Integrating Artificial Intelligence in Higher Education: A Systematic Review and Perspectives in Latin America

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Abstract

This review systematically analyzed the literature published between 2018 and 2023 in Latin America on the inclusion of artificial intelligence in higher education. The aim was to identify which studies have been published on this topic, indicating what the scientific production has contributed, but also the weaknesses and gaps that persist. The question it sought to answer was: How has the integration of artificial intelligence in higher education been addressed in Latin America? It concludes that the available information allows us to answer that the main interest has been to show, in a reflective, exploratory, or descriptive way, the challenges and opportunities of artificial intelligence in higher education. That is, there have mainly been conceptual analyses on the implications of this emerging technology, rather than empirical research on its implementation or actual impact. Gaps persist regarding case studies, concrete applications of AI, or assessments of its effectiveness in Latin American educational contexts.

Keywords: Artificial Intelligence, higher education, Latin America.

Introduction

The emergence of Artificial Intelligence has been a turning point in many aspects of human daily life. In this regard, education faces important challenges, starting with the need to explain the impact that these technologies have on university education. Therefore, it is important to identify and evaluate the type of research that is being published on the topic in order to determine where future contributions should be directed.

Thus, this systematic review research conducted an analysis of the state of the art literature exists. The objective was to identify which studies have been published between 2018 and 2023 in Latin America on the inclusion of artificial intelligence in higher education. One of the intentions is to indicate what the scientific production has made known on the subject, but, above all, the weaknesses and inconsistencies that persist and the opportunities for improvement. In this sense, the question that was tried to answer was: How has the integration of artificial intelligence in higher education in Latin America been addressed? This article has concluded that the information available today allows us to answer that the

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main interest has been to show in a reflective, exploratory or descriptive way the challenges and opportunities of AI in higher education.

However, there are currently systematic review studies of the literature on higher education and artificial intelligence in Latin America indexed in Scopus, the closest to the present review being the study by Vargas-Murillo et al. (2023). However, the authors focus on the use of ChatGPT and only take into account publications from the last year. This is an obstacle when trying to suggest possible routes for future research. Therefore, this review covers the last 6 years; which helps to see the trajectory that the subject has had. Likewise, it does not focus on the use of a single artificial intelligence tool — ChatGPT — which allows the literature to be expanded to other perspectives and applications.

Methodology

The research design was qualitative, with a systematic review approach. It is understood, according to García-Peñalvo (2022), that its purpose is "to identify what is known, but, above all, what is unknown about the field under investigation." (p. 1). For this, the type of study of the literature was the analysis of the state of the art, since current issues were addressed and contrasted with a topic that has been treated for a long time (Grant & Booth, 2009). That is, the questions raised by the integration of Artificial Intelligence in higher education.

However, the search protocol that determined the phases for the literature review was, according to the typification of Grant and Booth (2009), the SALSA framework. It owes its name to the four main steps of the review process: Search, AppraisaL, Synthesis and Analysis. In order to answer the research question –RQ1– how have the integration of artificial intelligence in higher education in Latin America been addressed? The following question was posed as a question for the mapping of bibliographic production – MQ1 – how many and what types of scientific studies have been published in the last six years in relation to the integration of artificial intelligence in higher education in Latin America?

Thus, the following table simplifies how the study of the literature, according to the SALSA framework, methodologically allowed to determine the findings and answer the research question. Of course, attending to the question that guided the mapping of the production of bibliography around the analysis of the ethical issues that the inclusion of artificial intelligence in educational practices has raised.

Table 1

Literature Review Process

RQ1: How have you addressed the integration of artificial intelligence in higher education in Latin America?	
MQ1: How many and what types of scientific studies have been published in the last six years regarding the integration of artificial intelligence in higher education in Latin America?	
Search	Primary sources were searched in the Scopus database. The keywords recorded were: Artificial Intelligence and Higher Education in a time range of the last 6 years —from 2018 to 2023—. The search was filtered and narrowed down to Latin American countries. The results showed the existence of 139 articles in Scopus. Likewise, the check-up indicated that it has been since last year where there has been a greater volume of scientific production in the field.
Evaluation	The evaluation of the primary sources initially collected was defined by quality criteria. These were: research articles,

	documented findings on the implementation of AI in higher education, and studies conducted in Latin America or other parts of the world, but their main theme was the integration of AI in Latin American higher education. After the purge, there were 37 investigations that met the criteria.
Synthesis	The information collected from the primary sources that resulted from the evaluation was synthesized according to the criteria set out in the research question. The following considerations are highlighted: • Most of the scientific literature – 17 articles – that talk about the subject focuses on analysing artificial intelligence in aspects other than teaching-learning processes or university governance. The main interest is to show in a reflective, exploratory or descriptive way the challenges and opportunities of AI in higher education. • Secondly, there is research – 12 articles – that document the results of the application of artificial intelligence in teaching-learning processes in the framework of higher education. • To a lesser extent, there are 8 articles that focus on the challenges and implications offered by artificial intelligence in different contexts of the teaching-learning process.
Analysis	The scientific literature on the integration of AI in higher education in Latin America is not yet abundant. Perhaps this is due to the fact that this technology is just making its way in the region. In general, recommendations, theoretical-conceptual constructions, reflections, exploratory and descriptive analyses predominate. Little research has been done on the impacts of AI on processes of training, evaluation and monitoring of learning or the contributions that this technology can provide to university governance. The results and discussion section will elaborate on this.

Source: Authors' own creation (2023).

Results and Discussion

In order to answer the research question: how have the integration of artificial intelligence in higher education in Latin America been addressed? It can be stated, based on the systematic review developed here, that most of the scientific literature produced between 2018 and 2023 focuses on analyzing the challenges and implications offered by artificial intelligence in different contexts of higher education. Reflective writings, exploratory analyses or descriptive studies that present in a general way considerations based on the bibliographic review or state of the art of the subject stand out.

Likewise, a second volume of research has been found that reports the results obtained as a result of the application of artificial intelligence in the teaching-learning processes within the framework of higher education. Among the aspects that the researchers highlight about the implementation of AI in classroom processes, they mention: complex thinking, knowledge assessment, potential risks to learning, adaptive learning, improvement of the learning experience, emotional development during learning and alternative interactions and response to student doubts.

Finally, a small number of studies show the applicability of artificial intelligence in university governance and administration. Among the contributions that this technology

would provide in this aspect are: design of an analytical tool to study and predict trends in the labor market and education, to analyze and manage the knowledge generated within higher education centers, to improve data protection and administrative information, to classify network traffic in data centers of higher education institutions and to evaluate the impact of the confinement of situations such as Covid-19.

In summary, the scientific literature on the integration of artificial intelligence in higher education in Latin America is not yet abundant. Perhaps this is due to the fact that this technology is just making its way in the region. However, the predominant studies focus on recommendations, theoretical-conceptual constructions, reflections, exploratory and descriptive analyses. Little research has been done on the impacts of AI on processes of training, evaluation and monitoring of learning or the contributions that this technology can provide to university governance. In this, there is a lack of practical research that favors the empirical and contextual implementation of artificial intelligence in processes of effective transformation of Latin American university education.

Below are the results of the analysis of the 37 selected sources on artificial intelligence in higher education in the last six years in Latin America. First, a component analysis is presented where the main categories and subcategories in which we can group the sources are displayed. Subsequently, a bibliometric analysis is carried out that includes classification and discrimination by year, authors, country, area of knowledge, citations by year, co-authorship and co-occurrences.

Table 2

Literature analysis by category

Authors	Categories	Subcategories
(Bates et al., 2020; Cantú-Ortiz et al., 2020; De Oliveira Fornasier, 2021; Geada & Jamil, 2023; Hernández-de-Menéndez et al., 2020; Lau et al., 2019; Martín-Núñez et al., 2023; Ocaña-Fernández et al., 2020; Pérez Gama et al., 2019; Pinargote-Ortega et al., 2023; Quezada Castro et al., 2022; Serna Gómez et al., 2021; Silva, 2022; Singh & Hiran, 2022; Tiza et al., 2023; Toapanta et al., 2022; Vargas-Murillo et al., 2023)	• Conceptualizations and Empirical Evaluations	• Opportunities, challenges and implications • Impacts and adaptations • Literature Review
(Castrillón et al., 2020; Esparza et al., 2018; Gonzalez, 2021; Gonzalez et al., 2022; Jiménez et al., 2021; Motta et al., 2019; Oliveira et al., 2019; Olmos-López et al., 2023; Rico et al., 2023; Rincon-Flores et al., 2020; Rodríguez-Hernández et al., 2021; Sanabria-Z et al., 2023)	• Applications in the teaching-learning process	• Academic performance • Other
(Arango-Uribe et al., 2023; Bojorque & Pesántez-Avilés, 2020; Gomez et al., 2023;	• Applications outside the teaching-learning process	• Disciplinary • Administrative

Gonzalez-Rodriguez et al., 2020; Guerrero-Velástegui et al., 2023; Jojoa et al., 2022; Ponce et al., 2019; Toapanta et al., 2023)

Conceptualizations and Empirical Evaluations

Table 1 shows three broad categories. The first and most extensive encompasses empirical conceptualizations and evaluations. What distinguishes this grouping from the others is that it is research that, despite the fact that its central theme is artificial intelligence, does not have direct applications or implementations of it. There we can find, on the one hand, reflective writings, exploratory analyses or descriptive studies that expose in a general way the opportunities, challenges and implications offered by artificial intelligence in different contexts such as the governance and transformation of the university as an institution (Pérez Gama et al., 2019; Serna Gómez et al., 2021; Silva, 2022), the labour market of professions (De Oliveira Fornasier, 2021; Lau et al., 2019; Ocaña-Fernández et al., 2020) and the transformation of higher education (Bates et al., 2020; Singh & Hiran, 2022). On the other hand, there is a literature that evaluates the impact and particular adaptations in different countries, institutions, areas and programs. Case studies and qualitative studies can be found (Cantú-Ortiz et al., 2020; Quezada Castro et al., 2022; Toapanta et al., 2022), quantitative studies (Martín-Núñez et al., 2023; Tiza et al., 2023) and collections of empirical studies in specific disciplines (Geada & Jamil, 2023). Finally, in this category are literature reviews or state of the art on the subject. There is a generalist state of the art that encompasses different technological innovations – including artificial intelligence – (Hernández-de-Menéndez et al., 2020), a review of the literature focused on the use of ChatGPT (Vargas-Murillo et al., 2023) and another focused on sentiment analysis techniques (Pinargote-Ortega et al., 2023).

Applications in the teaching-learning process

As its name indicates, this category includes those studies that report applications of artificial intelligence oriented towards some aspect of the teaching-learning process within higher education. First, there are studies that aim to evaluate or predict the academic performance of both students (Castrillón et al., 2020; Rincon-Flores et al., 2020; Rodríguez-Hernández et al., 2021) and teachers (Esparza et al., 2018). Second, this category includes studies that impact the teaching-learning process in a different way. There you will find a variety of studies with different tools that aim to improve some aspect or process of teaching and learning. Among the elements intervened are: educational practices in general (Olmos-López et al., 2023), complex thinking (Sanabria-Z et al., 2023), knowledge assessment (Rico et al., 2023), potential risks to learning (Motta et al., 2019), adaptive learning (Singh, 2023), improvement of the learning experience (Gonzalez, 2021; González et al., 2022), emotional development during learning (Jiménez et al., 2021), and alternative interactions and response to student doubts (Oliveira et al., 2019).

Applications outside the teaching-learning process

This category includes studies that apply artificial intelligence in aspects other than the teaching-learning process but that are still within the framework of higher education. On the one hand, there are studies focused on disciplinary issues such as sustainable development (Arango-Uribe et al., 2023), an intelligent clothing storage and retrieval system (Gonzalez-Rodriguez et al., 2020), and the capture and modeling of interactions of the magnetic fields of permanent magnets (Ponce et al., 2019). On the other hand, the general category includes administrative deployments. The uses of artificial intelligence in this context are: as an analytical tool to study and predict trends in the labour market and education (Guerrero-Velástegui et al., 2023), to analyse and manage the knowledge generated within higher education centres (Bojorque & Pesántez-Avilés, 2020), to improve data protection and administrative information (Toapanta et al., 2023), to classify network

traffic in data centers of higher education institutions (Gómez et al., 2023) and to assess the impact of confinement due to COVID-19 on the university community (Jojoa et al., 2022).

Bibliometric analysis

Figure 1

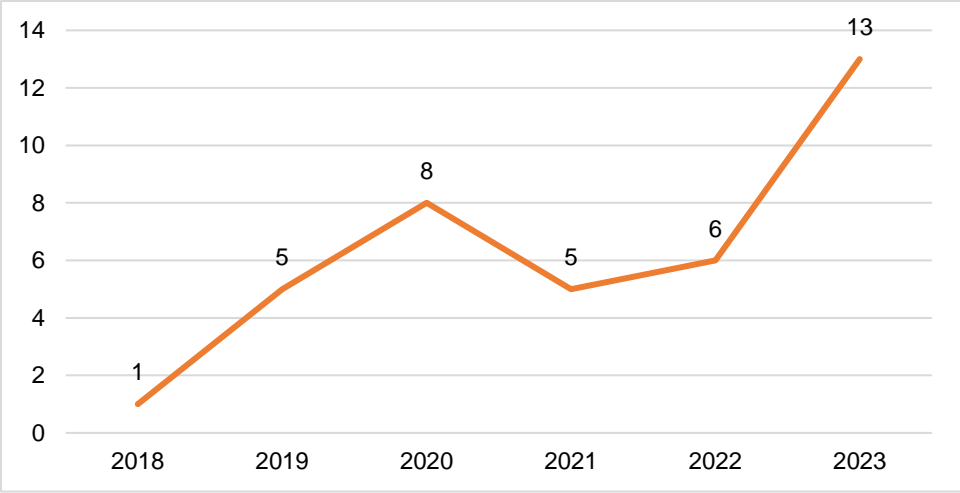Evolution of the number of documents published annually from 2018 to 2023

Figure 1 illustrates the dynamics of publication over a six-year period. A modest start is seen in 2018, with only one paper published. However, in 2019, the number increases to five, indicating a growing interest in the topic. In 2020, the upward trend continues, reaching a peak of eight publications, which could reflect a turning point in research or an event that catalyzed a higher volume of academic work. However, this momentum is not sustained in 2021, where a decrease to five documents is recorded, suggesting a possible consolidation or displacement of research interests. In 2022, there is a slight recovery to six publications, hinting at a stabilization of interest in the topic. The year 2023 marks a remarkable and exceptional rise to thirteen papers, which doubles almost any other year recorded in the graph and suggests a renewed and significant momentum in the field of study; this can be explained by the emergence of ChatGPT in a free and commercial way in late 2022 and early 2023 and what this meant for education in general.

Figure 2

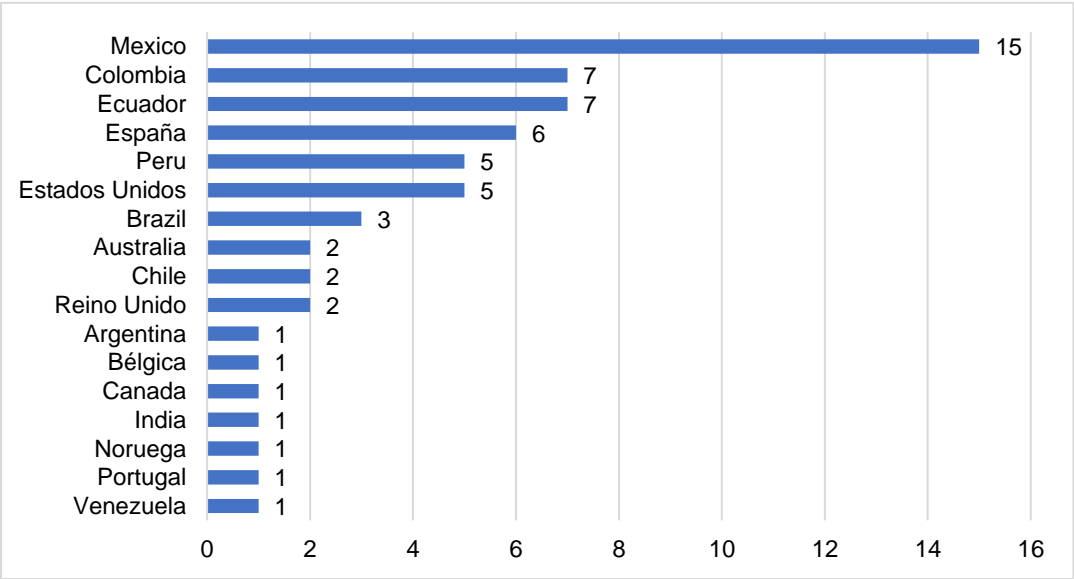Distribution of published documents by country

Figure 2 provides an overview of the country's contribution to the literature focused on Latin America. Mexico stands out as the main contributor, with a total of 15 publications, reflecting a robust academic production from within the region. Colombia and Ecuador are not far behind, with 7 papers each, indicating a strong research interest and commitment to Latin American issues. Spain, although geographically distant, shows a strong connection with Latin America, evidenced by its 6 publications. The representation of Peru and the United States, with 5 publications each, suggests a transnational interest and academic dialogue that crosses both national and cultural lines. Brazil, with 3 papers, and Australia and Chile, with 2 each, along with the United Kingdom, also bring diverse perspectives to Latin American research. Countries with only one publication — Argentina, Belgium, Canada, India, Norway, Portugal, and Venezuela — demonstrate that interest in Latin American affairs spans a global spectrum.

Despite the fact that most of the contributions come from Latin American countries, the significant presence of works originating in other parts of the world highlights the importance and global impact of Latin American experiences in contemporary research.

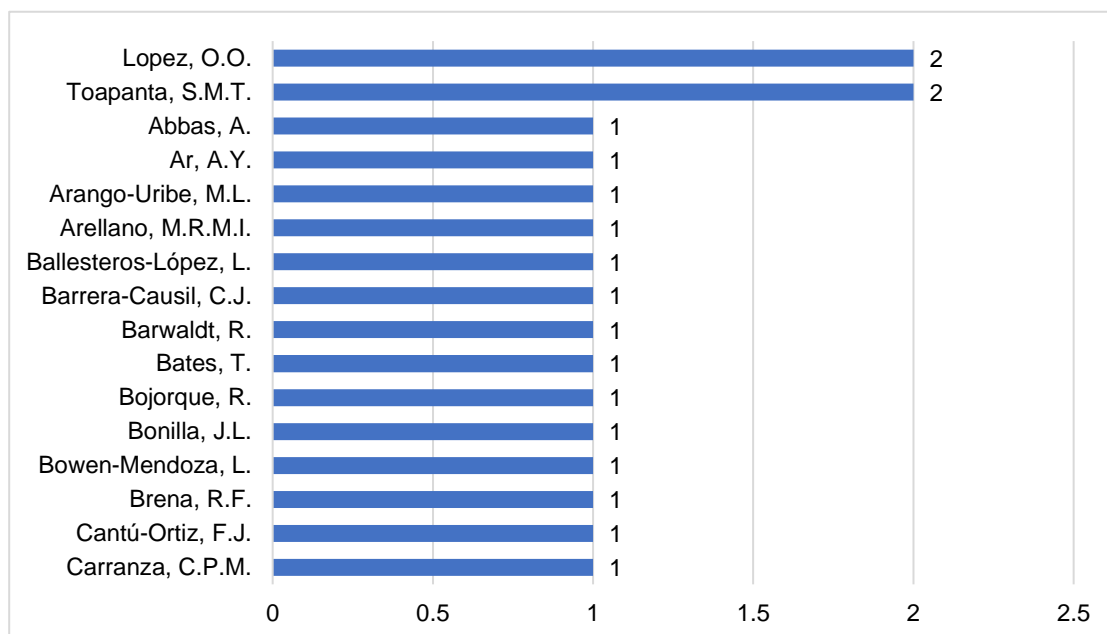Figure 3

Individual Authors' Contribution to Literature

Figure 3 selectively represents the contribution of individual authors to the topic under investigation, highlighting López, O.O (Rico et al., 2023; Rincon-Flores et al., 2020) and Toapanta, S.M.T. (2022, 2023) as the most prolific with two articles each. Although only a few names are shown, there are actually a total of 151 authors who have contributed with a single publication. This extensive list of contributors with a single entry reflects the nascent state of the field: an emerging academic community with initial and expanding involvement. The low individual output noted is indicative of a topic that is in its early stages of development and therefore presents ample opportunity for future research and exploration.

Figure 4

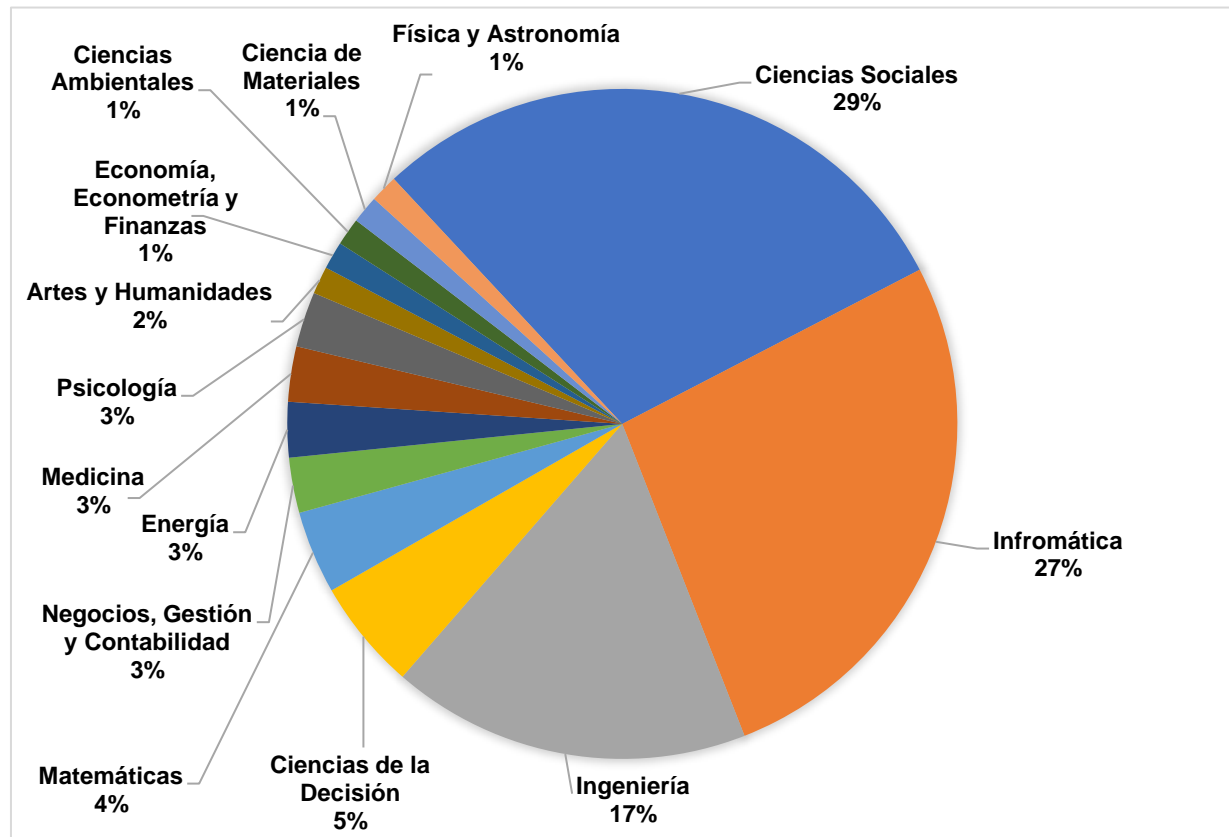Percentage distribution of publications by academic discipline. In original Spanish language

Figure 4 shows the proportion of publications classified by field of study. The social sciences lead the distribution with 29%, which demonstrates a high research interest in this area. Next in importance, we find Computer Science, which represents 27% of the total. Engineering also ranks high at 17%, underlining its significant impact on technological advancement. The disciplines of Decision Sciences and Mathematics contribute with 5% and 4%, respectively, which indicates a moderate participation in the research as a whole. Psychology, Medicine and Energy, each with 3%, together with Business, Management and Accounting, reflect an equal contribution and show the multidisciplinarity of the subject.

On the other hand, the Arts and Humanities, Economics, Econometrics and Finance, as well as Environmental Sciences and Materials Science, each with 1%, together with Physics and Astronomy, although with a more discreet presence, complete the diversity of the research spectrum. This multifaceted profile of publications highlights the interdisciplinary nature of the field of study and its interconnectedness with a variety of academic and professional sectors.

Figure 5

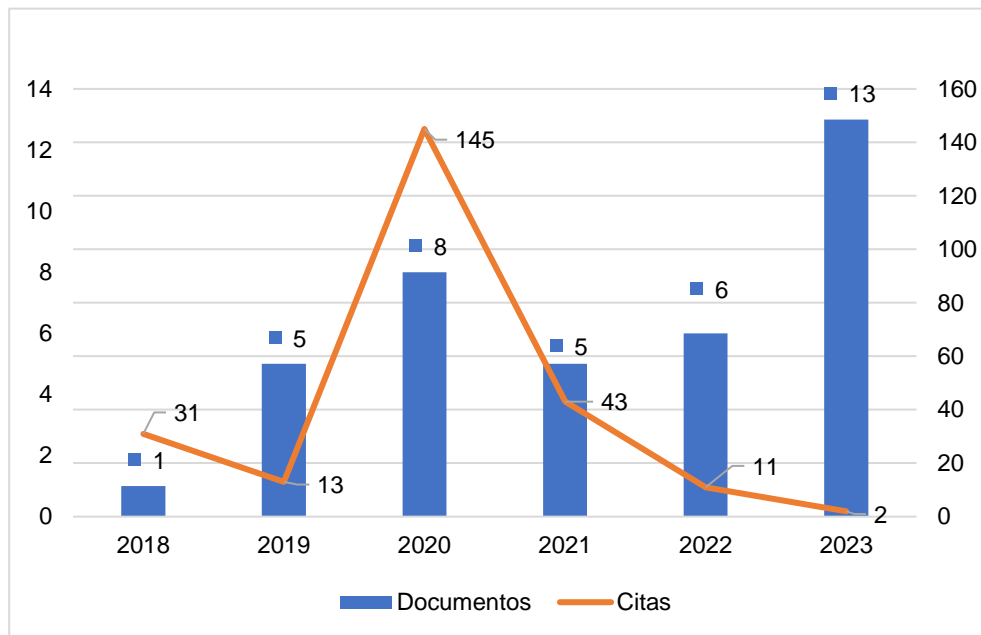Temporal analysis of documents and citations by year. In original Spanish language

Figure 5 presents a comparison between the number of documents published and citations from 2018 to 2023. A modest beginning can be seen with a paper written by Esparza et al. (2018) which received 31 citations, suggesting that, as there is little literature, it served as a basis for subsequent work. The year 2019 saw an increase to five papers, but a decrease of 13 citations, indicating that this year's publications did not have as much influence as the aforementioned 2018 one.

In 2020, a peak of 8 papers was reached and a notable increase in citations to 145, reflecting a particularly significant year both in terms of productivity and influence in the academic community. However, it should be noted that the majority of this year's citations were sustained by authors such as Bates (2020) with 50 citations, Hernandez-de-Menéndez et al. (2020) with 49 citations, and Cantú-Ortiz et al. (2020) with 31 citations, all of them reported by Scopus. It is noteworthy that all these sources belong to the category "conceptualizations and empirical evaluations" of the present research, which indicates that panoramic perspectives on the subject were favored.

In 2021, despite remaining at five papers, citations drop dramatically to 43, which could indicate a variation in the relevance or visibility of publications. It is noteworthy that 38 of these citations belong to (Rodríguez-Hernández et al., 2021). For 2022, 6 papers are reported and a further decrease in citations to 11, suggesting a lower impact or maturation of the topic. Finally, 2023 sees an uptick to 13 documents, albeit with only two citations, suggesting a renewed interest in document production, but a possible delay in the accumulation of citations.
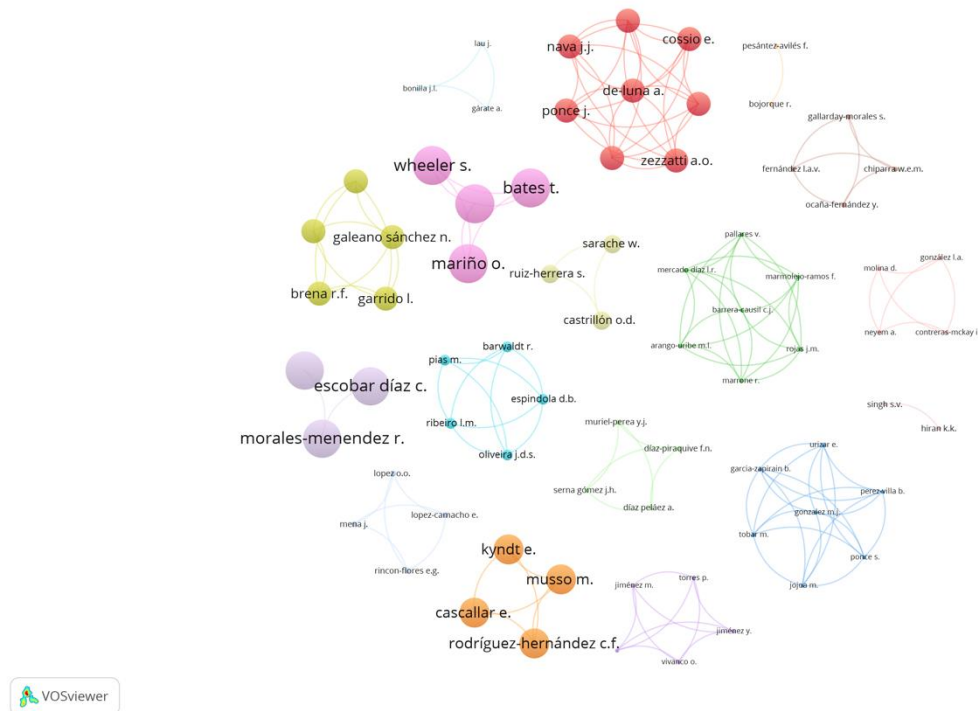
Figure 6

Co-authoring map

Figure 6 shows a visual analysis of co-authorship networks within the literature relevant to the field of study. Each node, represented by a name, symbolizes an author while the lines connecting the nodes represent co-authorship between researchers. The thickness of the lines suggests the frequency and strength of the collaboration, while the size of the nodes is parameterized to show the citation rate. The present analysis was limited to authors with at least one document and two citations, which resulted in a selection of 74 authors out of a possible 153.

The analysis reveals that there is no co-authorship outside of individual publications, as there is no evidence of the formation of global networks. Thus, the existence of isolated clusters is due to co-authorship within the same source. By way of illustration, the cluster with the highest collaborative strength – the one in red at the top – is a single source (Esparza et al., 2018) and each of its members has a citation strength of 7 since there are 8 authors. The same situation occurs in the other groupings.

This can be explained by the fact that the topic is still very incipient and constantly changing. Another element that helps explain these network formations is the fact that the topic of artificial intelligence in higher education does not belong to a specific discipline and its application in different areas does not imply the need for interdisciplinary collaboration.
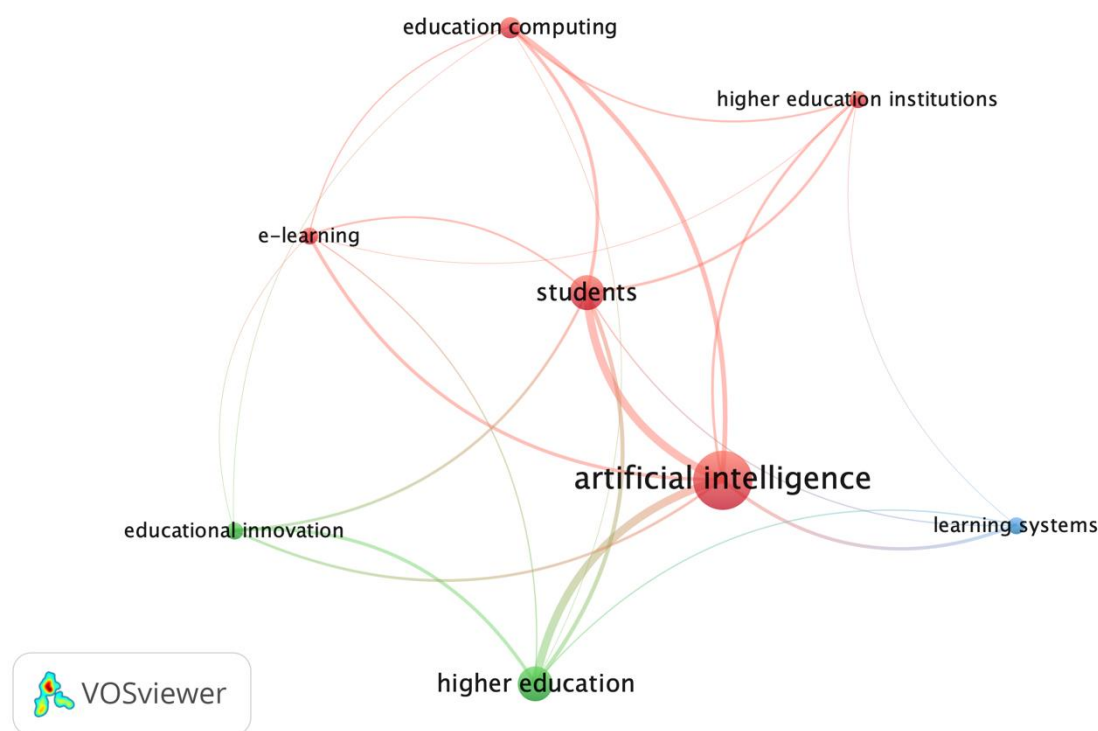
Figure 7

Keyword Co-Occurrence Network

Figure 7 shows a co-occurrence analysis that illustrates the relationship between key terms frequently mentioned in the literature. The unit of analysis was all the keywords, both those of the authors and those of the indexes. The delimitation per minimum occurrence of each word was 5. Thus, out of 313 words, 8 met the criteria.

At the center of the network, the term "artificial intelligence" acts as a nucleus, evidencing its position as a central axis in current research. This term is strongly linked to "higher education" and "students." The relationship with the first term is obvious, however, it is remarkable that the topic revolves around students. In addition, the connections with "e-learning" and "educational computing" highlight the role of technology in the delivery of modern education.

On the other hand, terms such as "educational innovation" and "learning systems" are less prominently linked, suggesting emerging or complementary areas within the broad framework of artificial intelligence in higher education.

Conclusions

This research, with a systematic review approach, mapped the scientific production produced in the last six years around the type of questions raised by the integration of artificial intelligence in higher education in Latin America. In this, it was found that publications have been increasing: going from 1 in 2018 to 13 in 2023, the latter being the highest number of articles indexed in Scopus. This coincides with the growing interest in the topic in many areas of daily life, including education.

However, most of the production of the scientific literature, on average 46%, has addressed issues that lack empirical support provided by implementation in real scenarios, whose findings would show the impact of AI on Latin American higher education. Instead, all of them mainly deal with issues related to the challenges and opportunities that this technology

would bring to university education. That is, they are reflective writings, exploratory analyses or descriptive studies that expose in a general way considerations based on the bibliographic review or state of the art of the subject.

This shows the lack of research that shows the results of experiences of implementing AI in training processes or administrative management in university education in Latin America. However, it must be considered that there is still a lot of uncertainty on the subject and there are several scenarios where sufficient conceptual and technical tools are lacking. However, compared to other regions of the world, Latin America is lagging behind and this could suggest the need to advance in this type of study that would bring real changes to the higher education system.

Therefore, although the region has been making progress in the production of scientific articles where AI is analyzed in the context of higher education, most of them only address reflective or exploratory topics of the issue. This could suggest that Latin American higher education has not yet begun to explore in depth the impacts that artificial intelligence would have on training and administrative processes in universities.

Acknowledgment

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