# PIXEL BIT

Nº 70 MAYO 2024
CUATRIMESTRAL

e-ISSN:2171-7966
ISSN:1133-8482

## Revista de Medios y Educación

Píxel-Bit. Revista de Medios y Educación. 2024 - ISSN: 1133-8482. e-ISSN: 2171-7966.

# PIXEL-BIT

## REVISTA DE MEDIOS Y EDUCACIÓN

**Nº 70 - MAYO- 2024**

https://revistapixelbit.com

EDITORIAL UNIVERSIDAD DE SEVILLA

Ciencias de la Educación

**PIXEL-BIT**
REVISTA DE MEDIOS Y EDUCACIÓN
**MAYO 2024**

# Nº 70

## EQUIPO EDITORIAL (EDITORIAL BOARD)



Píxel-Bit. Revista de Medios y Educación. 2023 - ISSN: 1133-8482. e-ISSN: 2171-7966.

Píxel-Bit. Revista de Medios y Educación. 2023 - ISSN: 1133-8482. e-ISSN: 2171-7966.

## FACTOR DE IMPACTO (IMPACT FACTOR)

SCOPUS Q1 Education: Posición 236 de 1406 (83% Percentil). CiteScore Tracker 2022: 5,6 - Journal Citation Indicator (JCI). Emerging Sources Citation Index (ESCI). Categoria: Education & Educational Research. Posición 257 de 739. Cuartil Q2 (Percentil: 65.29) - FECYT: Ciencias de la Educación. Cuartil 1. Posición 16. Puntuación: 35,68- DIALNET MÉTRICAS (Factor impacto 2021: 1.72. Q1 Educación. Posición 12 de 228) - REDIB Calificación Glogal: 29,102 (71/1.119) Percentil del Factor de Impacto Normalizado: 95,455- ERIH PLUS - Clasificación CIRC: B- Categoría ANEP: B - CARHUS (+2018): B - MIAR (ICDS 2020): 9,9 - Google Scholar (global): h5: 42; Mediana: 42 - Journal Scholar Metric Q2 Educación. Actualización 2016 Posición: 405a de 1,115- Criterios ANECA: 20 de 21 - INDEX COPERNICUS Puntuación ICV 2019: 95.10

*Píxel-Bit, Revista de Medios y Educación* está indexada entre otras bases en: SCOPUS, Fecyt, DOAJ, Iresie, ISOC (CSIC/CINDOC), DICE, MIAR, IN-RECS, RESH, Ulrich's Periodicals, Catálogo Latindex, Biné-EDUSOL, Dialnet, Redinet, OEI, DOCE, Scribd, Redalyc, Red Iberoamericana de Revistas de Comunicación y Cultura, Gage Cengage Learning, Centro de Documentación del Observatorio de la Infancia en Andalucía. Además de estar presente en portales especializados, Buscadores Científicos y Catálogos de Bibliotecas de reconocido prestigio, y pendiente de evaluación en otras bases de datos.

## EDITA (PUBLISHED BY)

Grupo de Investigación Didáctica (HUM-390). Universidad de Sevilla (España). Facultad de Ciencias de la Educación. Departamento de Didáctica y Organización Educativa. C/ Pirotecnia s/n, 41013 Sevilla.
Dirección de correo electrónico: revistapixelbit@us.es . URL: https://revistapixelbit.com/
ISSN: 1133-8482; e-ISSN: 2171-7966; Depósito Legal: SE-1725-02
Formato de la revista: 16,5 x 23,0 cm

**PIXEL-BIT**
REVISTA DE MEDIOS Y EDUCACIÓN

# Nº 70

MAYO 2024

## Índice



Píxel-Bit. Revista de Medios y Educación. 2024 - ISSN: 1133-8482. e-ISSN: 2171-7966.

PIXEL-BIT
e-ISSN: 2171-7966
REVISTA DE MEDIOS Y EDUCACIÓN
MEDIA & EDUCATION JOURNAL

# Analysis of the Use of Artificial Intelligence in University Education: A Systematic Review

## Análisis del uso de la inteligencia artificial en la educación universitaria: una revisión sistemática

**Dr. Óscar López-Regalado**
Docente a tiempo completo. Universidad César Vallejo, Perú

**Dr. Nemecio Núñez-Rojas**
Docente a tiempo completo. Universidad San Ignacio de Loyola, Perú

**D. Óscar Rafael López-Gil**
Interno de Medicina Humana. Universidad Católica Santo Toribio de Magrovejo, Perú

**Dr. José Sánchez-Rodríguez**
Profesor Titular de Universidad. Universidad de Málaga, España

**Recibido:** 2024/01/07; **Revisado:** 2024/01/31; **Aceptado:** 2024/04/24; **Online First:** 2024/04/29; **Publicado:** 2024/05/01

**RESUMEN**
The frequent changes in university education have been structurally disrupted by the incorporation of artificial intelligence (AI), through the use and application by students and professors in the teaching-learning process. The objective was to analyze and interpret the results of artificial intelligence in university education and assess its contributions in the period from 2019 to 2023. The method was applied systematic and bibliometric review to answer the specific research questions, using clear, systematic and replicable search methods; A universe of 917 publications indexed in Scopus, WoS and PubMed was accessed and a sample of 59 scientific articles was selected. The results indicate that most of the publications have been carried out in China, followed by Spain and the United States, there is also evidence of little collaboration between researchers, dispersion in specific topics and isolation in small networks. In universities, the application of artificial intelligence tools is evidenced, in their correct use for the development of deep learning with the activation of higher cognitive processes in students, who require the pedagogical guidance of teachers trained in this subject.

**ABSTRACT**
Frequent changes in university education have been structurally disrupted by the incorporation of artificial intelligence (AI), through the use and application by students and professors in the teaching-learning process. The objective was to analyze and interpret the results of artificial intelligence in university education and assess its contributions in the period from 2019 to 2023. The method was applied systematic and bibliometric review to answer the specific research questions, using clear, systematic and replicable search methods; a universe of 917 publications indexed in Scopus, WoS and PubMed was accessed and a sample of 59 scientific articles was selected. The results indicate that most of the publications have been made in China, followed by Spain and the United States; there is also scarce collaboration among researchers, dispersion in specific topics and isolation in small networks. In universities, there is evidence of the application of artificial intelligence tools, in their correct use for the development of deep learning with the activation of higher cognitive processes in students, who require the pedagogical guidance of teachers trained in this subject.

**KEYWORDS · KEYWORDS**
Artificial intelligence; college education; teaching; learning; research.
Inteligencia artificial; educación universitaria; enseñanza; aprendizaje; investigación.

## 1. Introduction

Technological progress has transformed global behaviors and habits, especially in communication, interaction, and information consumption, thanks to Information and Communication Technologies (ICTs) that are now an integral part of daily life. In this context, there is a need for the world's educational systems to evolve and, in particular, for universities to adapt to the social trends and practices of the moment (Bozkurt et al., 2021).

In this context, Artificial Intelligence (AI) is one of the concepts with exponential development in recent months, in different fields of human knowledge, including education. AI originated in 1950 and was first implemented in 1956. It was conceived as computer systems that perform cognitive tasks similar to human mental ones, including machine learning, natural language processing, data mining, neural networks, and problem-solving algorithms. (King, 2023; Kit et al., 2021; Rangel-de Lázaro & Duart, 2023).

AI has the potential to be used in different areas of science; In the field of education, it contributes to the automation of administrative, pedagogical tasks, support within the classroom for students and teachers. In addition, outside the school environment, it serves as support for the performance of academic work for both (Fennel-Lucena et al., 2019). However, on the academic side, it is still not contributing to the development of higher thinking such as critical thinking, problem-solving, creativity, and knowledge management (Bates et al., 2020); in university education, there is a lack of critical reflection on: the pedagogical, ethical, metacognitive, evaluation and academic integrity implications (Bozkurt et al., 2021; Khosravi et al., 2022); likewise, in education there is a lot of concern about generative AI around teaching, learning, originality and plagiarism as ethical considerations for a more connected world in the field of education (Chatterjee & Dethlefs, 2023; Lim et al., 2023).

In university higher education, AIs must be taken full advantage of, developing precise and specific language, in order to understand how AI-powered technologies affect the dynamics of teaching and learning processes (Bearman et al., 2023).

The advancement of AI and emerging computing technologies such as: quantum computing, wearable devices, robots, sensing devices, wireless devices, and 5G, can be used for teaching, learning, and educational management (Gwo-Jen et al., 2020).

The teaching of AI got its start in college education, when advanced programming educators struggled to convey ideas and concepts to K-12 students about syntax-based programming (Kit et al., 2021), along these lines, educational software that incorporates artificial intelligence techniques is more frequently used with the intention of strengthening the teaching and learning process (Bates et al., 2020).

Universities must address AI in accordance with the socio-technical changes produced by transformations in the perception of authority and the capacity for action in the academic field (Bearman et al., 2023); it also deals with it from a dystopian point of view (present today), facing the challenges, opportunities and utopian (near future), assimilating the exponential growth of technology and the increase in the capacity of AI, which challenges labor practices and plays a fundamental role in the evolution of society (Bearman et al., 2023; Carson 2019; Moscardini et al., 2022).

The application of AI in higher education offers opportunities such as using AI-based learning models to ethics in their application, including: assessing student performance,

investigating the effectiveness of AI systems, re-evaluating existing educational theories, the importance of using big data analytics, as well as collaboration between humans and AI systems (Gwo-Jen et al., 2020).

Some university professionals are concerned that many students misuse AI tools for plagiarism, academic integrity, or misuse data in research (Bockting et al., 2023 cited in Crawford et al., 2023); however, university professors must be willing to generate new ways of learning (Crawford et al., 2023) adapting their style of teaching, assessment and development of teaching materials.

AI in universities affects: teaching, learning, teaching-learning process, educational management and research itself, to know it the following questions are posed: What is the annual production, the distribution by countries and sources that publish about the research?; What is the relationship between the titles, keywords of the author and the abstract of the articles? What is the temporal relevance of the keywords in the context of the study? How does collaboration between authors occur and the frequency of citation of the articles investigated? What is the contribution of AI to teaching, learning, teaching-learning process, educational management, and research in universities between 2019 and 2023?

To achieve the above, two objectives are proposed: 1. To analyze and interpret the bibliometric results of the biblioshiny on artificial intelligence in university education and 2. To evaluate the contribution of AI to teaching, learning, teaching-learning process, educational management and research in universities between 2019 and 2023.

## 2. Methodology

The purpose of the systematic and bibliometric review is to answer specific questions, through clear, systematic and replicable search methods, to identify the sources of information, reducing bias in selection (Arévalo et al., 2021; Lame, 2019). This is followed by a process of extracting and coding data from studies to synthesize findings and project knowledge that can be applied in practice.

### 3.1. Search strategy

The search was carried out with descriptors in English related to artificial intelligence, performing an advanced search in the international databases: Scopus, WOS and PubMed, using Boolean operators AND and OR, being the search algorithm: ("Artificial Intelligence" OR "Machine Learning" OR "Intelligent Tutoring Systems" OR "expert systems" OR "Machine Intelligence") AND ("Higher Education" OR "Institutions of Higher Education" OR "University Education" OR "Higher Education" Science Education"), the combination of operators and specific constraints yielded 484 papers in Scopus, 288 in WOS, and 145 in PubMed, for a total of 917 papers.

## 3.2. Inclusion and Exclusion Criteria

The inclusion criteria were precisely defined: 1) articles published between 2019 and 2023; 2) availability in English and Spanish; 3) access to the full text; 4) articles exclusively on university education or university higher education; 5) varied geographical origin and 6) open access.

On the other hand, the exclusion criteria were based on 1) documents not relevant to the research topic; 2) duplicates in databases; 3) theoretical, systematic, qualitative, and proposed review articles; 4) languages other than English and Spanish; 5) retracted scientific article; 6) Articles outside the years covered by the study. After these processes, Figure 1 excluded 858 documents and included 59 articles suitable for analysis.

## 3.3. Data collection

The data collection process was divided into five stages:

1. **Initial collection:** Scopus, WOS and PubMed articles were accessed, initially obtaining 917 documents. 60 duplicates were eliminated, and a review of titles and abstracts was conducted, resulting in the exclusion of 676 articles. At the end of this stage, there was a set of 181 articles.

2. **Extraction and formatting:** We extracted 99 articles from Scopus, 77 from WOS in bibtex or. bib format, and 5 from PubMed in .txt format. These documents were processed in the Rstudio tool, generating a file with a. Rproj.

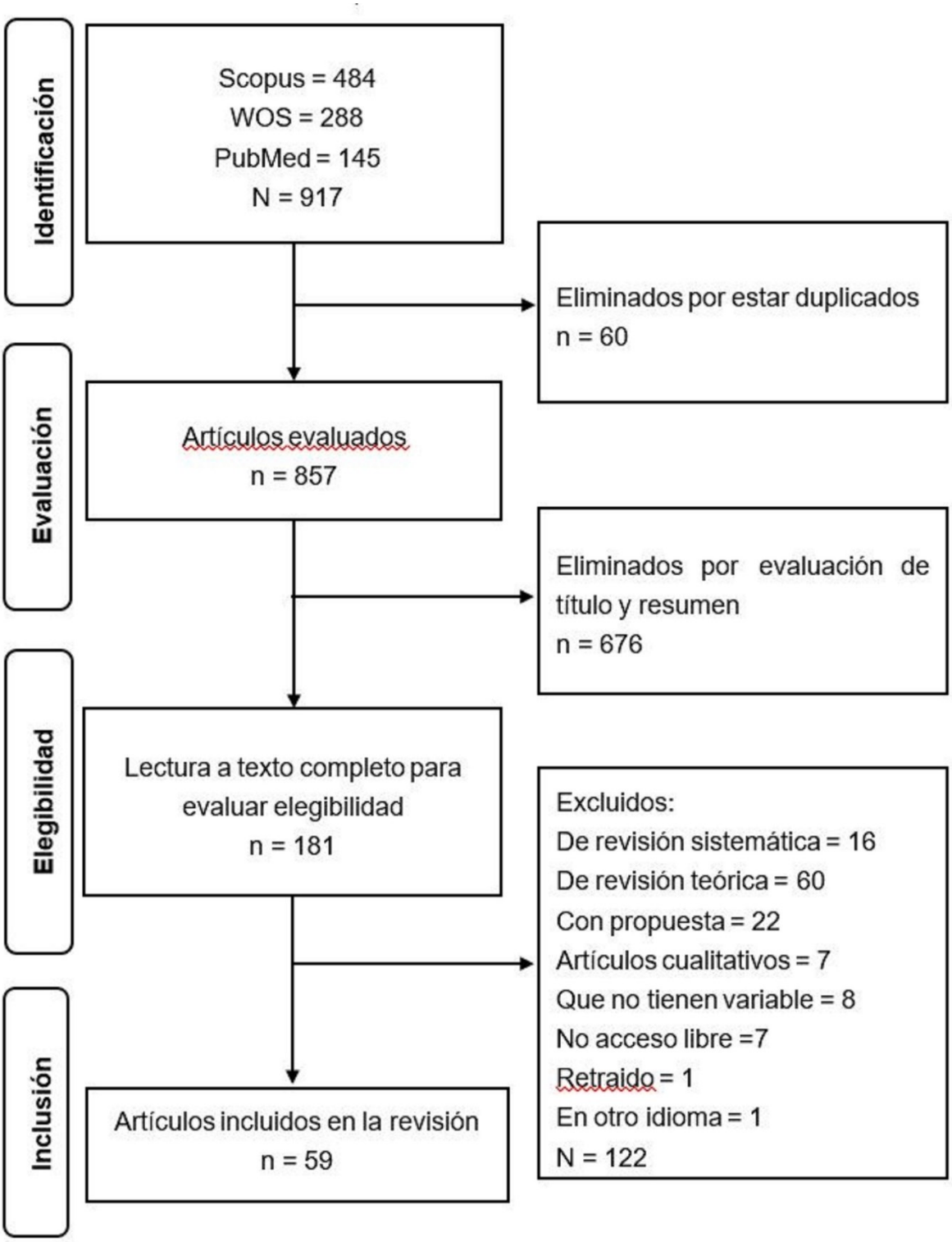
3. **Data integration:** The bibliometrix (biblioshiny) file with. Rproj to export an Excel file that will integrate the information from the three databases.

4. **Exhaustive analysis:** The articles were downloaded and read carefully in their entirety. Following this detailed analysis, 122 documents were excluded for reasons detailed in the PRISMA diagram.

5. **Final selection and analysis:** 59 articles were kept as a sample for analysis. These documents were quantitatively processed using the bibliometrix (biblioshiny) tool. In addition, a thorough and detailed reading of each article was carried out to develop a matrix of categories related to the objectives of the study.

**Figure 1**

*Exclusion and inclusion process*



## 3. Analysis and results

### 3.1. Quantitative bibliometric analysis

The research focuses on scientific articles published between 2019 and 2023 in Table 1, specifically on the relationship between artificial intelligence and university education. A total of 59 documents were selected according to strict quality criteria, identified in prestigious databases such as Scopus, WOS, and PubMed. Despite the short period considered, 204 keywords used by the authors were found. The lack of research carried out by a single author is remarkable, indicating the need to foster collaboration between researchers worldwide.

**Table 1**

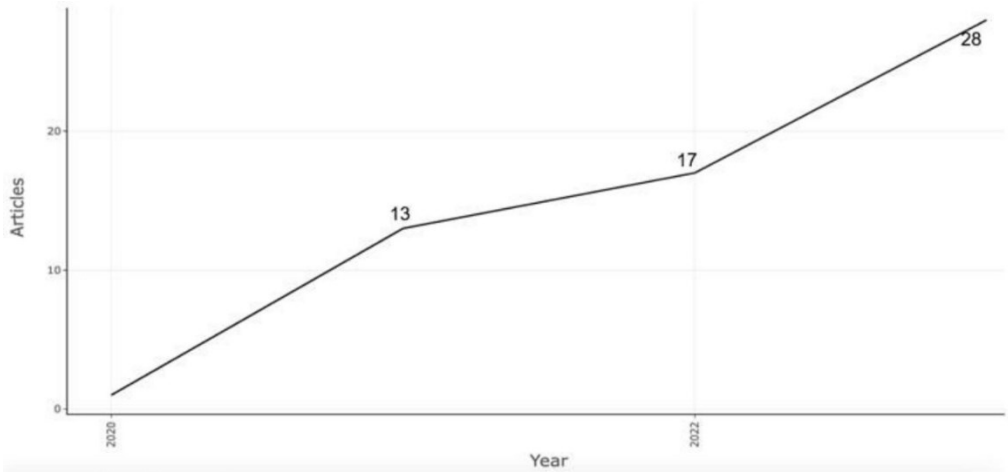
*Main Information*

| Description | Results |
|---|---|
| Time Frame | 2019-2023 |
| Sources (magazines) | 43 |
| Documents | 59 |
| Average Document Age | 0,78 |
| Average citations per document | 2.797 |
| References | 1485 |
| More Keywords (ID) | 111 |
| Author's Keywords (DE) | 204 |
| Authors | 191 |
| Single-author papers | 8 |
| Co-authors per document | 3.46 |
| Percentage of international co-authorship | 22.03 |

Note: Source: Data from biblioshiny

**Figure 2**

*Annual production*



The representation of the production of articles per year in Figure 2 shows that research activity was mainly concentrated between 2020 and 2023, with the last year being the most prominent, with 28 articles identified during the consultation in the databases on October 6 and 7. In contrast, the year 2020 had a reduced production, with only one article identified, and no relevant documents were found for the year 2019.

**Figure 3**

*Scientific production by country*

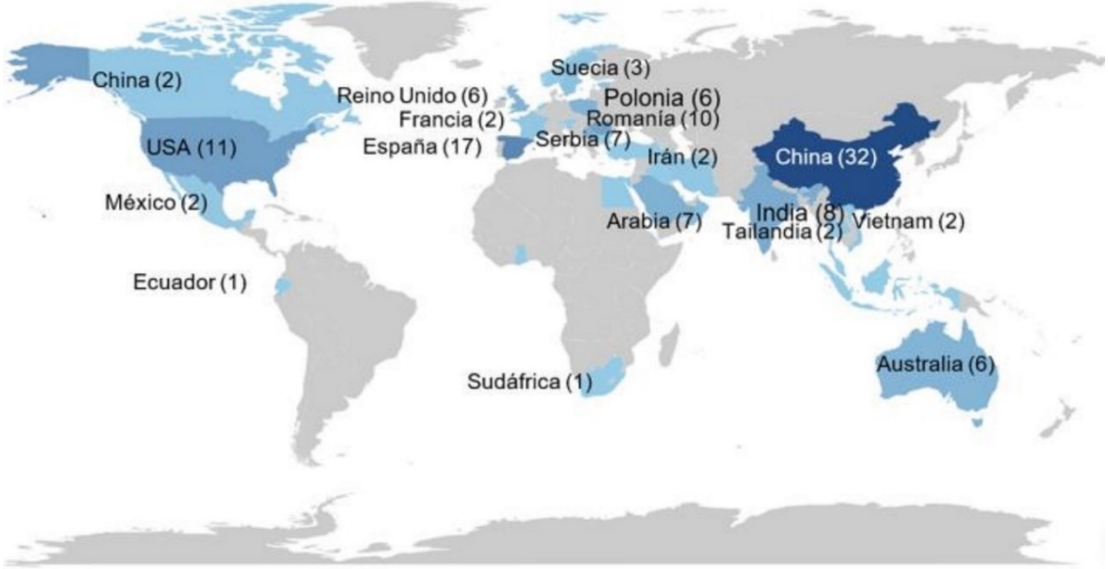



Figure 3 shows the geographical distribution of scientific production on the topic under investigation. China leads with a difference of 15 articles with respect to Spain, which in turn surpasses the United States by 6 articles. The differences between the other countries are minimal, with variations of just 1 article.

**Figure 4**

*Sources of publish. Bradford's Law*

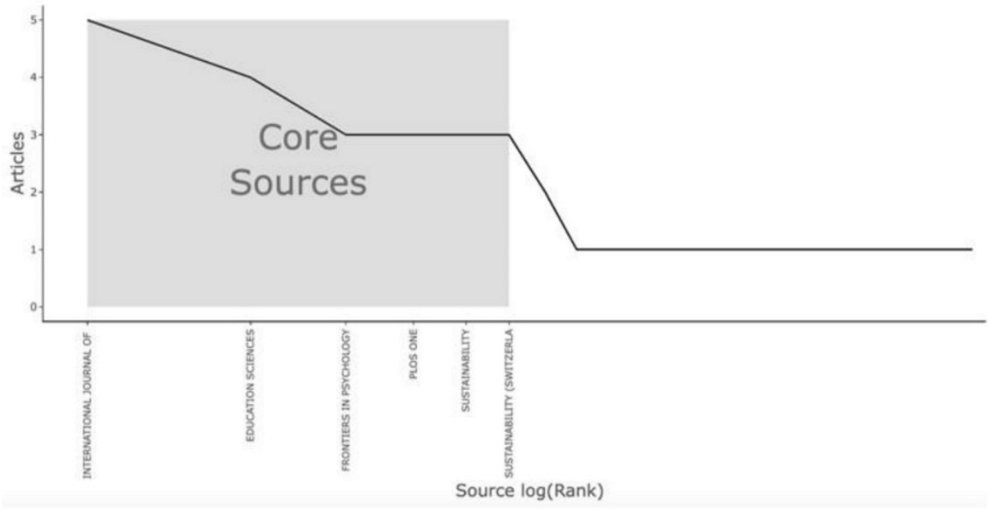


Figure 4 presents Bradford's law of dispersion, analyzing the growth of articles published in journals indexed in databases such as Scopus, WOS, and PubMed. In the highlighted gray area, a ranking of the 7 most prolific journals is shown, with a publication ranging from 2 to 5 articles. For example, the International Journal of Educational Technology in Higher Education leads with 5 articles, followed by Sustainability (Switzerland) with 2. In addition, to the right, there is a long line indicating that 36 journals have contributed 1 article each on the topic under investigation.

**Figure 5**

*Relationship between titles, author's keywords, and abstract*

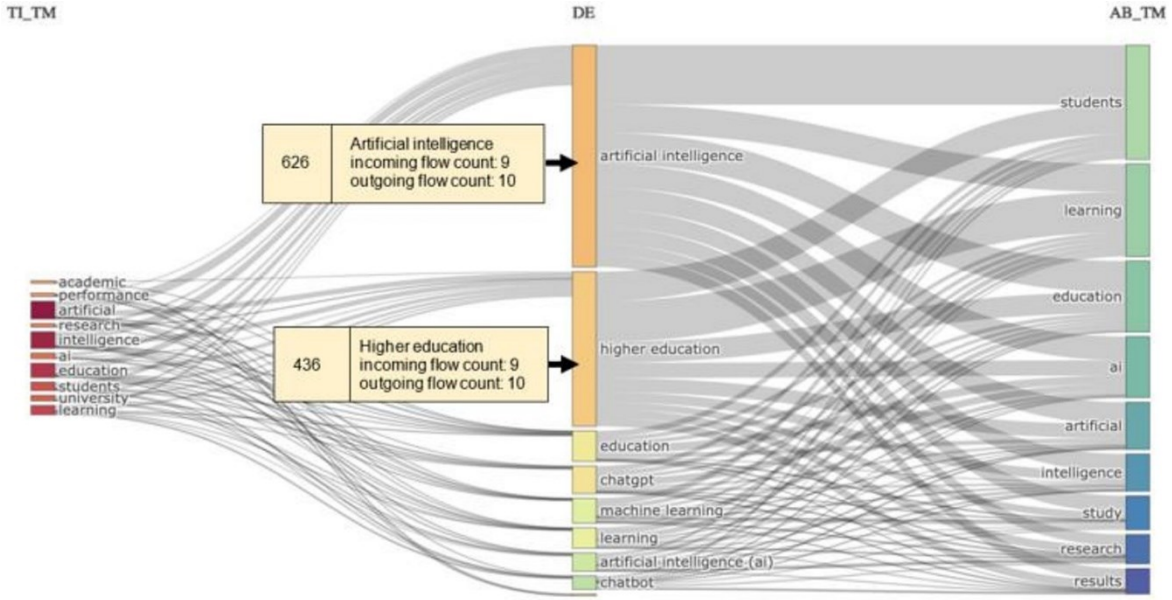



Figure 5 shows three columns representing the key fields of the articles investigated, with connecting lines of different thicknesses. The first column (TI_TM) highlights keywords such as "artificial intelligence" repeated 50 times, followed by "education" with 40. In the Author Keywords (ED) column, "artificial intelligence" is the most recurrent with 626 occurrences, followed by "higher education" with 436. In the summaries column (AB_TM), "students" is repeated 322 times and "learning" 261 times, while "results" is the least used with 72 repetitions. A significant relationship between "artificial intelligence" and "higher education" is observed in the titles and abstracts of the articles investigated.

**Figure 6**

*Relevance and time density of keywords*

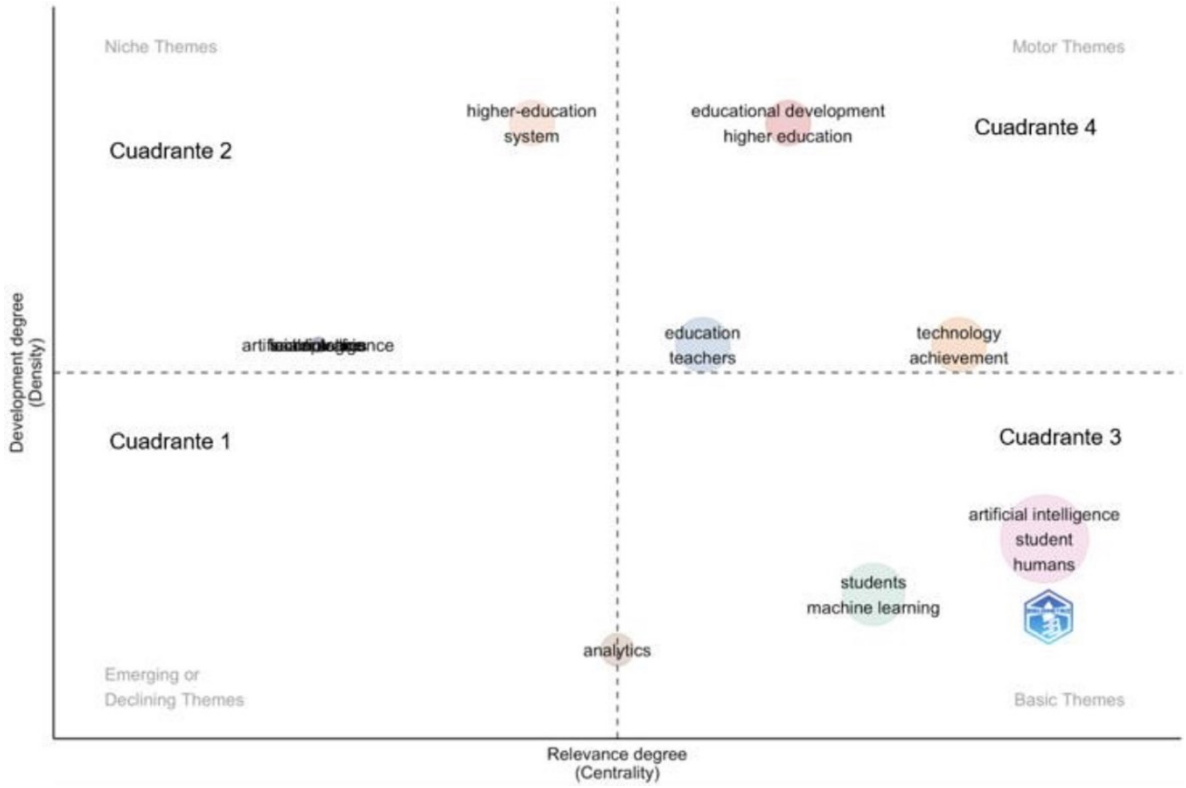



Figure 6 presents four quadrants that indicate the relevance and degree of keyword development. In quadrant one, the word "analytics" shows less relevance and development. In quadrant two, "higher education" and "system" have less relevance but a higher degree of development, with potential to stand out in future research. Quadrant three highlights keywords such as "artificial intelligence," "students," and "machine learning," suggesting importance but less development. In the fourth quadrant, "educational development" and "higher education" are relevant and dense terms, promoting future research. Other keywords such as "education", "teachers", "technology" and "achievements" may also be relevant for future research, generating new trends in the area.

Figure 7 shows keywords extracted from the articles analyzed. "Artificial intelligence" (8 times) stands out, followed by "students" (4 times) and "analytics", "education", "student" and "technology" (3 times each). Other words have fewer repetitions. It is important to note that the most frequent word is part of one of the variables investigated in this study.

**Figure 7**

*Word cloud used by the authors*


**Figure 8**

*Collaboration between authors and the frequency of citation of articles*

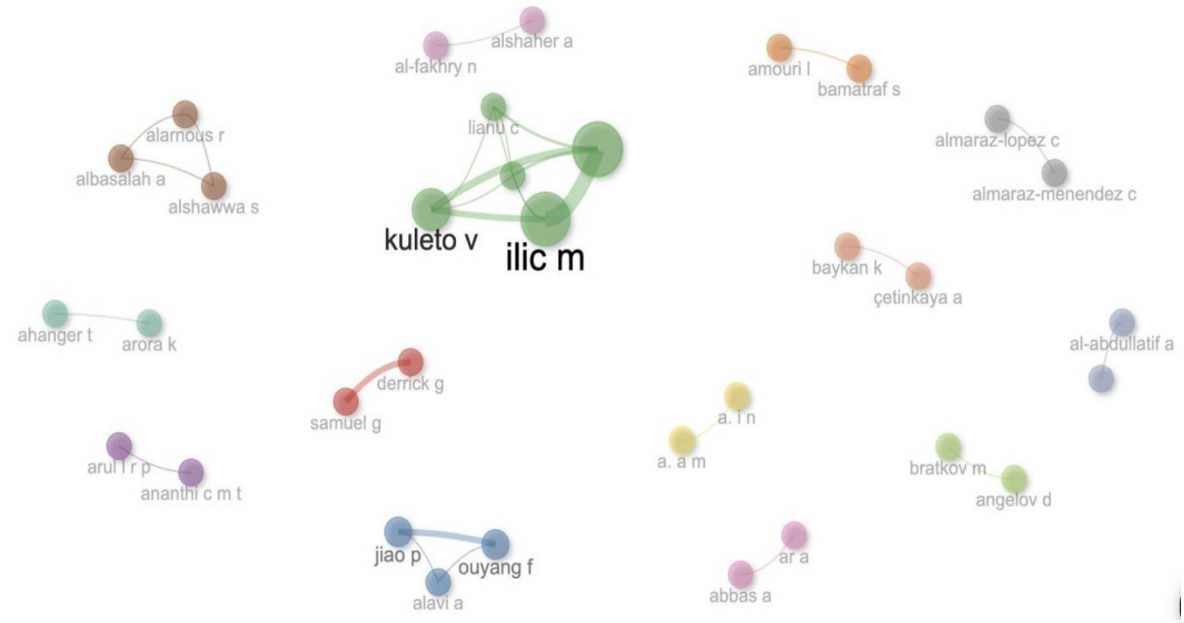



Figure 8 shows the cooperative relationships between authors in research, with colors representing clusters and nodes representing authors. A predominant network with key nodes such as ilic m, kuleto v and lianu c is highlighted, suggesting a strong collaboration between several authors. In addition, there are two additional networks and several smaller ones formed by two authors. This visualization indicates a limited number of collaborative

networks worldwide on the topic, highlighting the need to strengthen collaboration among researchers in this field.

**Figure 9**

*Co-citation Network*

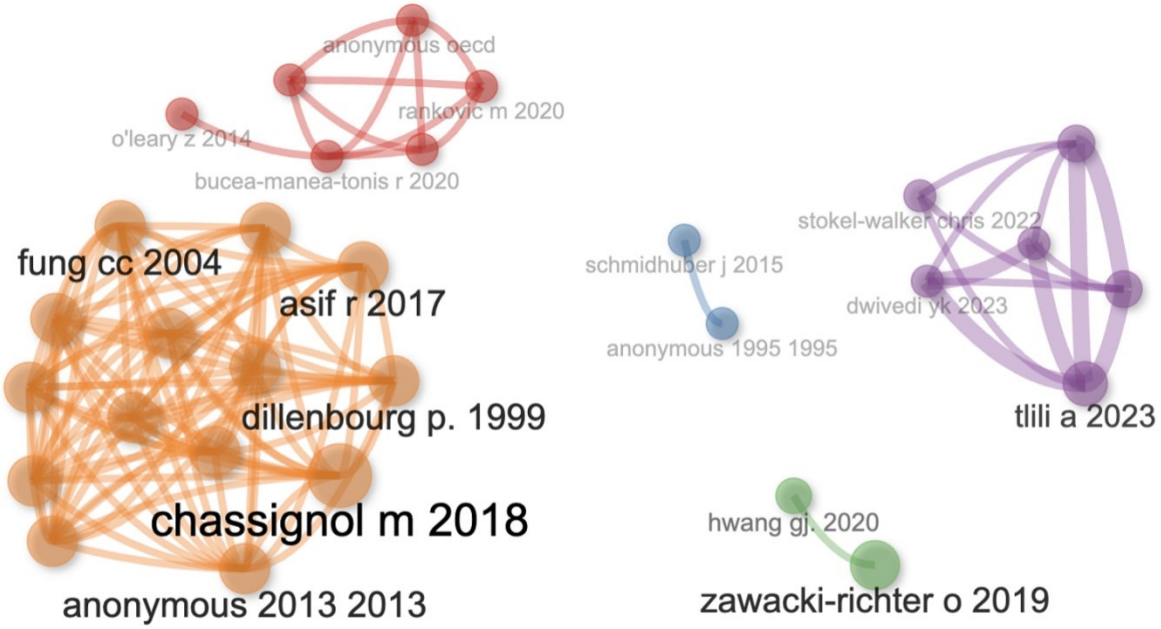



Figure 9 shows colored clusters representing groups of authors citing others within the same cluster. For example, in the orange cluster we can see authors who cite chassignol m 2018 and others who also cite it. This is repeated in the red and purple clusters, indicating co-citation patterns that reflect trends and areas of interest in research. It would be valuable to analyze these clusters to identify topics of common interest, relationships between research and influential authors.

## 3.2. Qualitative bibliometric analysis

**Table 2**

AI's Contribution to the Categories of University Education

| Author(s) | Application |
|---|---|
| | **Teaching** |
| (Faraj, 2022) | Artificial intelligence can help students develop the skills of the future; it is necessary for universities to implement AI in teaching to help students achieve their goals. |

| Author(s) | Application |
|---|---|
| (Ramallal et al., 2022) | Information and communication technologies with artificial intelligence (ICT-AI), seen from the perspective of virtual training with artificial intelligence (FVIA), are considered emerging tools with the potential to enrich teaching at all levels. |
| (Nikonova et al., 2023) | The use of mobile applications in language teaching is advancing and showing effectiveness even without artificial intelligence algorithms; however, it is suggested to use it in the education systems of higher institutions. |
| (Guan et al., 2021) | The mental state of teachers favors the academic level and the teaching capacity, based on the management of artificial intelligence. |
| | **Learning** |
| (Huang et al., 2022) | The efficacy of different AI-based self-regulated learning strategies in a game-based learning environment was evaluated. |
| (Ilić et al., 2021) | Serbian universities have implemented artificial intelligence to encourage analytical learning and greater student engagement during the educational process. |
| (Li et al., 2021) | The application of a higher education system based on artificial intelligence must be analyzed in detail to ensure effective learning. |
| (Walczak & Cellary, 2023) | Universities need to prepare students for continuous learning, and artificial intelligence can help. |
| (Kelly et al., 2023) | Generative AI tools are transforming higher education, ensuring the academic integrity of students. |
| (Chaudhry et al., 2023) | The implementation of artificial intelligence through ChatGPT in higher education has the potential to improve student learning and academic performance. |
| and(Wang, 2023) | Artificial intelligence can help students learn languages in a personalized and collaborative way. |
| (Currie et al., 2023) | Artificial intelligence through GPT3.5 could be adopted to enrich student learning in medical imaging. |
| (Nazari et al., 2021) | The AI-powered Grammarly tool app enhances the learning of academic writing in the English language. |

| Author(s) | Application |
|---|---|
| (Yang et al., 2023) | The application of gamified artificial intelligence educational robots (AIERs) provides information, evaluation, and personalized feedback during learning. |
| (Ananthi & Arul, 2023) | Using the Random Forest method powered by the XGBoost algorithm, students believe that online learning is most effective when every student receives the lecture, regardless of the number of students present in the virtual classroom. |
| (Elkhodr et al., 2023) | Undergraduate and graduate ICT students saw ChatGPT as a valuable and engaging tool for learning, showing a lot of interest in employing artificial intelligence. |
| (Al-Abdullatif et al., 2023) | The positive influence of the Bashayer chatbot system, as an artificial intelligence-based tool, to improve learning motivation among graduate students. |
| (Alqahtani, 2023) | The application of artificial intelligence through machine learning makes learning in electronic environments more flexible. |
| (Wang et al., 2022) | He believes that student-centered content design can help students learn AI concepts without the limitations of programming syntax, questions, and practical learning tasks. |
| (Zhu & Ren, 2022) | Artificial intelligence plays an important role in learning because it is related to the understanding of content and teaching methods. |
| | **Teaching – Learning** |
| (Leoste et al., 2021) | Emerging technologies (ETs) have the potential to transform teacher teaching and student learning. |
| (Kuleto et al., 2021) | Artificial intelligence can provide individualized learning experiences for students and teachers to tailor their teaching methods and strategies. |
| (Chiu, 2023) | Teachers must be willing to co-learn those who learn the most have the facility to teach and develop greater learning using generative AI. |
| (Essel et al., 2022) | The chatbot (AI) in education generated high student satisfaction by providing instant feedback, generating a positive change in the teaching, and learning process. |
| (Bucea-Manea-Țoniş et al., 2022) | Artificial intelligence personalizes the learning process, making a significant contribution to teaching. |

| Author(s) | Application |
|---|---|
| (McGrath et al., 2023) | University professors showed low levels of understanding about artificial intelligence, they need to have more training to use them in teaching; thinking that it could serve as a support for students. |
| (Kelly et al., 2023) | The ethical use of generative artificial intelligence (GenAI) in academic activity and student learning; teaching practice, teaching and assessment with their benefits and limitations. |
| | **Educational Management** |
| (Quy et al., 2023) | AI is an inevitable trend in higher education, requiring an effort from institutions to overcome legal, technological, and organizational challenges. |
| (Grabińska et al., 2021) | Artificial intelligence is forcing universities to adapt their curricula and teaching methods, developing new skills to succeed in the future. |
| (Benhayoun-Sadafiyine & Lang, 2021) | Higher education needs to align academic training in AI with market needs and provide teachers with an overview of learning outcomes in their subjects. |
| (Ouyang et al., 2023) | The proposal of an integrated approach to AI and feedback encouraging personalized learning and the implications between the development of AI models and educational application. |
| (Almaraz-López et al., 2023) | University students' interest in artificial intelligence is greater, and there is a need to provide AI training in all disciplines, to use them in a safe and responsible way. |
| (Wang et al., 2021) | Universities established AI decision systems to help solve complex decision-making problems with the participation of professors. |
| (Gupta & Mishra, 2022) | Predictive analytics models must have large samples and have the participation of teachers and act as predictors of students' academic performance. |
| (Tominc & Rožman, 2023) | It proposes practical guidelines for educators, focused on enhancing students' preparation for AI, adapting curricula to integrate essential skills into today's work landscape. |
| (Dealer, 2022) | University institutions make the decision to invest in intelligent tutoring systems, technologies, and artificial intelligence, for the digital training of teachers and students. |

| Author(s) | Application |
|---|---|
| (Jiao et al., 2022) | The AI-based quantitative prediction model can be used to assess and predict learning performance, class participation, and student performance online. |
| (Chiu, 2023) | Curricula should be reformulated in initial teacher training, incorporating generative artificial intelligence in the classroom, being a new literacy for teacher teaching. |
| (Romero-Rodriguez et al., 2023) | The acceptance of ChatGPT artificial intelligence by university students leads to a rethinking of teacher training, learning, research, and educational practice in higher education. |
| (Rezapour & Elmshaeuser, 2022) | Universities should provide face-to-face, synchronous, and asynchronous classes facilitating learning in a healthy way and working on the financial aspect of students in order to avoid economic stress. |
| (Afzaal et al., 2023) | The AI-based approach paves the way for intelligent learning systems that automatically provide students with effective, data-driven recommendations. |
| (Subirats et al., 2023) | It was possible to determine student profiles, with artificial intelligence; They were very relevant to change the habits of the students, proposing gamification strategies. |
| (Martín-Núñez et al., 2023) | Higher education institutions and curriculum designers can consider AI to create more impactful designs and learning experiences. |
| (Mahmmod et al., 2022) | The proposed model seeks to enable academic organizations to improve the academic performance of their students using artificial intelligence. |
| (Ilieva et al., 2023) | An analysis on the influence of intelligent chatbots on university education reveals that many students recognize their educational potential and have employed them. |
| (Ruiz-Rojas et al., 2023) | It highlights the relevance of using generative artificial intelligence tools and instructional design matrices to improve virtual classrooms and enrich the learning process. |
| (Sanabria-Z et al., 2023) | Merging physical and digital environments offers a route to investigate hybrid achievements in pedagogy in an agile and competitive way and integrate AI into learning management systems. |

| Author(s) | Application |
|---|---|
| (Saadé et al., 2023) | It highlights the need to develop training in IoT and AI, through institutional policies that offer financial support and services, to effectively integrate it into teaching practice. |
| (Akiba & Fraboni, 2023) | Academic advisors could leverage generative AI tools, such as ChatGPT, to address professional challenges for elementary school teachers. |
| (Rahman, 2022) | The findings highlight institutional challenges and student concerns such as the expansion of information technology infrastructure geographically and a government budget review to strengthen digital infrastructure in higher education. |
| (Çetinkaya et al., 2023) | The Cubic Support Vector (SVM) machine produces results that can motivate educators and parents to propel students toward careers in programming. |
| (Chan, 2023) | It proposes a framework of policies for the ecological education of artificial intelligence for integration in university environments, through pedagogy, governance, and operability, which guarantee the ethical use of AI in university teaching. |
| (Koć-Januchta et al., 2022) | The study highlights that books enriched with artificial intelligence facilitate more meaningful learning with less mental effort. |
| (Mohd et al., 2022) | With chatbots, a new model was sought, which would allow users to ask frequently asked questions on academic and university topics, which are used in administration and customer service. |
| (Bamatraf et al., 2021) | There are considerable ethical concerns about the social implications that artificial intelligence can generate, in terms of job loss and job changes. |
| (Parapadakis, 2020) | The successes of artificial intelligence in the industry can help in a variety of problem areas in education, providing some useful insights. |
| (Artiles-Rodriguez et al., 2021) | The use of conversational virtual agents as a tool to tutor university students' work, the data reveal a high level of student satisfaction with the use of Chatbots. |
| | **Research** |
| (Albasalah et al., 2022) | There is a very strong correlation between the objectives of joint scientific research between professors and university students of health sciences and humanities in university centers. |

| Author(s) | Application |
|---|---|
| (Samuel, Chubb, et al., 2021) | Ethics in this research should be based on public health, focusing on justice, population well-being, and equity rather than just protecting individuals from potential research risks. |
| (Samuel, Diedericks, et al., 2021) | It has been shown that research can be hindered by the stakeholders to whom the research is disseminated, which can have implications for the social responsibility of research and the political environment. |

## 4. Discussion

The review of the scientific literature on artificial intelligence applied to education includes key categories that we consider as regularities in the management of the training process of students. Such categories are learning, teaching, teaching-learning process, educational management and research.

In relation to learning, AI is easily applied by students at the educational levels that comprise basic education and higher education; However, it occurs at the level of information search, developing basic cognitive processes such as knowing and understanding oriented to superficial learning, characterized by freeing oneself from the task with minimal effort, although giving the feeling of complying with what is required; In contrast to the higher cognitive processes such as analyzing, synthesizing, evaluating, and creating, typical of deep learning, they would be unlikely to be developed autonomously by the student (Biggs & Tang, 2011). This type of learning requires a meaningful and adequate approach to the task, an appropriate background of knowledge, a high conceptual level and a well-structured one; requiring the pedagogical work of the teacher to use AI as a medium in education and extended reality as effective methodologies (Ilić et al., 2021).

The personalization of learning is one of the main opportunities offered by AI, with the student being the one who actively participates in the choice of educational content, in search strategies according to their specific needs (Jiménez-García et al., 2024). Similar studies on AI in a game-based learning environment with positive outcomes (Huang et al., 2022) and gamification (Yang et al., 2023), with systems such as the gamified artificial intelligence educational robot (GAIER), which simulates virtual teachers, who interact with students by providing information, evaluation and personalized feedback during learning; They significantly improve student performance and motivation.

In the teaching category, AI represents a challenge for the training of teachers so that they have the pedagogical and digital skills implied by innovation in teaching methods and the use of numerous tools that make up the broad concept of AI applied to education. For Russel quoted in (UNESCO, 2023), generative artificial intelligence, is an excellent aid for teachers due to its ability to provide content and dialogue with students; however, its development has to be controlled and supervised. The same author maintains, referring to the teacher, that, "his work will change, but we will always need teachers"; they will also

need to be familiar with the advancement of the latest AI technologies and how to effectively integrate them into their teaching practices (Alenezi et al., 2023).

As for the teaching and learning process, after the launch of ChatGPT at the end of 2022, it quickly spread to students and teachers to find a space for controversy in classrooms in schools and universities. The speed with which generative AI technologies are being incorporated into education systems in the absence of controls, standards, or regulation is alarming; For this reason, a guide was published to regulate AI in education, some of the guidelines being to establish an age limit of 13 years for the use of artificial intelligence in classrooms, to adopt data protection and privacy regulations, and to offer specific training to teachers, among others (UNESCO, 2023).

In education management, schools and universities need informed advice on how to interact with AI, as they argue (Quy et al., 2023) referring to this inevitable trend in higher education to overcome legal, technological, and organizational challenges; the 44 recommendations, grouped into different themes: planning AI in education policies; AI for education management and delivery; AI to support teaching and teachers, among other topics (UNESCO, 2019).

University authorities have to make the decision to implement the conditions to integrate AI into the training of professionals, through intelligent tutoring systems, technologies and artificial intelligence, which promote digital training for teachers and students (Dealer, 2022). Other institutional challenges such as the expansion of information technology infrastructure at the geographic level, connectivity at the country and universal level; technical training and government budget allocation to strengthen digital infrastructure in higher education (Rahman, 2022).

In relation to research, generative AI tools are having a huge impact on education and research, because they can generate text, images, video, music, programming codes, among others. About that (Burgos et al., 2023) They argue that we must incorporate AI as an allied tool, and know how to use it wisely and ethically. However, they point out that the process of researching and writing a scientific article requires the guidance and supervision of expert human researchers to ensure the accuracy, coherence, and credibility of the content.

## 5. Conclusions

A scientometric study was carried out on AI and its implications in university education, 917 publications indexed in high-impact databases such as Scopus, WoS and PubMed were accessed, selecting a sample of 59 publications between 2019 - 2023. Most of the publications have been made in China, followed by Spain and the United States, the source with the highest number of articles being the International Journal of Educational Technology in Higher Education and Sustainability (Switzerland). An aspect to highlight in the study is the lack of collaboration between researchers, which shows dispersion in specific topics and isolation in small networks.

In education, AI has rapidly disrupted the structures of educational institutions in terms of educational management, governance and strategic development policies, therefore, its

application is essential, which has generated short-term responses, but very few are being placed on the horizon that they demand for their correct use in the training of human beings and professionals who will be leading society in the coming years.

The different AI tools available through the internet demand the correct use for the development of deep learning with the activation of higher cognitive processes, since the findings show that AI helps enormously in terms of information, development of autonomous learning and immediate feedback to students. The methodology of teaching will change, but we will always need teachers.

## Authors´Contribution

**Conceptualization,** O.L.-R. and N.N.-R.**; data curation,** O.L.-R. and O.R.L.-R.**; formal analysis,** O.L.-R., N.N.-R. and J.S.-R.**; research,** O.L.-R., N.N.-R. and J.S.-R.**; methodology,** O.L.-R., N.N.-R. and O.R.L.-R.**; project management,** O.L.-R. R., N.N.-R. and O.R.L.-R.**; methodology,** O.L.-R., N.N.-R. and J.S.-R.**; project management,** O.L.-R. and N.N.-R.**; resources,** O.L.-R. and O.R.L.-R.**; and resources,** O.L.-R., N.N.-R. and J.S.-R.**; project management,** O.L.-R. and N.N.-R. R. and O.R.L.-R.**; software,** O.L.-R., O.R.L.-R. and J.S.-R.**; supervision,** O.L.-R., N.N.-R. and J.S.-R.**; validation,** O.L.-R., N.N.-R. and J.S.-R.**; writing: draft preparation,** O.L.-R., N.N.-R. and J.S.-R.**; writing: draft preparation,** O.L.-R., O.L.-R. and J.S.-R. R.**; writing: preparation of the original draft,** O.L.-R., N.N.-R., O.R.L.-R. and J.S.-R.**; drafting: revision and editing,** O.L.-R., N.N.-R. and J.S.-R.

## References


Afzaal, M., Zia, A., Nouri, J., & Fors, U. (2023). Informative Feedback and Explainable AI-Based Recommendations to Support Students' Self-regulation. *Technology, Knowledge and Learning*. https://doi.org/10.1007/s10758-023-09650-0

Akiba, D., & Fraboni, M. C. (2023). AI-Supported Academic Advising: Exploring ChatGPT's Current State and Future Potential toward Student Empowerment. *Education Sciences*, *13*(9), 885. https://doi.org/10.3390/educsci13090885

Al-Abdullatif, A. M., Al-Dokhny, A. A., & Drwish, A. M. (2023). Implementing the Bashayer chatbot in Saudi higher education: Measuring the influence on students' motivation and learning strategies. *Frontiers in Psychology*, *14*, 1129070. https://doi.org/10.3389/fpsyg.2023.1129070

Albasalah, A., Alshawwa, S., & Alarnous, R. (2022). Use of artificial intelligence in activating the role of Saudi universities in joint scientific research between university teachers and students. *PLOS ONE*, *17*(5), e0267301. https://doi.org/10.1371/journal.pone.0267301

Alenezi, M., Mohamed, A. M., & Shaaban, T. S. (2023). Revolutionizing EFL special education: How ChatGPT is transforming the way teachers approach language learning. *Innoeduca. International*

*Journal of Technology and Educational Innovation*, *9*(2), Article 2. https://doi.org/10.24310/innoeduca.2023.v9i2.16774

Almaraz-López, C., Almaraz-Menéndez, F., & López-Esteban, C. (2023). Comparative Study of the Attitudes and Perceptions of University Students in Business Administration and Management and in Education toward Artificial Intelligence. *Education Sciences*, *13*(6), 609. https://doi.org/10.3390/educsci13060609

Alqahtani, M. (2023). Artificial intelligence and entrepreneurship education: A paradigm in Qatari higher education institutions after covid-19 pandemic. *International Journal of Data and Network Science*, *7*(2), 695-706. https://doi.org/10.5267/j.ijdns.2023.3.002

Ananthi, Mary. T., & Arul, R. (2023). Ensemble Machine Learning Model for University Students' Risk Prediction and Assessment of Cognitive Learning Outcomes. *International Journal of Information and Education Technology*, *13*(6), 948-958. https://doi.org/10.18178/ijiet.2023.13.6.1891

Arévalo, B. M. D., Salazar, C. R. R., & López, Ó. (2021). Moodle platform for in-service teacher training. *Aloma: Revista de Psicologia, Ciències de l'Educació i de l'Esport*, *39*(2), Article 2. https://doi.org/10.51698/aloma.2021.39.2.75-83

Artiles-Rodríguez, J., Guerra-Santana, M., Aguiar-Perera, M. V., & Rodríguez-Pulido, J. (2021). Embodied conversational agents: Artificial intelligence for autonomous learning. *Pixel-Bit. Journal of Media and Education*, *62*, 107-144. https://doi.org/10.12795/pixelbit.86171

Bamatraf, S., Amouri, L., El-Haggar, N., & Moneer, A. (2021). Exploring the Socio-economic Implications of Artificial Intelligence from Higher Education Student's Perspective. *International Journal of Advanced Computer Science and Applications (IJACSA), 12*(6), Article 6. https://doi.org/10.14569/IJACSA.2021.0120641

Bates, T., Cobo, C., Mariño, O., & Wheeler, S. (2020). Can artificial intelligence transform higher education? *International Journal of Educational Technology in Higher Education*, *17*(1), 42. https://doi.org/10.1186/s41239-020-00218-x

Bearman, M., Ryan, J., & Ajjawi, R. (2023). Discourses of artificial intelligence in higher education: A critical literature review. *Higher Education*, *86*(2), 369-385. https://doi.org/10.1007/s10734-022-00937-2

Benhayoun-Sadafiyine, L., & Lang, D. (2021). Does higher education properly prepare graduates for the growing artificial intelligence market? Gaps identification using text mining. *Human Systems Management*, *40*(5), 639. https://doi.org/10.3233/HSM-211179

Biggs, J. B., & Tang, C. (2011). *Teaching for quality learning at university: What the student does* (4th edition). McGraw-Hill, Society for Research into Higher Education & Open University Press. https://acortar.link/abJZZt

Bozkurt, A., Karadeniz, A., Baneres, D., Guerrero-Roldán, A. E., & Rodríguez, M. E. (2021). Artificial intelligence and reflections from educational landscape: A review of AI studies in half a century. *Sustainability (Switzerland), 13*(2), 1-16. Scopus. https://doi.org/10.3390/su13020800

Bucea-Manea-Ţoniş, R., Kuleto, V., Gudei, S. C. D., Lianu, C., Lianu, C., Ilić, M. P., & Păun, D. (2022). Artificial Intelligence Potential in Higher Education Institutions Enhanced Learning Environment in Romania and Serbia. *Sustainability*, *14*(10), Article 10. https://doi.org/10.3390/su14105842

Burgos, L. M., Suárez, L. L., & Benzadón, M. (2023). Artificial intelligence ChatGPT and its usefulness in research: The future is already here. *Medicina (Buenos Aires), 83*(3), 500-503. https://acortar.link/47WUUz

Carson, J. T. (2019). Blueprints of distress?: Why quality assurance frameworks and disciplinary education cannot sustain a 21st-century education. *Teaching in Higher Education*, *24*(8), 1014-1023. https://doi.org/10.1080/13562517.2019.1602762

Çetinkaya, A., Baykan, Ö. K., & Kırgız, H. (2023). Analysis of Machine Learning Classification Approaches for Predicting Students' Programming Aptitude. *Sustainability*, *15*(17), Article 17. https://doi.org/10.3390/su151712917

Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education*, *20*(1), 38. https://doi.org/10.1186/s41239-023-00408-3

Chatterjee, J., & Dethlefs, N. (2023). This new conversational AI model can be your friend, philosopher, and guide ... And even your worst enemy. *Patterns*, *4*(1). https://doi.org/10.1016/j.patter.2022.100676

Chaudhry, I. S., Sarwary, S. A. M., The Refae, G. A., & Chabchoub, H. (2023). Time to Revisit Existing Student's Performance Evaluation Approach in Higher Education Sector in a New Era of ChatGPT — A Case Study. *Cogent Education*, *10*(1), 2210461. https://doi.org/10.1080/2331186X.2023.2210461

Chiu, T. K. F. (2023). The impact of Generative AI (GenAI) on practices, policies and research direction in education: A case of ChatGPT and Midjourney. *Interactive Learning Environments*, *0*(0), 1-17. https://doi.org/10.1080/10494820.2023.2253861

Crawford, J., Cowling, M., & Allen, K. A. (2023). Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI). *Journal of University Teaching and Learning Practice*, *20*(3), 2. https://doi.org/10.53761/1.20.3.02

Currie, G., Singh, C., Nelson, T., Nabasenja, C., Al-Hayek, Y., & Spuur, K. (2023). ChatGPT in medical imaging higher education. *Radiography*, *29*(4), 792-799. https://doi.org/10.1016/j.radi.2023.05.011

Elkhodr, M., Gide, E., Wu, R., & Darwish, O. (2023). ICT students' perceptions towards ChatGPT: An experimental reflective lab analysis. *STEM Education*, *3*(2), Article steme-03-02-006. https://doi.org/10.3934/steme.2023006

Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education.

*International Journal of Educational Technology in Higher Education*, *19*(1), 57. https://doi.org/10.1186/s41239-022-00362-6

Faraj, A. O. K. (2022). A Proposal to Employ Artificial Intelligence Applications in Developing Prince Sattam Bin Abdulaziz University Students' Future Skills. *Education Research International*, *2022*, e6433372. https://doi.org/10.1155/2022/6433372

Grabińska, B., Andrzejewski, M., & Grabiński, K. (2021). The students' and graduates' perception of the potential usefulness of Artificial Intelligence (AI) in the academic curricula of Finance and Accounting Courses. *e-mentor*, *92*(5), 16-25. https://doi.org/10.15219/em92.1544

Guan, H., Chen, Q., Han, S., & Zhang, B. (2021). The Influence of "Artificial Intelligence + Human–Computer Interaction" on Teachers' Psychological Changes in Academic Management in Colleges. *Frontiers in Psychology*, *12*. https://acortar.link/Goerj4

Gupta, S. L., & Mishra, N. (2022). Artificial Intelligence and Deep Learning-Based Information Retrieval Framework for Assessing Student Performance. *International Journal of Information Retrieval Research (IJIRR), 12*(1), 1-27. https://doi.org/10.4018/IJIRR.2022010101

Gwo-Jen, H., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, *1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Hinojo-Lucena, F.-J., Aznar-Díaz, I., Cáceres-Reche, M.-P., & Romero-Rodríguez, J.-M. (2019). Artificial Intelligence in Higher Education: A Bibliometric Study on its Impact in the Scientific Literature. *Education Sciences*, *9*(1), Article 1. https://doi.org/10.3390/educsci9010051

Huang, S., Fang, S., Hung, C., & Chen, Y. (2022). Psychometric evaluation of a nursing competence assessment tool among nursing students: A development and validation study. *BMC MEDICAL EDUCATION, 22*(1). https://doi.org/10.1186/s12909-022-03439-y

Ilić, M. P., Păun, D., Popović, N., Hadžić, A., & Jianu, A. (2021). Needs and Performance Analysis for Changes in Higher Education and Implementation of Artificial Intelligence, Machine Learning, and Extended Reality. *Education Sciences*, *11*(10), Article 10. https://doi.org/10.3390/educsci11100568

Ilieva, G., Yankova, T., Klisarova-Belcheva, S., Dimitrov, A., Bratkov, M., & Angelov, D. (2023). Effects of Generative Chatbots in Higher Education. *Information*, *14*(9), Article 9. https://doi.org/10.3390/info14090492

Jiao, P., Ouyang, F., Zhang, Q., & Alavi, A. H. (2022). Artificial intelligence-enabled prediction model of student academic performance in online engineering education. *Artificial Intelligence Review*, *55*(8), 6321-6344. https://doi.org/10.1007/s10462-022-10155-y

Jiménez-García, E., Orenes-Martínez, N., & López-Fraile, L. A. (2024). Pedagogy Wheel for Artificial Intelligence: Adaptation of Carrington's Wheel. *ITEN-Ibero-American Journal of Distance Education*, *27*(1), Article 1. https://doi.org/10.5944/ried.27.1.37622

Kelly, A., Sullivan, M., & Strampel, K. (2023). Generative artificial intelligence: University student awareness, experience, and confidence in use across disciplines. *Journal of University Teaching & Learning Practice*, *20*(6). https://doi.org/10.53761/1.20.6.12

Khosravi, H., Shum, S. B., Chen, G., Conati, C., Tsai, Y.-S., Kay, J., Knight, S., Martinez-Maldonado, R., Sadiq, S., & Gašević, D. (2022). Explainable Artificial Intelligence in education. *Computers and Education: Artificial Intelligence*, *3*, 100074. https://doi.org/10.1016/j.caeai.2022.100074

King, M. R. (2023). A Conversation on Artificial Intelligence, Chatbots, and Plagiarism in Higher Education. *Cellular and Molecular Bioengineering*, *16*(1), 1-2. https://doi.org/10.1007/s12195-022-00754-8

Kit, D. T., Lok, J. K., Wah, S. K., & Shen, M. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, *2*, 100041. https://doi.org/10.1016/j.caeai.2021.100041

Koć-Januchta, M. M., Schönborn, K. J., Roehrig, C., Chaudhri, V. K., Tibell, L. A. E., & Heller, H. C. (2022). "Connecting concepts helps put main ideas together": Cognitive load and usability in learning biology with an AI-enriched textbook. *International Journal of Educational Technology in Higher Education*, *19*(1), 11. https://doi.org/10.1186/s41239-021-00317-3

Kuleto, V., Ilić, M., Dumangiu, M., Ranković, M., Martins, O. M. D., Păun, D., & Mihoreanu, L. (2021). Exploring Opportunities and Challenges of Artificial Intelligence and Machine Learning in Higher Education Institutions. *Sustainability*, *13*(18), Article 18. https://doi.org/10.3390/su131810424

Lame, G. (2019). Systematic Literature Reviews: An Introduction. *Proceedings of the Design Society: International Conference on Engineering Design*, *1*(1), 1633-1642. https://doi.org/10.1017/dsi.2019.169

Leoste, J., Jõgi, L., Õun, T., Pastor, L., San Martín López, J., & Grauberg, I. (2021). Perceptions about the Future of Integrating Emerging Technologies into Higher Education—The Case of Robotics with Artificial Intelligence. *Computers*, *10*(9), Article 9. https://doi.org/10.3390/computers10090110

Li, J., Li, J., Yang, Y., & Ren, Z. (2021). Design of Higher Education System Based on Artificial Intelligence Technology. *Discrete Dynamics in Nature and Society*, *2021*, e3303160. https://doi.org/10.1155/2021/3303160

Lim, W. M., Gunasekara, A., Pallant, J. L., Pallant, J. I., & Pechenkina, E. (2023). Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. *The International Journal of Management Education*, *21*(2), 100790. https://doi.org/10.1016/j.ijme.2023.100790

Mahmmod, R., Abdulfattah, A., & Abdullah, N. (2022). The Effect of Using Artificial Intelligence on Learning Performance in Iraq: The Dual Factor Theory Perspective. *International information and engineering technology association*, *27*(2), 255-265. https://doi.org/10.18280/isi.270209

Marchante, B. M. (2022). The use of ICTs and artificial intelligence in the revision of the writing process in Valencian public universities. *Research in Education and Learning Innovation Archives*, *28*, Article 28. https://doi.org/10.7203/realia.28.20622

Martín-Núñez, J. L., Ar, A. Y., Fernández, R. P., Abbas, A., & Radovanović, D. (2023). Does intrinsic motivation mediate perceived artificial intelligence (AI) learning and computational thinking of students during the COVID-19 pandemic? *Computers and Education: Artificial Intelligence*, *4*, 100128. https://doi.org/10.1016/j.caeai.2023.100128

McGrath, C., Pargman, T. C., Juth, N., & Palmgren, P. J. (2023). University teachers' perceptions of responsibility and artificial intelligence in higher education—An experimental philosophical study. *Computers and Education: Artificial Intelligence*, *4*, 100139. https://doi.org/10.1016/j.caeai.2023.100139

Mohd, N. I., Lahad, N., Yusof, A. F., & Al-Sharafi, M. (2022). AI-Based Chatbots Adoption Model for Higher-Education Institutions: A Hybrid PLS-SEM-Neural Network Modelling Approach. *Sustainability*, *14*(19), Article 19. https://doi.org/10.3390/su141912726

Moscardini, A. O., Strachan, R., & Vlasova, T. (2022). The role of universities in modern society. *Studies in Higher Education*, *47*(4), 812-830. https://doi.org/10.1080/03075079.2020.1807493

Nazari, N., Shabbir, M. S., & Setiawan, R. (2021). Application of Artificial Intelligence powered digital writing assistant in higher education: Randomized controlled trial. *Heliyon*, *7*(5), E07014. https://doi.org/10.1016/j.heliyon.2021.e07014

Nikonova, E., Yakhyaeva, K., Pivkina, N., & Schetinina, A. (2023). Using Artificial Intelligence Tools in Teaching a Foreign Language in Higher Technical Institutions. *European Journal of Contemporary Education*, *12*(2). https://doi.org/10.13187/ejced.2023.2.578

Ouyang, F., Wu, M., Zheng, L., Zhang, L., & Jiao, P. (2023). Integration of artificial intelligence, performance, prediction and learning analytics to improve student learning in online engineering course. *International Journal of Educational Technology in Higher Education*, *20*(1), 4. https://doi.org/10.1186/s41239-022-00372-4

Parapadakis, D. (2020). Can artificial intelligence help predict a learner's needs? Lessons from predicting student satisfaction. *London Review of Education*, *18*, 178-195. https://doi.org/10.14324/LRE.18.2.03

Quy, V. K., Thanh, B. T., Chehri, A., Linh, D. M., & Tuan, D. A. (2023). AI and Digital Transformation in Higher Education: Vision and Approach of a Specific University in Vietnam. *Sustainability*, *15*(14), Article 14. https://doi.org/10.3390/su151411093

Rahman, A. (2022). Mapping the Efficacy of Artificial Intelligence-based Online Proctored Examination (OPE) in Higher Education during COVID-19: Evidence from Assam, India. *International Journal of Learning, Teaching and Educational Research*, *21*(9), Article 9. https://doi.org/10.26803/ijlter.21.9.5

Ramallal, P. M., Murillo, A. M., & Mondaza, M. R. (2022). Virtual trainers with artificial intelligence: Degree of acceptance among university students. *Educate*, *58*(2), Article 2. https://doi.org/10.5565/REV/EDUCAR.1482

Rangel-de Lázaro, G., & Duart, J. M. (2023). You Can Handle, You Can Teach It: Systematic Review on the Use of Extended Reality and Artificial Intelligence Technologies for Online Higher Education. *Sustainability*, *15*(4), Article 4. https://doi.org/10.3390/su15043507

Rezapour, M., & Elmshaeuser, S. K. (2022). Artificial intelligence-based analytics for impacts of COVID-19 and online learning on college students' mental health. *PLOS ONE, 17*(11), e0276767. https://doi.org/10.1371/journal.pone.0276767

Romero-Rodríguez, J.-M., Ramírez-Montoya, M.-S., Buenestado-Fernández, M., & Lara-Lara, F. (2023). Use of ChatGPT at University as a Tool for Complex Thinking: Students' Perceived Usefulness. *Journal of New Approaches in Educational Research*, *12*(2), Article 2. https://doi.org/10.7821/naer.2023.7.1458

Ruiz-Rojas, L. I., Acosta-Vargas, P., De-Moreta-Llovet, J., & Gonzalez-Rodriguez, M. (2023). Empowering Education with Generative Artificial Intelligence Tools: Approach with an Instructional Design Matrix. *Sustainability*, *15*(15), Article 15. https://doi.org/10.3390/su151511524

Saadé, R. G., Zhang, J., Wang, X., Liu, H., & Guan, H. (2023). Challenges and Opportunities in the Internet of Intelligence of Things in Higher Education—Towards Bridging Theory and Practice. *IoT*, *4*(3), Article 3. https://doi.org/10.3390/iot4030019

Samuel, G., Chubb, J., & Derrick, G. (2021). Boundaries Between Research Ethics and Ethical Research Use in Artificial Intelligence Health Research. *Journal of Empirical Research on Human Research Ethics*, *16*(3), 325-337. https://doi.org/10.1177/15562646211002744

Samuel, G., Diedericks, H., & Derrick, G. (2021). Population health AI researchers' perceptions of the public portrayal of AI: A pilot study. *Public Understanding of Science*, *30*(2), 196-211. https://doi.org/10.1177/0963662520965490

Sanabria-Z, J., Castillo-Martínez, I. M., González-Pérez, L. I., & Ramírez-Montoya, M. S. (2023). Complex thinking through a Transition Design-guided Ideathon: Testing an AI platform on the topic of sharing economy. *Frontiers in Education*, *8*, 1186731. https://doi.org/10.3389/feduc.2023.1186731

Subirats, L., Corral, A. P., Pérez-Ruiz, S., Fort, S., & Sacha, G.-M. (2023). Temporal analysis of academic performance in higher education before, during and after COVID-19 confinement using artificial intelligence. *PLOS ONE*, *18*(2), e0282306. https://doi.org/10.1371/journal.pone.0282306

Tominc, P., & Rožman, M. (2023). Artificial Intelligence and Business Studies: Study Cycle Differences Regarding the Perceptions of the Key Future Competences. *Education Sciences*, *13*(6), Article 6. https://doi.org/10.3390/educsci13060580

UNESCO. (2019). *Beijing Consensus on Artificial Intelligence and Education*. https://acortar.link/e5awg2

UNESCO. (2023). *School in the Age of Artificial Intelligence—UNESCO Digital Library*. https://acortar.link/Tr99SR

Walczak, K., & Cellary, W. (2023). Challenges for higher education in the era of widespread access to Generative AI. *Economics and Business Review*, *9*(2), 71-100. https://doi.org/10.18559/ebr.2023.2.743

Wang, C.-J., Zhong, H.-X., Chiu, P.-S., Chang, J.-H., & Wu, P.-H. (2022). Research on the Impacts of Cognitive Style and Computational Thinking on College Students in a Visual Artificial Intelligence Course. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.864416

Wang, R., Li, J., Shi, W., & Li, X. (2021). Application of Artificial Intelligence Techniques in Operating Mode of Professors' Academic Governance in American Research Universities. *Wireless Communications and Mobile Computing*, *2021*, e3415125. https://doi.org/10.1155/2021/3415125

Wang, Y. (2023). Artificial Intelligence Technologies in College English Translation Teaching. *Journal of Psycholinguistic Research*, *52*(5), 1525-1544. https://doi.org/10.1007/s10936-023-09960-5

Yang, Q.-F., Lian, L.-W., & Zhao, J.-H. (2023). Developing a gamified artificial intelligence educational robot to promote learning effectiveness and behavior in laboratory safety courses for undergraduate students. *International Journal of Educational Technology in Higher Education*, *20*(1), 18. https://doi.org/10.1186/s41239-023-00391-9

Zhu, J., & Ren, C. (2022). Analysis of the Effect of Artificial Intelligence on Role Cognition in the Education System. *Occupational Therapy International*, *2022*, e1781662. https://doi.org/10.1155/2022/1781662

# CALL FOR PAPERS

PIXEL BIT
REVISTA DE MEDIOS Y EDUCACIÓN
MEDIA & EDUCATION JOURNAL

## Aplicaciones tecnológicas relacionadas con la edad temprana infantil

*Technology applications related to early childhood*

**Coordinadora:**


**Dra. Olga María alegre de la Rosa**

Universidad de la Laguna

*Spain*


## Introducción

Decir que las aplicaciones tecnológicas están relacionadas con la primera infancia es quedarse corto.

La primera infancia es un estadio de desarrollo que mejora la vida escolar. Es la etapa más importante para cambiar la vida futura de un niño. La educación de un niño empieza en casa.

La tecnología determina la calidad de la educación temprana de un individuo. La educación infantil mejora los conocimientos, las habilidades y desarrolla la personalidad y la actitud de los niños. Sobre todo, la tecnología en la primera infancia afecta la familia del niño.

Un niño con un alto grado de ayudas tecnológicas aumenta su capacidad de desarrollo.

En este monográfico sobre la importancia de las aplicaciones tecnológicas relacionadas con la primera infancia, discutiremos su valor en la escuela y la familia.

*To say that Technology applications related to early childhood is an understatement.*

*Early childhood is a weapon to improve school life. It is the most important stage for changing future lives. A child's education begins at home.*

*Technology certainly determines the quality of an individual's early education. Early childhood education improves knowledge, skills and develops personality and attitude of children. Most notably, early childhood technology affects a child's family.*

*A child with a high level of technological aids increases their developmental capacity.*

*This monograph on the importance of technology applications related to early childhood will tell you about its value in school and family.*

## Alcance

El monográfico **Aplicaciones tecnológicas relacionadas con la edad temprana infantil** abordará intervenciones tecnológicas tempranas para niños con necesidades especiales, modelos de atención integral que proporcionan servicios tecnológicos y apoyos de manera holística, abordando las necesidades del niño y su familia de manera coordinada, avances tecnológicos en el diagnóstico precoz con la colaboración de distintos profesionales (médicos, terapeutas, educadores y trabajadores sociales), e investigaciones tecnológicas recientes obre educación temprana

*The monograph **Technology applications related to early childhood** will address early technology interventions for children with special needs, integrated care models that provide technology services and supports holistically, addressing the needs of the child and family in a coordinated way, technology advances in early diagnosis with the collaboration of different professionals (doctors, therapists, educators and social workers), and recent technology research on early education.*

## Descriptores/Líneas Temática

- Modelos tecnológicos para la educación temprana
- Guía para padres y madres sobre edad temprana
- Uso de tecnologías digitales para educación temprana
- Educación informática integrada en tecnología para la primera infancia
- Relación entre los antecedentes de los futuros maestros y el uso de la tecnología en la educación infantil: visión comparada
- Relación entre los antecedentes de los futuros maestros y el uso de la tecnología en la educación infantil: estudio de caso
- Comunicación educador-cuidador a través de la tecnología
- Aplicación tecnológica para la medición del desarrollo infantil: estudio comparado
- Aplicación tecnológica para la medición del desarrollo infantil: estudio de caso
- Revisión de la literatura de naturaleza empírica sobre el uso de la tecnología en la educación temprana
- Tecnología y sostenibilidad en el cuidado de la educación temprana

- El desarrollo artístico en la educación temprana con ayuda de dispositivos tecnológicos
- Los juegos y las actividades dramáticas en la educación temprana
- Mapeo bibliográfico y análisis de contenido en la educación científica de la primera infancia
- Educación tecnológica temprana en países europeos: estudio de caso
- Uso de la realidad virtual (VR), la realidad aumentada (AR) y la realidad mixta (MR) en educación temprana
- De la gamificación a la IA en educación temprana
- Aplicaciones móviles para niños con necesidades educativas especiales.

- *Technology models for early childhood education*
- *Parent's Guide to Early Childhood*
- *Use of digital technologies for early education*
- *Technology-integrated computer education for early childhood*
- *Relationship between prospective teachers' backgrounds and the use of technology in early childhood education.*
- *Educator-caregiver communication through technology.*
- *Technological application for the measurement of child development: a comparative study*
- *Technological application for the measurement of child development: case study*
- *Review of the empirical literature on the use of technology in early education*
- *Technology and sustainability in early childhood education care*
- *Artistic development in early childhood education using technological devices*
- *Games and dramatic play activities in early education*
- *Bibliographic mapping and content analysis in Early Childhood Science Education*
- *Early Technology Education in European countries: a case study*
- *The use of virtual reality (VR), augmented reality (AR) and mixed reality (MR) in early education*
- *From gamification to AI in early education*
- *Mobile applications for children with special educational needs.*

# EDITORES INVITADOS

**Dra. Aleksandra Karovska Ristovska**

*Universidad de Málaga (Spain)*

Profesora titular Profesor titular en la Universidad Ss. Cirilo y Metodio, Facultad de Filosofía, Departamento de Educación Especial y Rehabilitación

*Full professor at the Ss. Cyril and Methodius University, Faculty of Philosophy, Department of Special Education and Rehabilitation*

La Doctora Aleksandra Karovska Ristovska defendió su tesis doctoral sobre el Análisis Comparativo del Lenguaje de Signos Estadounidense (ASL) y el Lenguaje de Signos de Macedonia (MSL) en 2014 en la Facultad de Filosofía del Reino Unido, que le valió el título de Doctora en Ciencias de la Educación Especial y Rehabilitación. Profesora Asistente 2014, y asociada en 2019. De agosto de 2018 a enero de 2019, fue profesora visitante de Fulbright en la Universidad George Mason, Fairfax, Virginia del Norte, EE.UU. Asistió a seminarios y cursos e hizo visitas de estudio a universidades de Holanda, Alemania, Noruega, EE.UU. Durante la visita de estudio a Estados Unidos, obtuvo un certificado para trabajar con niños con dislexia usando el método Orton Gillingham. Ha participado en muchos proyectos nacionales e internacionales y es la directora del proyecto Erasmus KA203 FAST (Fostering Accessible Study Technologies: Accessible Learning Management System in Humanities and Social Sciences). Realiza una serie de actividades como miembro de comités de la Facultad de Filosofía (comité de Tecnologías de la Información y la Comunicación, comité de enseñanza, comité de evaluación).

*PhD. Aleksandra Karovska Ristovska defended her doctoral dissertation on Comparative Analysis of the American Sign Language (ASL) and the Macedonian Sign Language (MSL) in 2014 at the Faculty of Philosophy – UKIM, which earned her the title of Doctor of Special Education and Rehabilitation Sciences. Assistant Professor in 2014, and Associate in 2019. From August 2018 to January 2019, she was a Fulbright Visiting Professor at George Mason University, Fairfax, Northern Virginia, USA). She attended seminars and courses and made study visits to universities in the Netherlands, Germany, Norway, USA. During the study visit to the United States, she obtained a certificate for working with children with dyslexia using the Orton Gillingham method. She has participated in many national and international projects and is the head of the Erasmus + KA203 FAST project (Fostering Accessible Study Technologies: Accessible Learning Management System in Humanities and Social Sciences). She performs a series of activities as a member of committees of the Faculty of Philosophy (committee for information and communication technologies, committee for teaching, committee for evaluation).*

**Dr. José Manuel Sáez López**

*UNED (Spain)*

Profesor titular de Universidad. Facultad de Educación. UNED

*Full professor at the University. Faculty of Education. UNED*

El Dr. José Manuel Sáez López es profesor Titular en la Universidad Nacional de Educación a Distancia (UNED) España. Desde el año 2024 es Vicedecano de Estudiantes y Calidad. Su trabajo científico y académico ha sido publicado en 59 revistas revisadas por pares (9 JCR y 25 Scopus). Sus líneas de investigación son la integración de la tecnología educativa, estrategias metodológicas, ludificación y programación en el aula. Actividad Investigadora destacada: Sáez-López, J. M. & Sevillano-García, M. L. & Pascual-Sevillano, M. A. (2019). Aplicación del juego ubicuo con realidad aumentada en Educación Primaria.. *Comunicar, 61* (XXVII), 71-82. https://doi.org/10.3916/C61-2019-06 Sáez-López, J. M. & Sevillano-García, M. L. & Vázquez-Cano, E. (2019). The effect of programming on primary school students' mathematical and scientific understanding: educational use of mBot. *Educational Technology Research and Development, 67*(6), 1405-1425. https://doi.org/10.1007/s11423-019-09648-5 Sáez-López, J.M., Román-González, M. y Vázquez-Cano, E. (2016). Visual programming languages integrated across the curriculum in elementary school. A two year case study using scratch in five schools. *Computers & Education, 97*, 129-141 .http://dx.doi.org/10.1016/j.compedu.2016.03.003

*PhD. José Manuel Sáez López is Full Professor at the Universidad Nacional de Educación a Distancia (UNED) Spain. Since 2024 he is Vice-Dean of Students and Quality. His scientific and academic work has been published in 59 peer-reviewed journals(9 JCR and 25 Scopus). His research interests are the integration of educational technology, methodological strategies, gamification and classroom programming. Outstanding research activity:Sáez-López, J.M. & Sevillano-García, M.L. & Pascual-Sevillano, M.A.(2019). Application of ubiquitous gaming with augmented reality in Primary Education. Comunicar, 61 (XXVII), 71-82. https://doi.org/10.3916/C61-2019-06. Sáez-López, J.M. & Sevillano-García, M.L. & Vázquez-Cano, E. (2019). The effect of programming on primary school students' mathematical and scientific understanding: educational use of mBot. Educational Technology Research and Development, 67(6), 1405-1425.https://doi.org/10.1007/s11423-019-09648-5.Sáez-López, J.M., Román-González, M. and Vázquez-Cano, E. (2016).Visual programming languages integrated across the curriculum in elementary school. A two year case study using scratch in five schools. Computers & Education, 97, 129 141. http://dx.doi.org/10.1016/j.compedu.2016.03.003*

**Dr. Daniel Mara**

*University "Lucian Blaga" of Sibiu, (Romania)*

Profesor titular de la Facultad de Ciencias y Humanidades de la Universidad "Lucian Blaga" de Sibiu, Rumanía

*Full professor at Faculty of Social Sciences and Humanities, University "Lucian Blaga" of Sibiu, Romania*

Doctor en Psicología por la Universidad de Bolonia. Participación en más de 100 conferencias, congresos y simposios nacionales e internacionales. Conferenciante invitado a presentar trabajos científicos en universidades europeas de prestigio y de todo el mundo: Universidad de Bolonia (Italia) en 2000, 2008, 2010, 2012, 2013, 2018, 2019; Universidad de California Los Ángeles (EEUU) en 2002; Universidad de las Islas Baleares (España) en 2005, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018; Universidad de León (España) en 2008, Universidad de Bérgamo (Italia) en 2008, Universidad de Sassari (Italia) 2003, 2014, 2017; Universidad de Birmingham (Reino Unido) en 2009, 2011; Facultad de Humanidades y Economía de Sieradz (Polonia) en 2011, 2017; Universidad Federal de Río de Janeiro (Brasil) en 2011; Universitas Airlangga Surabaya (Indonesia) en 2017. Autor de más de 100 artículos, trabajos científicos y estudios; Autor de 4 volúmenes - como autor único, 4 volúmenes como coautor, 14 capítulos en volúmenes colectivos, 10 volúmenes coordinados (de los cuales cuatro en solitario y seis en colaboración), un artículo en una revista indexada en Web of Science, 19 artículos publicados en los volúmenes de "proceedings" de conferencias internacionales indexadas en ISI Thomson con Peer-Review, 10 artículos en revistas BDI, 30 artículos publicados en revistas extranjeras y rumanas con Peer-Review y comité editorial internacional, 20 artículos publicados en revistas rumanas, 30 artículos en revistas no BDI.

*PhD University of Bologna. Participation in over 100 conferences, congresses, national and international symposiums. Guest lecturer – invited to present scientific work at European prestigious universities and around the world: University of Bologna (Italy) in 2000, 2008, 2010, 2012, 2013, 2018, 2019; University of California Los Angeles (USA) in 2002; University of the Balearic Islands (Spain) in 2005, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018; University of Leon (Spain) in 2008, University of Bergamo (Italy) in 2008, University of Sassari (Italy) 2003, 2014, 2017; University of Birmingham (United Kingdom) in 2009, 2011; College of Humanities and Economics in Sieradz (Poland) in 2011, 2017; Federal University of Rio de Janeiro (Brazil) in 2011; Universitas Airlangga Surabaya (Indonesia) in 2017. Author of over 100 articles, scientific papers and studies; Author of 4 volumes – as a single author, 4 volumes as co-author, 14 chapters in collective volumes, 10 coordinated volumes (out of which four alone and six in collaboration), one article in a Web of Science indexed journal, 19 articles published in the «proceedings» volumes of ISI Thomson indexed international conferences with Peer-Review, 10 articles in BDI journals, 30 articles published in foreign and Romanian journals with Peer-Review and international editorial committee, 20 articles published in Romanian journals, 30 articles in non-BDI journals.*

**Dr. Christos Markides**

*University Cyprus*

Profesor Asistente del Departamento de Ingeniería Eléctrica e Informática de la Universidad Frederick de Chipre

*Assistant Professor of the Department of Electrical and Computer Engineering and Informatics at Frederick University Cyprus*

El Dr. Christos Markides es miembro del Departamento de Ingeniería Eléctrica e Informática de la Universidad Frederick de Chipre. Se incorporó a la facultad en 2002, donde imparte cursos de licenciatura y posgrado. Se licenció con honores en Cibernética e Informática y obtuvo un máster (Dist.) en Ingeniería y Ciencias de la Información por la Universidad de Reading (Reino Unido) en 1999 y 2001, respectivamente. Se doctoró en la Escuela de Ingeniería y Ciencias Matemáticas de la City University de Londres (Reino Unido) en 2014. Es miembro de IEEE y ACM, y revisor de IEEE. El Dr. Christos Markides ha participado activamente en el diseño y desarrollo de varios sistemas de información para plataformas de escritorio y móviles para diferentes programas de investigación financiados por la Unión Europea y la Fundación para la Investigación y la Innovación. Sus intereses de investigación actuales incluyen la investigación de tecnologías y arquitecturas para sistemas y plataformas de Big Data en términos de sistemas operativos subyacentes y sistemas de bases de datos. Además, sus intereses de investigación incluyen Big Data Analytics, Deep Learning y Visualización en entornos de computación móvil y en la nube, para obtener información para diversos proyectos de análisis de datos.

*PhD. Christos Markides is a member of the Department of Electrical and Computer Engineering and Informatics at Frederick University Cyprus. He joined the faculty in 2002, teaching at undergraduate and postgraduate level courses. He received his BSc Hons. in Cybernetics and Computer Science, and MSc (Dist.) in Engineering and Information Sciences from the University of Reading, UK in 1999 and 2001 respectively. He received his Ph.D. degree from the School of Engineering and Mathematical Sciences at City University London, U.K in 2014. He is a member of IEEE, and ACM, and reviewer for IEEE. Dr Christos Markides has actively participated in designing and developing various information systems for desktop and mobile platforms for different research programmes funded by the European Union and the Research and Innovation Foundation. His current research interests include the investigation of technologies, and architectures for Big Data systems and platforms in terms of the underlying operating systems, and database systems. Moreover, his research interests include Big Data Analytics, Deep Learning, and Visualisation in Mobile and Cloud Computing Environments, for obtaining insight for various data analysis projects.*

## ENVÍO DE MANUSCRITOS

**Envío de Manuscritos**

https://onx.la/fea19

**Normativa para autores**

https://onx.la/bc8ea

## FECHAS CLAVE

**Inicio de envíos**
01-09-2024

**Límite de envíos**
01-02-2025

**Publicación**
01-09-2025