

Generating content in digital education through Artificial Intelligence tools. A Bibliometric Review

Generando contenido en la educación digital a través de herramientas de Inteligencia Artificial. Una Revisión Bibliométrica



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Abstract

The development of educational content using artificial intelligence algorithms has been implemented favorably to increase dynamics within and in autonomous activities as a methodological tool to improve cognitive learning qualities in students. Digital educational models in the wake of COVID-19 have accelerated scientific research on the use of artificial intelligence to support student academic performance, focusing primarily on computer-assisted learning dynamics. This study uses bibliometric analysis to evaluate the performance of these predictive mathematical algorithms on scientific learning over the last 50 years, demonstrating that this self-learning gap has generated indispensable content for education today. An introduction to artificial intelligence models as a tool for assisted learning is presented. The implications of digital education and the resources that can be used in learning dynamics and didactics are analyzed, generating variables that define their degree of use and level of learning through specialized review literature using the Prisma2020 tool.

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Keywords: educational model, digital education, predictive algorithms

Resumen

El desarrollo de contenido educativo mediante algoritmos de inteligencia artificial se ha implementado de forma favorable para aumentar la dinámica dentro y en actividades autónomas como herramienta metodológica para mejorar las cualidades de aprendizaje cognitivo en estudiantes. Los modelos educativos digitales a raíz de la COVID-19 han acelerado la investigación científica sobre el uso de la inteligencia artificial para apoyar el rendimiento académico estudiantil, centrándose principalmente en dinámicas de aprendizaje asistido por computadora. Este estudio mediante un análisis bibliométrico evalúa el desempeño de estos algoritmos matemáticos predictivos sobre el aprendizaje científico a través de los últimos 50 años demostrando que esta brecha de autoaprendizaje ha generado contenido indispensable para la educación en la actualidad. Se presenta una introducción a los modelos de inteligencia artificial como herramienta para el aprendizaje asistido. Se analizan las implicaciones de la educación digital y los recursos que se pueden emplear en la dinámica y didáctica de aprendizaje, generando variables que definen su grado de uso y nivel de aprendizaje a través de literatura de revisión especializada empleando la herramienta Prisma2020.

Palabras clave: modelo educativo, educación digital, algoritmos predictivos

Introduction

The development of online education before, during, and after COVID-19 represented a major challenge for many countries around the world, as it presented conditions for which developing countries and some regions of Latin America were unprepared, both in terms of infrastructure and pedagogy. This model of online education was implemented unevenly, depending on institutional policies, study dynamics, adaptations by educational centers, and psychosocial factors. These elements contribute greatly to inequality in education.

Developing countries lack a viable educational model that meets the highest standards of the global market, but this should not undermine the efforts of educators to strengthen their educational systems. These educational barriers have caused some countries already

mired in poverty to fall further behind in their development, while others have found opportunities in digital, technological, and smart production, as well as in the media, which has given them international visibility, as in the cases of Singapore and Iceland. These strategies were based on a vision of the future of global needs and the emergence of new buyers in the global context and the fourth industrial revolution.

After the COVID-19 pandemic, the use of digital platforms to access basic services, including education, health, food, and work, grew significantly. This led to the adoption of policies focused on virtualizing educational processes and strengthening digital classrooms. Authors such as Vivas and Passiani assert that, although e-learning educational methodologies have driven the development of education in virtual classrooms, the dynamics remain deficient because they do not propose control of the type of artificial intelligence tools or the ability to impart knowledge without it being seen as part of a logical AI process, which means that users do not generate real learning in the medium or long term.

In Ecuador, digital education has become known since the COVID-19 pandemic as a tool to replace face-to-face learning, but it has been hampered by technological infrastructure limitations and the ability of educators to adapt and complement traditional methods of education outside the classroom.

Recent literature highlights the results and implications of how complexity and contingency affect teaching and learning. Based on its learning potential, the digital education model can be characterized as having been consolidated through an AI-assisted methodology decoded into various algorithms that improve user preferences for use and learning.

Thanks to these preferences, spaces for digital content have been designed that improve the capacity of the AI tool as an educational assistant that stimulates learning through teaching methods and platforms that enhance the user experience and retention. In this sense, digital education has opened the door to active education during COVID-19, which has given rise to virtual classrooms or distance or programmed learning spaces, which have taken on various forms, such as synchronous and asynchronous, bringing students much closer to digital education.

In a recent analysis of the specialized literature, several studies have pointed out unfavorable effects linked to the use of artificial intelligence in educational environments. According to the

systematic review, around 20% of students report a decrease in their cognitive autonomy due to their growing dependence on automated tools. Likewise, the authors report that approximately 18% of teachers identify difficulties in maintaining the balanced development of critical and creative skills when AI models are integrated into training activities. The research also shows that about 16% of educational institutions have faced risks associated with privacy and data management, which represents one of the main ethical challenges in the adoption of these technologies. These percentages reveal that, while AI has driven advances in digital learning, it also generates significant tensions that need to be considered in its pedagogical implementation.

In recent years, various studies have highlighted limitations and adverse effects associated with the integration of artificial intelligence into teaching methodologies. Zhu points out that excessive use of AI-based conversational systems can reduce students' critical thinking and cognitive autonomy, noting that in a significant percentage of the studies analyzed, students accept between 60% and 70% of AI responses without verification, which can lead to conceptual errors and intellectual dependence.

Similarly, Urzúa's review identifies that 48% of the articles examined report ethical or pedagogical challenges arising from the use of language models, especially in automation-centered methodologies. Among these problems are a lack of transparency, reduced teacher-student interaction, and poor pedagogical supervision in AI-assisted digital environments.

At the methodological level, González-Espinosa found that only 32% of AI-based teaching proposals fully comply with human-centered design criteria, which implies that a considerable majority (68%) have shortcomings related to reliability, usability, ethics, and teacher participation in the instructional process. This data is relevant, as it shows that a large part of AI-supported methodologies are not developed with the student's comprehensive pedagogical experience as a priority.

Finally, Schmidpeter & Funk, in an empirical study at the university level, report that 41% of students express concern about the reliability of intelligent systems in academic activities, and 37% acknowledge having experienced a decline in their ability to solve problems without AI assistance, suggesting a negative impact on essential learning processes when the methodology relies excessively on these tools.

Taken together, these findings lead to the conclusion that, while AI-assisted teaching methodologies offer significant opportunities for educational innovation, the most recent studies agree that there are unfavorable percentages that reveal cognitive, ethical, and pedagogical risks. These data underscore the need to strengthen methodological approaches, promote critical and balanced use of AI, and ensure teacher integration in the design of learning experiences mediated by intelligent technologies.

According to the UN report on education, 5.35 billion people, or 66.2% of the global population, use the internet worldwide. The number of internet users increased by 97 million people, representing a 1.8% increase compared to 2023. Based on this data, research has shown that access to educational society is around 70 to 72%, which is considered moderately acceptable.

Analysis of this report shows that the digital education model still has a 28% educational accessibility gap worldwide, which does not create equal opportunities for all students. However, the asynchronous modality has made it possible to schedule and record classes that tend to be shared, thus increasing accessibility to education.

Given the apparent success of the digital education model, artificial intelligence has established itself as a tool to support student knowledge development over the last decade and is currently considered a successful invention or a boom in contemporary society.

In light of this digital development, this study was conducted using a bibliometric analysis that evaluates the performance of these predictive mathematical algorithms on scientific learning over the last decade, comparing 5 years pre-COVID and 5 years post-COVID, demonstrating that this self-learning gap has generated indispensable content in digital education through a literature review on scientific platforms such as Scopus, Science Direct, and Scielo, using the Prisma2020 tool for information synthesis.

A common problem has been identified in various higher education institutions linked to design courses: many architecture students find it difficult to develop creative and efficient proposals during the design process. Although teachers show willingness and effort to address these difficulties, daily practice reveals several weaknesses that hinder learning and limit students' ability to innovate, generating a marked tendency to reproduce existing models. Among the factors that influence this are the lack of pedagogical and psychological

preparation of teachers, a limited ability to identify and work with different learning styles, and a weak articulation between the ways of teaching and the ways in which students learn.

Artificial intelligence (AI) is playing an increasingly important role in teaching methods in digital education, which has been undergoing significant development over the last decade. The potential of AI-assisted tools has an evolutionary potential that offers efficiency in the understanding and delivery of knowledge. One of its most notable applications is generative design, which proposes increasing dynamics of knowledge, broadening the spectrum of knowledge to logical processes that increase the difficulty of knowledge, thus formalizing the so-called digital dynamics.

The capacity offered by a generative tool goes beyond a simple process; rather, it executes commands that can be adapted to the user's understanding and meet their specific demands. In students, this understanding is provided by the teacher or educator who configures the student's learning levels so that a methodology of logical processes is executed that corresponds to a correct approach to the virtual classroom where the dynamics of the class unfold.

The process becomes didactic when it contemplates active attention to a process that must reach a goal, and as this must be carried out in a digital environment, it is of great interest to understand that all digital teaching can have its limitations, since the coding of processes can evolve to a certain level where it must be adapted and improved to the next study goal.

Materials and methods

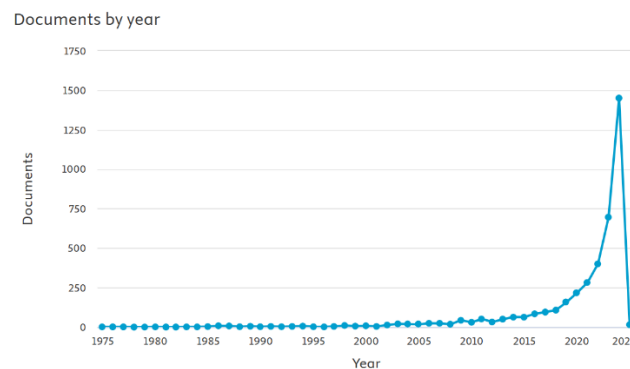
The research is carried out through a systematic review of high-impact articles in the Scopus and ScienceDirect scientific databases, structuring an interrelational graph of the gaps and positive influence of artificial intelligence on the digital educational model. This data was systematized in AnalyzeSearch and Analytics to obtain the annual impact of publications and determine the indicators that contribute to the development of spatial learning in student performance. The hermeneutic method was used, in which a 50-year regression of the development of digital education and the contribution of artificial intelligence to content creation as a dynamic and didactic learning methodology was performed. To this end, texts by representative authors in the global context were selected, along with their impact, type of contribution, and relevant contribution by

authors. This data was relevant for analyzing their citation index and impact, generating a correlation of variables such as digital education and artificial intelligence as a learning methodology. Two phases of bibliometric analysis of the information were carried out on the PRISMA 2020 and VOSViewer platforms to generate a checklist and impact graphs for the abstraction of relevant results from the application of the generative artificial intelligence model in spatial learning focused on the performance of students at the higher education level.

Results

To develop the analysis, a hermeneutic approach was applied that allowed for a historical reconstruction of the evolution of the topic within academic literature. Based on this retrospective examination, it was identified that scientific interest had already been present since the mid-1970s. This historical overview has given rise to five fundamental contributions that have guided and strengthened research in the area. Thanks to these advances, scientific production has experienced sustained growth, currently accumulating a considerable volume of publications dedicated to the study of this topic.

Figure 1. Representation of the bibliometric systematization of scientific documents on AI.

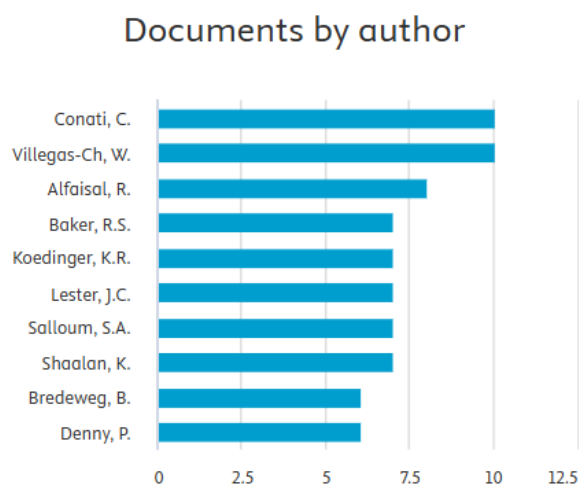


Source: Own elaboration

Based on a bibliometric analysis of data synthesized in the Scopus and ScienceDirect scientific databases, it has been possible to generate a regression of the impact of artificial intelligence and its influence on digital education, leading to a minimum of 300 publications up to the year 2000, when the initial terms were linked to emerging computing and process robotics. From the 21st century

onwards, this reality changed with the introduction of so-called virtual classrooms and generative processes, with a surge up to 2015 with more than 1,000 publications. The evolution of artificial intelligence in the last decade has accounted for more than 89% of scientific publications, already consolidating processes and dynamics of study assisted by artificial intelligence.

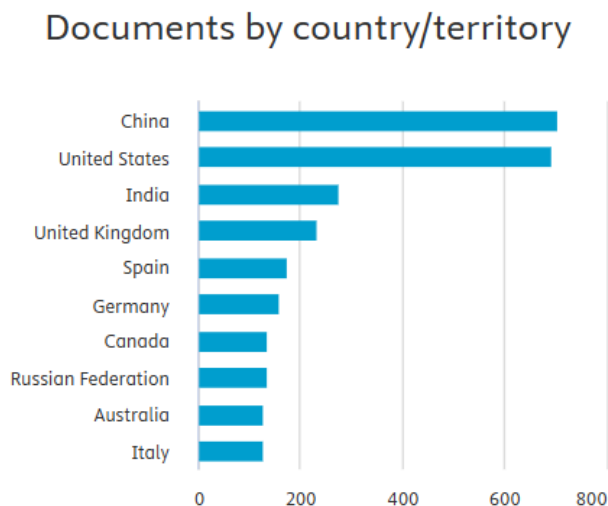
Figure 2. Record of publications on artificial intelligence classified by author



Source: Own elaboration

In our search for authors in publications, we found Conati C. to be the most relevant author in generating studies on how artificial intelligence can be the tool of the future for generating generative knowledge that replaces human processes and can strengthen confidence in the results of artificial intelligence through controlled means. His research highlights the relationship between artificial intelligence and virtual education, emphasizing how this link benefits the development of critical thinking in students.

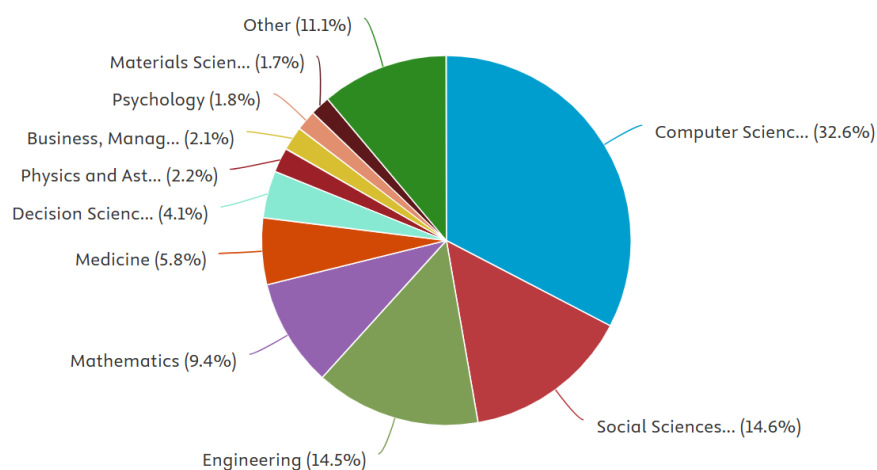
Figure 3. Distribution of publications on AI by country of origin



Source: Own elaboration

China is currently the leader in publications covering artificial intelligence tools and how robotics can increase the level of understanding within so-called virtual classrooms; the dynamics in conjunction with robotics present students with an evolution towards this new branch of knowledge. In most of the countries, researchers analyze how the ethical sphere, the generation of knowledge, and the drive for innovation can create a dependency that must be combated through control and logical processes.

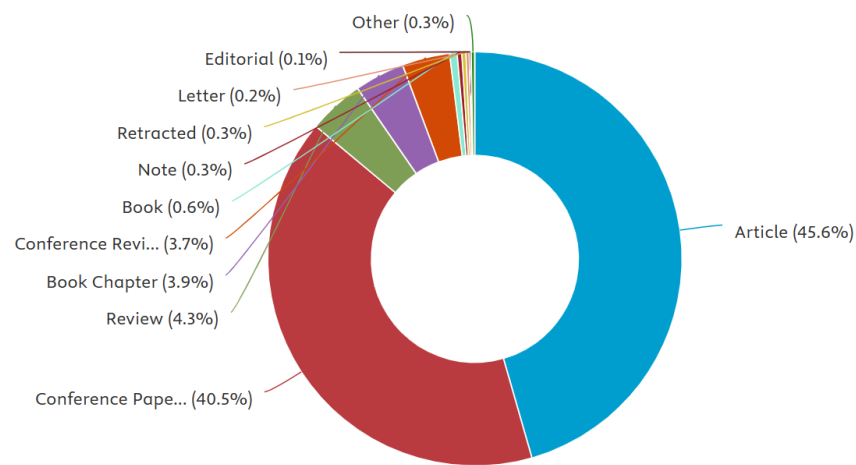
Figure 4. Distribution of publications on AI by academic area



Source: Own elaboration

The literature review found regular and exceptional patterns linked to the use of artificial intelligence in the education sector. The results indicate that computer science continues to be the leading area in the development and implementation of AI in university education. However, as an increasingly common, albeit unusual, behavior, the social sciences have begun to integrate these technologies more actively, demonstrating that even the search for general information or basic knowledge is increasingly being influenced by the use of AI.

Figure 5. Classification of types of scientific documents related to AI



Source: Own elaboration

The final findings of the literature review indicate that more than 3,000 documents are grouped into articles and conference papers, while the cumulative output up to 2025 exceeds 4,000 works. This increase shows rapid growth since 2020, when research in artificial intelligence grew by more than 60%. The analysis revealed that two expressions frequently appeared in searches conducted on ScienceDirect and Scopus: the relationship between artificial intelligence and robotics, as well as the appropriate use of artificial intelligence. These ideas mark the most prominent research trends.

Research that directly responded to variables in the field of education was selected to analyze the effect of artificial intelligence on the digital education model. Following this criterion, a categorization was made based on a comparison between the SJR and Scopus databases, taking into account indicators such as the number of citations and impact factors.

The article “Digital game-based learning: Towards an experiential gaming model” is one of the most cited in this list, with more than a thousand academic citations. This is considered an atypical case because its perspective focuses on education through video games as an experimental alternative to the conventional educational model.

Likewise, the article “Machine learning: Trends, perspectives, and prospects” stands out for having a very high number of citations, exceeding several thousand. This case is considered an example of how machine learning research can be implemented from platforms that improve continuous learning with assisted education tools for all types of education and how these processes are becoming an emerging methodology for digital education.

In conclusion, the future of digital education is influenced by the operation of artificial intelligence tools and how they evolve with human knowledge to become more interpretive and humanizing, so their adoption within education provides facilities and innovation to generate new content that translates into scientific knowledge.

a. PRISMA 2020 Analysis

The PRISMA 2020 methodology was used, including its checklists and corresponding flowchart, to systematize and obtain final results from the scientific article review process. The PRISMA 2020 statement was used (including the lists of indicators and variables within the search flow), which included all review articles from the complete search list comprising 9,324 items, some of which included subtopics corresponding to the study indicators defined by the keywords “digital education model” and “artificial intelligence.” Structured abstracts of systematic reviews presented in journals and conferences were included. This yielded the following results:

Table 1. *PRISMA 2020 analysis applied to the AI study*

PRISMA 2020 Main Checklist

TITLE			
Title	1	Identify the report as a systematic review.	artificial intelligence
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	digital education model
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Measure the good use of artificial intelligence
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	usage dependency
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Scopus
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	education
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	peer review
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	independent researchers
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	data analysis
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	citation index
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	review not applied
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	relevant investigations
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item 5)).	tabulations
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	statistics
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	standardization of the mean
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	meta-analysis
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	meta-regression
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	number of publications
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	data collection
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	deductive method
RESULTS			

Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	article review
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	cited studies
Study characteristics	17	Cite each included study and present its characteristics.	educational studies
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	plagiarism
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	credible interval
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	author contributions
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	credible interval
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	published results
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	published results
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	credible interval
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	credible interval
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	credible interpretation
	23b	Discuss any limitations of the evidence included in the review.	study limitations
	23c	Discuss any limitations of the review processes used.	study limitations
	23d	Discuss implications of the results for practice, policy, and future research.	policy limitations
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	registration number
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	review protocol
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	review
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	non-financial support
Competing interests	26	Declare any competing interests of review authors.	most cited
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	public

PRISMA Abstract Checklist

TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	Yes
Synthesis of results	6	Specify the methods used to present and synthesize results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes
Registration	12	Provide the register name and registration number.	Yes

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *MetaArXiv*. 2020, September 14. DOI: 10.31222/osf.io/v7gm2. For more information, visit: www.prisma-statement.org

Source: Own elaboration

b. VOSViewer analysis

In the second stage, a bibliometric analysis was performed to examine research trends at the intersection of AI, digital education, and teaching tools during the period 1975-2025. To this end, the Scopus and ScienceDirect databases were used, selected for their broad scope and recognition in the academic community. Specific keywords related to AI were defined to retrieve relevant documents, so that the search was divided into two concurrent fields that allowed for better visualization of knowledge and learning of the generative artificial intelligence model. For this purpose, a sequence data table was structured for the process (see Table 2).

Table 2. Search strategy

Tabla 1. Estrategia de búsqueda

AI AND knowledge	AI AND impact
(TITLE-ABS-KEY (artificial AND intelligence) AND TITLE-ABS-KEY (digital education model AND teaching tools)) AND PUBYEAR > 2015	(TITLE-ABS-KEY (artificial AND intelligence) AND TITLE-ABS-KEY (good use AND impact)) AND PUBYEAR > 2015

AI AND knowledge

AI AND impact

(TITLE-ABS-KEY (artificial AND intelligence) AND TITLE-ABS-KEY (digital education model AND teaching tools)) AND PUBYEAR > 2015

(TITLE-ABS-KEY (artificial AND intelligence) AND TITLE-ABS-KEY (good use AND impact)) AND PUBYEAR > 2015
 Source: Own elaboration
 Graphic gamification was handled as a chain of interrelationships around scientific searches and two groups of variables, namely artificial intelligence in knowledge and artificial intelligence and its impact.
 Figure 6. VOSViewer analysis of AI
 Source: Own elaboration
 c. Criticism of the supplanting of artificial intelligence in scientific knowledge
 This criticism highlights that the proper use of AI can improve learning and research techniques; however, its misuse can lead to total dependence on and stagnation of scientific knowledge. An important look at digital educational processes using tools that facilitate the abstraction of knowledge is both questionable and approved, which is a paradigm between the proper use and impact of artificial intelligence on contemporary scientific knowledge in learning. The concept of artificial intelligence should not stray from the fact that it is a reality and creation of humanity, which must remain under its control and should not be unbalanced, as it cannot be totally autonomous. However, thanks to this transformation and evolution, it has proven capable of making its own decisions that, in the long run, will not be unethical or dehumanizing, which would affect the perception of good and evil in terms of an axiom. From this important point of action, hermeneutics, as the art of interpretation, is the key

to knowing how to understand and learn from artificial intelligence so that the techniques of its use and the methodology of its operation are understood and interpreted appropriately without hindering scientific knowledge and the autonomous advancement of educational societies. It is of paramount importance to maintain innovation and good research practices in order to generate agents of change who are not dependent. Therefore, the following critique will interrelate its proper use from a practical standpoint and how it has evolved within the scientific field in research that has provided clues that artificial intelligence may at some point supplant learning and knowledge guided by basic thought dynamics. The limitations of artificial intelligence make the model highly dependent on quality data translated into performance variables, so a composite algorithm can generate a definition of the reality of the design required and a specific choice of urban context, for which AI algorithms are only as good as the data they receive. Incorrect or incomplete data can lead to erroneous results. As a major concern generated by AI, the ethics and systemic evaluation of knowledge is questionable since the elements of identification, even in the Latin American educational system and in influence with the case study, do not allow us to perceive the limits of the application of artificial intelligence and to what extent it is known that the student has generated new knowledge or is emulated by AI or assisted robotics. In summary, while AI offers interesting possibilities for improving education, it also raises serious ethical, social, and practical concerns. Addressing these criticisms involves finding a balance between leveraging technology to improve education while ensuring equity, privacy, and preserving the human elements of teaching.

Discussion

Over the last 15 years, research on AI and education has grown significantly, with thousands of publications indexed in databases such as Web of Science and Scopus. A bibliometric analysis detected more than 5,945 articles published between 1975 and 2025, focusing on topics such as adaptive learning, applied machine learning, intelligent tutors, educational robotics, learning analytics, and neural networks applied to the educational context.

The results confirm that the use of artificial intelligence generates great interest among the scientific community in citations of scientific contributions to digital education models and their tools, with 1,078 citations. This attributes the field of technological innovation and social sciences as generating an important

contribution to this type of literature review. The contributions of artificial intelligence to digital education models have been around since 1975, which means that it is not a new science, but rather one that is constantly being reshaped. A look at how it evolves and develops has generated particular interest, as in just 10 years of literature review, it has generated more than 80% of contributions at a general level, with scientific articles on the operation and execution of educational models using artificial intelligence technologies as the means of dissemination.

Through the PRISMA 2020 analysis, it was found that, with respect to the 27 variables entered for data processing, contributions in artificial intelligence propose an upward trend in this new year 2025, which may remain stable and generate new relevant contributions to assisted robotics and the ability to adopt artificial intelligence from the perspective of advanced science. This could be a new teaching model, determining the correct methodology, use, and estimation of the scientific knowledge generated to promote the deduction of content.

However, the dependence on and lack of deductive interest in the knowledge being generated could lead to a limitation of critical thinking and autonomy among students, causing a slowdown in the knowledge curve and thus expanding the dominance of artificial intelligence over general knowledge and not promoting a more specialized cognitive development in generating critical professionals. Therefore, the preservation of knowledge must have limitations on the use of generative artificial intelligence, establishing rules of use and management that avoid altering the ethics and development of new knowledge.

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