Meza, L. C., Carita Chambi, L. M., Candia Menor, M. A., and Janampa Acuña, N. (2025). Integration of artificial intelligence in the scientific research process among university teachers. In R. Simbaña Q. (Coord). *Comprehensive Education. Multidimensional Perspectives and New Frontiers in Learning* (Volume I). (pp. 19-41). Religación Press.

<http://doi.org/10.46652/religacionpress.274.c440>

Flores-Martínez, P., García-Peñalvo, F. J., & Hernández-García, Á. (2020). Bibliometric analysis of research on artificial intelligence in education in Latin America. *Education in the Knowledge Society (EKS)*, 21, e2118.

<https://doi.org/10.14201/eks.2118>

Flores-Vivar, J., & García-Peñalvo, F. (2023). Reflections on the ethics, potential, and challenges of artificial intelligence in the context of quality education (SDG 4). *Comunicar*. <https://doi.org/10.3916/c74-2023-03>.

Forero-Corba, W., & Negre Bennasar, F. (2024). Techniques and applications of machine learning and artificial intelligence in education: A systematic review. *RIED-Ibero-American Journal of Distance Education*, 27(1), 209–253. <https://doi.org/10.5944/ried.27.1.37491>

- García-Peña, V. R., Mora-Marcillo, A. B., & Ávila-Ramírez, J. A. (2020). Artificial intelligence in education. *Dominio de las Ciencias*, 6(3), 648-666. <http://dx.doi.org/10.23857/dc.v6i3.1421>
- García Chávez, A. J., González Fraga, J. Á., & Gutiérrez López, E. (2025). Adoption of generative artificial intelligence in higher education: Perspectives and challenges. In J. A. Sepúlveda Rodríguez, R. I. Molina Rodríguez, & P. Avitia Carlos (Eds.), *Adoption of artificial intelligence and digital technologies in higher education* (Vol. 1, pp. 179-186).
- García-Perales, N., Hernández Rincón, M. L., & Suárez Lantarón, B. (2025). Teachers and technology: how do future teachers approach the use of artificial intelligence? *Interuniversity Electronic Journal of Teacher Training*, 28(1), 155–168. <https://doi.org/10.6018/reifop.638431>
- Gallardo, S. (2024, June). CloudIA: Portfolio of Artificial Intelligence Applications and Gadgets for Education. In *2024 XVI Congress on Technology, Learning, and Teaching of Electronics (TAEe)* (pp. 1-6). IEEE.
- Giola Molina, L. G. (2019). Scientific journals as a tool for disseminating knowledge. *Revista Mexicana de Sociología*, 81(4), 919–927. <https://doi.org/10.22201/iis.01882503p.2019.4.57982>
- Gnadlinger, F., Werminghaus, M., Selmanagić, A., Filla, T., Richter, J., Kriglstein, S., & Klenzner, T. (2024). Incorporation of an intelligent tutoring system into game-based auditory rehabilitation training for adults with cochlear implants: Development and validation of algorithms. *JMIR Serious Games*, 12. <https://doi.org/10.2196/55231>.
- Goenechea, C., & Valero-Franco, C. (2024). Education and artificial intelligence: An analysis from the perspective of teachers in training. *REICE. Ibero-American Journal on Quality, Effectiveness, and Change in Education*, 22(2), 33-50. <https://doi.org/10.15366/reice2024.22.2.002>
- Gregorio-Chaviano, O., López Mesa, E. K., & Limaymanta, C. H. (2022). Web of Science as a research tool and support for scientific activity: Pros and cons of its collections, products, and indicators. *E-Ciencias de la Información*, 12(1), 134–157. <https://doi.org/10.15517/eci.v12i1.46660>
- Huerta-Presa, S., & Zavala-Ramírez, J. R. (2023). Artificial intelligence and the context of teaching in Mexico. *Revista Tecnológica-Educativa Docentes 2.0*, 16(1), 49–56. <https://doi.org/10.37843/rtd.v16i1.336>
- López Regalado, O., Núñez-Rojas, N., López Gil, O. R., & Sánchez-Rodríguez, J. (2024). Analysis of the use of artificial intelligence in university education: a systematic review. *Pixel-Bit. Media and Education Journal*, 70, 97–122. <https://doi.org/10.12795/pixelbit.106336>

- Macías Lara, R. A., Solorzano Criollo, L. R., Choez Calderón, C. J., & Blandón Matamba, B. E. (2023). Artificial intelligence; analysis of the present and future in higher education. *Revista Científica Multidisciplinar G-Nerando*, 4(1). Retrieved from <https://revista.gnerando.org/revista/index.php/RCMG/article/view/98>
- Marcillo Pin, K. R., Cevallos Ponce, A. A., & Gutiérrez Cevallos, R. X. (2023). Implications of artificial intelligence in higher education. *Electronic Journal of Education and Quality (RefCalE)*, 15. <https://refcale.uleam.edu.ec/index.php/refcale/article/view/3742/2321>
- Martínez Cortés, J., Guevara Bazán, I. A., & Rodríguez González, D. (2024). Artificial Intelligence in Higher Education: Key Strategies for Addressing this Challenge. *Neuronum Journal*, 10(1), January–June. ISSN: 2422-5193(Online)
- Medina Romero, M. Á., & Torres Chávez, T. H. (2025). Regulation of artificial intelligence: Challenges for human rights in Mexico. *RIDE Ibero-American Journal for Educational Research and Development*, 15(30). <https://doi.org/10.23913/ride.v15i30.2291>
- Mena-Guacas, A. F., Vázquez-Cano, E., Fernández-Márquez, E., & López-Meneses, E. (2024). Artificial intelligence and its scientific production in the field of education. *University Education*, 17(1), 155–164. <https://doi.org/10.4067/S0718-50062024000100155>
- Morocho Cevallos, R. A., Cartuche Gualán, A. P., Tipan Llanos, A. M., Guevara Guevara, A. M., & Ríos Quiñónez, M. B. (2023). Integration of Artificial Intelligence in Education. *Ciencia Latina Multidisciplinary Scientific Journal*, 7(6), 2032-2053. https://doi.org/10.37811/cl_rcm.v7i6.8832
- Mosqueda Chávez, E. (2024). Artificial intelligence as an ally of learning and critical thinking. *Mexican Journal of Distance High School Education*, 16(32). <https://doi.org/10.22201/cuaieed.20074751e.2024.32.89555>
- Musibay Figueroa, C. L. (2024). Strategies to enhance creativity in education on Artificial Intelligence. *UNESUM-Ciencias Journal*, 8(2), 32-46. <https://doi.org/10.47230/unesum-ciencias.v8.n2.2024.32-46>
- Navarro Soplin, L. A., & Centurión Larrea, Á. J. (2024). Relationship between institutional climate and teacher performance: A review of the literature. *Horizontes. Journal of Research in Education Sciences*, 8(34), 1585–1597. <https://doi.org/10.33996/revistahorizontes.v8i34.820>
- Pack, A. (2023). Possible applications of generative AI in language education: demonstrations and an evaluation framework. *Teaching English with Technology*. <https://doi.org/10.56297/buka4060/vrro1747>.

- Palma-Rivera, D. P., Machuca-Vivar, S. A., & Villalta-Jada, B. E. (2025). Impact of artificial intelligence on higher education: teacher perceptions and academic challenges. *UGC Journal*, 3(S1), 129–135. Retrieved from <https://universidadugc.edu.mx/ojs/index.php/rugc/article/view/109>
- Panqueban, D., & Huinchahue, J. (2024). Artificial intelligence in mathematics education: A systematic review. *Uniciencia*, 38(1), 1–17. <https://doi.org/10.15359/ru.38-1.20>
- Parra-Sánchez, J. (2022). The Potential of Artificial Intelligence in Higher Education: A Personalization Approach. *Journal Tecnológica-Educativa Teachers* 2.0, 14(1), 19-27. <https://doi.org/10.37843/rted.v14i1.296>
- Ramos-Galarza, C. A., & García-Cruz, J. (2024). Guide to conducting quantitative systematic review studies. *Science and Academia*, 13(1). <https://doi.org/10.33210/ca.v13i1.444>
- Rossini, G. C., Gutiérrez, L. P. U., & Azahuanche, M. A. P. (2025). Artificial intelligence for developing research skills in university teachers. *Horizons. Journal of Research in Education Sciences*, 9(37). <https://doi.org/10.33996/revistahorizontes.v9i37.965>
- Ruiz-Miranda, E. (2023). The artificial intelligence revolution in education: a review of ChatGPT: <https://chat.openai.com/>. *Journal of Studies and Research in Psychology and Education*, 10(1), 156–160. <https://doi.org/10.17979/reipe.2023.10.1.9594>
- Samad, A., Izani, M., Razak, A., & Rosli, M. (2024, August). Enhancing Creative Design: Integrating Artificial Intelligence into Interior Design Education at the University of Sharjah. In *2024 International Visualization, Informatics and Technology Conference (IVIT)* (pp. 63-70). IEEE.
- Sánchez Rodríguez, A. N., Martínez Romero, M. E., Rodríguez Agreda, C. J., Romero Saldarriaga, J. G., & Romero Saldarriaga, M. A. (2024). Impact of artificial intelligence on educational practices. *LATAM Latin American Journal of Social Sciences and Humanities*, 5(2), 1038–1055. <https://doi.org/10.56712/latam.v5i2.1933>.
- Sihag, P. (2024). Transforming and Reforming the Indian Education System with Artificial Intelligence. *Digital Education Review*, 45, 98-105
- Silva-Peñañiel, G. E., Castillo-Parra, B. F., Tixi-Gallegos, K. G., & Urgiles-Rodríguez, B. E. (2024, March 19). The Artificial Intelligence Revolution in Higher Education. Editorial Grupo AEA. Retrieved from <https://www.editorialgrupo-aea.com/index.php/EditorialGrupoAEA/catalog/book/71>

- Tobar Litardo, J., Rodríguez Wong, C., Martínez Ruiz, S., & Pozo Benites, K. (2023). Challenges and opportunities for teachers in the implementation of artificial intelligence in Ecuadorian higher education. *South Florida Journal of Development*, 4(2), 867–889. <https://doi.org/10.46932/sfjdv4n2-020>
- Toh, Y. T., Ngoh, W. Y., Sureka, S., Iyer, G. N., & Natarajan, P. (2023, November). Artificial intelligence education—self-guided learning. In *2023 IEEE International Conference on Teaching, Assessment and Learning for Engineering (TALE)* (pp. 1-8). IEEE.
- Tomalá De La Cruz, M. A., Mascaró Benites, E. M., Carrasco Cachinelli, C. G., & Aroni Caicedo, E. V. (2023). Incidences of artificial intelligence in education. *RECIMUNDO*, 7(2), 238–251. [https://doi.org/10.26820/recimundo/7\(2\). Jun. 2023. 238–251](https://doi.org/10.26820/recimundo/7(2). Jun. 2023. 238–251).
- Van Den Berg, G., & Du Plessis, E. (2023). ChatGPT and generative AI: Possibilities for their contribution to lesson planning, critical thinking, and openness in teacher training. *Education Sciences*. <https://doi.org/10.3390/educsci13100998>.
- Vargas-Parga, L. A., & Cediél-Acosta, W. O. (2025). Innovating teaching strategies and personalized learning in higher education through the use of artificial intelligence for more dynamic and accessible teaching. *MQRInvestigar*, 9(1), e256. <https://doi.org/10.56048/MQR20225.9.1.2025.e256>
- Vera, F. (2023). Integration of Artificial Intelligence in Higher Education: Challenges and Opportunities. *Transformar*, 4(1), 17–34. Retrieved from from <https://www.revistatransformar.cl/index.php/transformar/article/view/84>
- Vera-Rubio, P. E., Bonilla-González, G. P., Quishpe-Salcán, C., & Campos-Yedra, H. M. (2023). Artificial intelligence in higher education: a transformative approach. *Knowledge Pole*, 8(11), 67-80. DOI: 10.23857/pc.v8i11.6193
- Watanabe, A. 2024. "Have Courage to Use your Own Mind, with or without AI: The Relevance of Kant's Enlightenment to Higher Education in the Age of Artificial Intelligence." *The Electronic Journal of e-Learning*, 46-58, <https://doi.org/10.34190/ejel.21.5.322>
- Yu, S., & Lu, Y. (2021). *An introduction to artificial intelligence in education*. Singapore: Springer.
- Zamora Varela, Y., & Mendoza Encinas, M. del C. (2023). Artificial intelligence and the future of higher education: challenges and opportunities. *Pedagogical Horizons*, 25(1), 1–13. <https://doi.org/10.33881/0123-8264.hop.25101>

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