The Impact of Artificial Intelligence in Educational Leadership

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Abstract

The introduction of artificial intelligence (AI) technologies in education has led to an exponential increase in studies investigating their impact on pedagogical practices and the contemporary challenges faced by educational leaders. This has revealed a range of opportunities and threats for pedagogical leadership. However, the specialized literature lacks a comprehensive overview of this issue.

This study provides a bibliometric analysis of the literature indexed in the Web of Science Core Collection (WoS), focusing on the interconnected fields of generative AI and educational leadership, encompassing a total of 127 studies. The research synthesizes valuable insights into teachers' perceptions of new technologies and how these technologies influence their teaching styles and leadership approaches.

The study also examines collaboration networks among authors, universities, and countries regarding the transformations in pedagogical leadership driven by AI use in education. The findings highlight the significant interest of educational leaders in leveraging AI's potential while mitigating its risks. Moreover, the study underscores the need for strategic leadership to balance AI's benefits with its challenges in education.

Keywords: *Artificial intelligence, Education, Educational leadership, Pedagogy, AIED*

JEL classification: J2, F6, I2

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1. Introduction

Educational leadership plays an essential role in shaping and improving the educational process, particularly in the context of integrating advanced technologies such as artificial intelligence (AI). The importance of AI in education has grown due to its capacity to enhance learning across diverse contexts (Hwang et al., 2020). Most studies in recent years on this topic highlight the benefits of methods based on various AI models and the improvement of student outcomes through personalized learning and assessment experiences. However, the impact of modern technologies on educational leaders has not yet been thoroughly analyzed, with many studies addressing this aspect only tangentially. The intersection of AI and educational leadership brings both new opportunities and significant risks. For

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instance, AI can streamline administrative tasks by automating routine processes and optimizing data analysis for decision-making. Educational leaders must develop comprehensive strategies for integrating AI into their schools, allocate resources for AI-specific infrastructure, and establish clear policies and regulations regarding the ethical use of AI (European Commission, 2022; Dwivedi et al., 2023). Additionally, teacher training must emphasize the development of AI-specific skills, effective assessment tools, innovation in teaching and research, and an interdisciplinary approach to education (Hodges & Ocak, 2023). However, AI integration in education may raise concerns about technology dependency, reduced creativity and interpersonal skills, and a potential narrowing of pedagogical leadership by transforming or diminishing the role of teachers (Ghamrawi et al., 2024).

Conducting a bibliometric analysis of existing literature at the intersection of educational leadership and artificial intelligence is both timely and necessary to provide insights into the future of education and address challenges related to emerging technological opportunities (Ur Rehman et al. 2024). By gaining a deeper understanding of the long-term effects of AI on pedagogical leadership and how teachers respond to these contemporary challenges, researchers can obtain valuable insights into practices, strategies, attitudes, and competencies for optimizing teachers' pedagogical and administrative activities. Therefore, our study will focus exclusively on identifying articles that address AI's impact on teachers' leadership, highlighting aspects related to relationships between authors, countries, institutions, and keywords. Managers increasingly want to improve the efficiency of human resources processes, and a solution with real results is Artificial Intelligence (AI), which provides real results in a virtual world for human resources managers, for companies, and also for candidates (Năstase et al. 2024).

Through bibliometric indicators generated by the WoS platform and VOSviewer software, we provide a comprehensive perspective on the importance and role of pedagogical leadership in the AI era, as well as future research directions in this field.

2. Literature Review

2.1 The use of Artificial Intelligence in Education

The use of AI in education is leading to a transformation of teaching and learning practices, as well as in the preparation and dissemination of information. Initial actions in this regard have focused on facilitating the educational process for students through automated and personalized interactions. The emergence and development of online education since the 2000s have also generated initial trends in personalized learning through student profiling (Guan et al., 2020). The study by Zawacki-Richter et al. (2019) focused on the use of AI in higher education, highlighting the importance of personalized learning and the role of AI in student development. Thus, artificial intelligence can personalize learning scenarios by

probabilistically analyzing student characteristics (learning styles, knowledge levels, behaviors) using Bayesian networks that allow predicting learning evolution based on individual data, dynamically adapting content, and identifying areas where the student needs additional support (Robinson, 2019). Roll and Wylie (2016) described the role of AI in intelligent tutoring systems and adaptive learning platforms that provide personalized feedback and guidance, as well as for assessing skills or academic performance. This has generated a transformative change in classroom learning practices and interactions between educators and students through technology.

Another important aspect refers to the implementation of AI in e-learning and the emergence of specific applications focused on personalizing content and assessments according to the individual needs of the student (Tang et al. 2021). This approach allows adapting content and assessments based on the unique characteristics of each student, thereby improving educational outcomes and the learning experience. Technological innovation is transforming the way organizations interact, collaborate and conduct their actitivities, regardless of their field of action, in public (Popa, et al., 2024) or private sector, offering unlimited opportunities for those who are ready to explore them (Cristache et al. 2024). The use of machine learning and deep learning algorithms allows both an analysis of student progress and the adaptation of educational content in real-time, depending on the student's progress and needs, identifying knowledge gaps and providing specific recommendations for improvement (Tapalova & Zhiyenbayeva, 2022).

Regarding the challenges related to the use of AI in education, most studies focus on regulations regarding confidentiality and data protection, as well as on aspects related to ethics and academic integrity (Huang, 2023; Chen et al., 2022). However, some researchers have pointed out that AI applications can negatively influence students' creative thinking, reducing opportunities for independent thinking and innovation (Lin & Chen, 2024). Also, constant performance monitoring by AI tools can generate anxiety and stress among students, as well as social isolation or poor interpersonal skills (Klimova & Pikhart, 2025). Therefore, a balanced integration of AI in education is necessary, aiming at both educational performance and student well-being.

2.2 Generative Technologies and Educational Leadership

Given the accelerated development of new generative technologies and the desire to streamline school management, the use of AI has not been limited solely to strictly pedagogical activities. Although few studies have focused strictly on the role of school leadership in the AI era (Hejres, 2022; Tyson & Sauers, 2021), it is nevertheless of particular importance in the educational process. School leaders play an important role in the coherent integration of AI into their schools, leveraging the potential offered by this technology, while at the same time trying to neutralize potential risks. Chassignol et al. (2018) conducted an initial review of the literature related to the use of artificial intelligence in education, addressing

aspects related to personalized teaching aids, pedagogical methods of teaching and assessment mediated by technology. Thus, in an initial phase, AI was used for administrative purposes to facilitate certain tasks related to scheduling, grading and student enrollment, or report generation (Johnson et al., 2021).

The most frequent processes performed by school leaders through AI include forecasting academic performance, managing absences, and preventing school dropout (Alvarado-Uribe et al., 2022). Thus, Bates (2020) argued that artificial intelligence can facilitate pedagogical activity related to grading and assessment, but also through the creation of personalized strategies in the educational act by teachers and the identification of students at risk of falling behind academically and supporting them in advance. However, studying the impact of AI on educational leadership is quite limited, with most researchers insisting that generative technologies can help leaders of any institution perform routine or mechanical tasks (Wang et al., 2022).

Through rapid and exhaustive data analysis, AI provides school leaders with information that can improve decision-making in curriculum design, resource allocation, personalized learning, and student performance monitoring (Kamalov et al. 2023). In contrast, Ratten (2023) emphasizes the practical and managerial implications of using chatgbt in education, as well as the critical need to re-examine existing educational practices in relation to technological innovations. By analyzing large data sets through AI, teachers can discover new methods of increasing pedagogical effectiveness, improving both their strategic planning and classroom management. We observe that the use of AI is becoming an indispensable role in the continuous professional development of teachers, providing them with access to innovative teaching resources and personalized training programs. Consequently, the use of AI by teachers as a tool for personalized and innovative teaching practices could be perceived by them as an opportunity to improve their leadership roles in relation to students (Ghamrawi et al., 2024). In the new paradigm, some researchers postulate that the role of the educator will be to supervise the activity of AI, with responsibilities related to quality control and fine-tuning of generative technologies or applications (Kamalov et al. 2023).

Given the fundamental functions of pedagogical leadership in building deep human connections, a number of studies explicitly address the potential of AI to replace teachers and leaders or reduce them to a functional role (Harris & Jones, 2023). In this sense, Ghamrawi et al. (2024) identify five sets of skills needed by teachers to keep up with evolving methodologies and technologies and to sustain their roles in a digital age: technological literacy, adaptability and continuous learning, collaboration and coaching skills, data-driven decision making, and human-centered approaches. Therefore, these aspects of education relating to the unique abilities of human teachers to engage, motivate, and inspire students, providing them with empathy, understanding, and guidance, become crucial in pedagogical activity and are difficult to replace solely through AI systems (OECD 2021).

As a result of the evolution of generative AI in recent years, new approaches and challenges have emerged regarding the digitization of education. We also observe a gap in examining the correlation of artificial intelligence applications with fundamental principles of leadership. Therefore, in this study, we insisted on a bibliometric approach to the entire corpus of studies on the impact of artificial intelligence on educational leadership in order to identify both current perspectives on the integration of new technological challenges into pedagogy and future research directions. From this point of view, AI offers new opportunities for school leadership, but also brings a wide range of ethical, moral, and pedagogical challenges. It is necessary for school leaders to adapt and constantly expand their knowledge and technological skills, supporting the training of teachers to meet these challenges and effectively integrating technology into their institutions. This can be achieved by exploring the scientific literature that can provide a comprehensive understanding of the implications of AI in education by identifying key areas, authors and sources that have focused on the topic, as well as less researched aspects regarding the risks and long-term effects generated by this phenomenon.

3. Methodology

3.1 Setting Research Objectives and Questions

The main purpose of this research is to identify the impact of the use of artificial intelligence on educational leadership by analyzing existing studies in the WoS database. In this sense, several secondary objectives were set, as follows:
O1: presenting the main researchers of this topic in the WoS database;
O2: determining how various countries have collaborated in addressing this topic;
O3: identifying the most important institutions that have shown increased attention to the issue of integrating AI into pedagogical leadership.

Our analysis is structured around five research questions:
Q1: What has been the evolution of articles related to the impact of artificial intelligence on educational leadership?
Q2: Who are the most prolific researchers in this field based on the number of articles published in WoS and citation counts?
Q3: Is there a pattern of collaboration between different countries and institutions on this topic?

By achieving these objectives, the research aims to emphasize the importance of integrating algorithms into the activity of educational leaders globally, by capitalizing on the opportunities generated by new technological advances in accordance with changing educational needs.

3.2 Data Extraction and Processing

The bibliographic analysis of the impact of generative intelligence on leadership was deepened through the VOSviewer software version 1.6.20.

According to the methodology of Zupic and Cater (2015), the following five stages were followed:

1. formulating the questions and identifying the bibliometric method of analysis in order to obtain answers;
2. initiating the thematic search in WoS and refining the initial results through specific inclusion and exclusion filters;
3. creating visual maps of the data obtained using the VOSviewer application for the purpose of an eloquent image of the existing networks between authors, countries, institutions, keywords used by authors.
4. setting specific requirements for bibliometric analyses restricted within the VOSviewer software: establishing the number of valid cases, the intensity of relationships, the background.
5. explaining the main figures, graphs or tables generated through the options of the Wos site and the VOSviewer application.

For the analysis of the impact of AI in educational leadership, we focused on identifying the relationships between authors, institutions, countries, or keywords related to the topic. Thus, starting from the research questions, a detailed analysis of the frequency of research on artificial intelligence in educational leadership was obtained, the most prolific authors were identified, as well as the institutions, countries, and sources that have paid attention to the topic over time. Emphasis was placed on the importance of the most used keywords and the most influential authors depending on the number of citations. Various models of cooperation between authors, institutions, or countries were also identified.

The time interval set for achieving the set objectives was between the years 1975-2025, the data being collected extracted on March 31, 2025, using the Web of Science (WoS) database. The search process initially used only the terms "education" and "artificial intelligence". Subsequently, the search was expanded by introducing terms related to the initial ones, such as: "school", "teacher", "principals", "school Improvement", "school improvement", "professional training", "digital education", "automatic intelligence", "intelligent assistance", "machine learning", "chatgbt", "intelligent system", "openai", "generative ai". After including the terms related to the concept of leadership (digital leadership, transformational leadership, leadership style, educational management), the research generated 14,047 articles, showing the growing interest in the integration and use of new generative technologies in education.

By refining these results with the help of inclusion (and exclusion) criteria, a number of 168 remained that address aspects exclusively related to the topic of AI in educational leadership. This discrepancy between the very large initial number of articles identified and those retained for the bibliometric analysis (approximately 0.7% of the number of initial studies) shows a very high concern for streamlining education through the use of AI, but also relatively little attention to the importance of school leaders in the new technological context.

Search Equation

Table 1

	Topic	Search terms
1	**Subject**	"education", "pedagoy", "teacher", "principal", "digital education", "artificial intelligence", "ChatGBT", "intelligent ssistance", "intelligent system", "openAI", "generative AI", "machine learning""
2	**Contextual approach: *leadership***	"educational leadership", "digital leadership", "transformational leadership", "leadership style", "educational improvement", "professional training", "educational management", "school improvement", "educational management", "classroom management", "school management"
3	**Level**	„kindergarten" OR „elementary school" OR „primary school" OR „middle school" OR „secundary school" OR „Bachelor" OR „high* school" OR „master" OR „doctor"

Source: own elaboration

Using the terms in Table 1, the search equation in the Web of Science (WoS) database approached 3 stages. In the first stage, the main topic was generated (artificial intelligence in education), and in the second stage, the contextual approach to aspects related exclusively to the field of leadership was insisted on). In the third stage, the aim was to reach the entire institutional educational act by including all chronologically arranged levels, from "kindergarten" to "doctor". We also used the "TS" formula in WoS, meaning "title, abstract and keywords", being considered the most eloquent in such analyses according to the recommendations of Zawacki-Richter et al. (2020) on systematic reviews in educational research. In order to efficiently refine the search, several specific inclusion and exclusion criteria were created, presented in Table 2.

Inclusion and Exclusion Criteria

Table 2

	Inclusion criteria	Exclusion criteria	Generated publications
1	Published between 1975 to 31.03.2025	published before 1975	14075
2	Indexed in Web of Science	Not indexed in Web of Science	14075
3	keywords included: „education" and „leadership" and „artificial intelligence"	not contain the terms: „education" and „leadership" and „artificial intelligence"	168
4	WoS Categories: Publications related to edutional leadership and artificial intelligence	WoS Categories: non-education publications, medicine, surgery, pharmacy, sport, tourism etc.	127
5	Article, Book, Chapters, Early Access, Letter, Proceeding Paper, Review Article	Published retracted	127

Source: own elaboration

According to the 3 criteria in the previous table, the 14075 publications were refined by keeping the tangential categories of education, leadership and generative technology, and excluding some areas that are not related to these concepts. This process resulted in a total of 127 publications, systematically collected, starting with 2012 and until March 31, 2025. The final distribution by category of the articles selected for analysis can be observed in Figure 1.

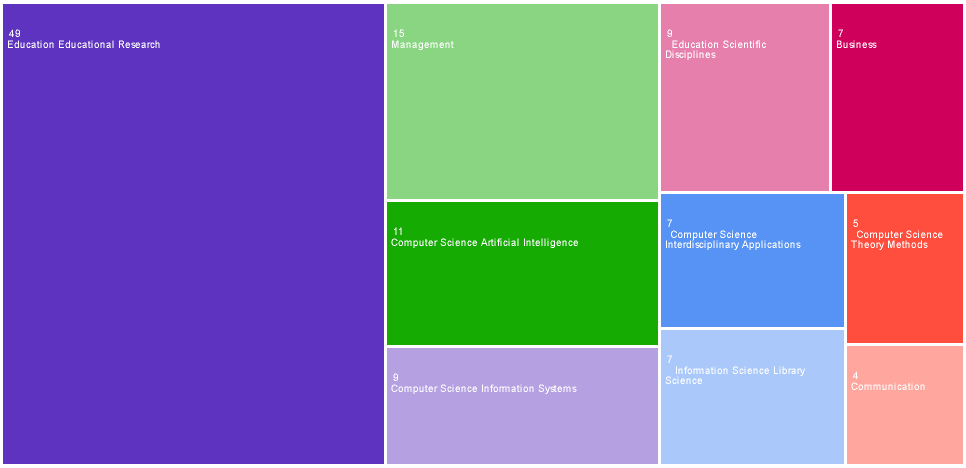

Figure 1. Final Distribution of Publications by Category
Source: Authors' own research, based on data extracted from WoS

4. Results and Discussion

4.1 Main Information about the Articles

Table 3 summarizes the key information regarding the search data performed in WoS. We emphasize that although the number of articles identified and analyzed bibliometrically is relatively small (127), the average number of citations per article (14.35) is relevant to highlight the importance of the topic.

Main Information about the Articles

Table 3

Description	**Results**
Timespan	1975 - 31.03. 2025
Sources	406
Documents	127
Citing Articles	871
Average citations per document	7.25
H- Index	13
Keywords Plus (ID)	216
Author's Keywords (DE)	511
Authors	440

Description	Results
Co-Authors per doc	3.46
article	89
book chapters	2
early access	13
proceedings paper	26
Review article	6
editorial material;	6

Source: own elaboration

4.2 Evolution of Articles Regarding the Impact of Artificial Intelligence on Educational Leadership

The first research question seeks to identify the temporal distribution of publications and the number of citations of the proposed topic. Analyzing Figure 2, we observe that although the search was performed over an extended period of years (approximately 50 years), the first article on this topic is recorded only in 2012, addressing the theme of human language processing by the iPhone Siri application as a personal assistant (Del Pino et al., 2012). It is worth mentioning that this article is based on the conclusions of the international forecasting workshop "Crazy futures" coordinated by Ziauddin Sardar and George Cairns in July 2011, in Romania, within the project Quality and Leadership for Higher Education. The attention of researchers regarding the impact of AI on educational leadership becomes visible and constant starting with 2017 when 3 articles are recorded.

We mention the upward trend and a significant increase from 2019, when 7 articles with 2 citations are recorded. The interest and attention given to the researched topic reaches its peak in 2024, being the most prolific year (52 publications and 454 citations). The spectacular evolution in recent years is generated by advances in the field of deep learning, the development of advanced algorithms, the increase in computing power, but also by the widespread adoption of digital means in education.

Although the analysis contains references only to the first 3 months of 2025 (12 publications, 163 citations), we can anticipate that the evolution will be increasing, the interest being increasingly greater on the opportunities and technological challenges on leadership in the field of education.

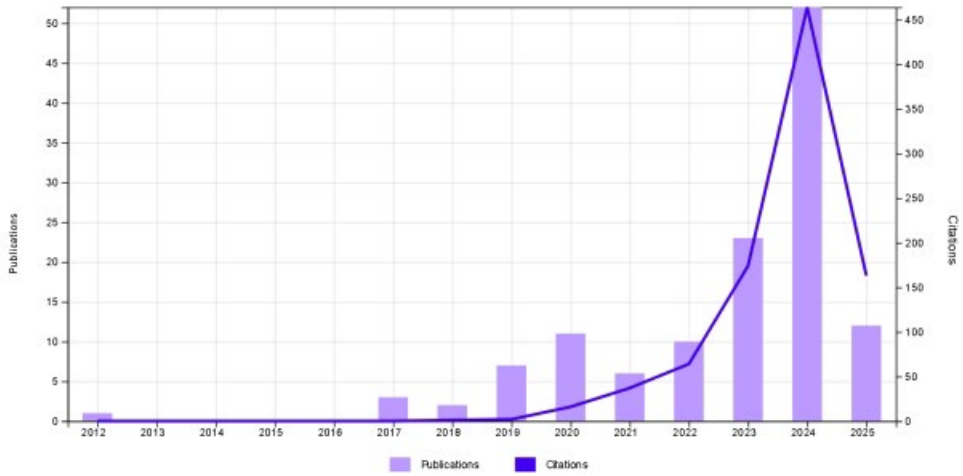

Figure 2. Times Cited and Publications Over Time

Source: Authors' own research, based on data extracted from WoS

4.3 Most Prolific Authors by Number of Articles

Identifying the main authors based on the number of articles written and the number of citations plays the role of evaluating the productivity and impact of researchers. Table 3 presents the top ten authors who have paid increased attention to the topic and have influenced other studies through their frequent citation by other authors. Only 10 authors were identified who participated in the elaboration of 2 studies in the field, and their ranking was done according to the number of citations. We note that although 440 authors and co-authors are registered, we still have a very small number of their works, the most prolific having only 2 signed articles. This highlights the fact that the approach to this issue is in an initial phase, and the contribution of the authors will be enriched in the following years by the elaboration of new articles.

The most Prolific Authors by the Number of Articles

Table 4

Author	Articles	Citations (f)
ALLEN Kelly-Ann	2	191
COWLING Michael	2	191
CRAWFORD Joseph	2	191
GHAMRAWI Norma	2	41
SHAL Tarek	2	41
LI Yaunyuan	2	36
WANG Chengliang	2	36
ALAM Muhammad	2	10

Author	Articles	Citations (f)
JENKINS Daniel	2	1
LUO Zhilin	2	0

Source: Authors' own research, based on data extracted from Wo*S*

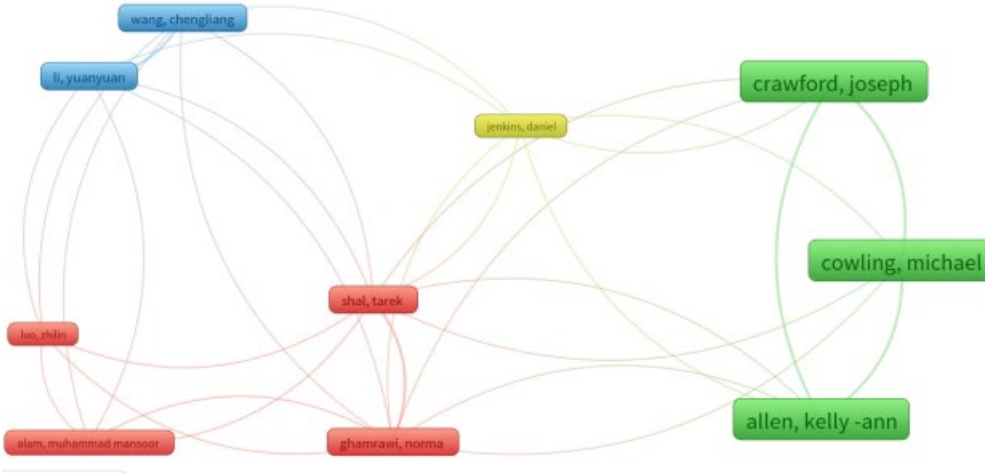

Figure 3. Network of Publications by Country
Source: Authors' own research, based on data extracted from Wos

The 10 authors are grouped into 6 clusters, among which the importance of the red cluster stands out, comprising the authors with the highest number of citations (180 citations): Allen Kelly-Ann (University of Tasmania, Australia), Michael Cowling (Central Queensland University, Australia), and Kelly-Ann Allen (Monash University, Australia). The most cited article by these three authors is titled „Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI)". The attention of this article is focused on plagiarism and academic integrity in the AI era, highlights the necessity of implementing pedagogical leadership as a support mechanism in developing students' character for responsible and efficient use of ChatGPT technology. Thus, educator-leaders must cultivate good character traits, facilitate deep learning for students, and build AI-friendly learning environments (Crawford et al., 2023).

An important contribution to the evolution of pedagogical leadership in the new technological context is the qualitative research by Ghamrawi Norma; Shal, Tarek; and Ghamrawi Najah, which is located in the center of the red cluster. In this study titled: „Exploring the impact of AI on teacher leadership: regressing or expanding?", the authors highlights the main challenges of AI in education based on 13 interviews with teachers. Their reasearch concludes that AI can enhance teachers' leadership by providing tools for personalization, designing an appropriate curriculum, and automating administrative tasks. However, it can also diminish the role of educators, as technology takes over some of their

responsibilities, such as facilitating information, reducing collaboration, and limiting the task of adapting education to the individual needs of students (Ghamrawi et al., 2023).

According to data generated from the WoS search, special recognition goes to authors Margaret Goralski and Tay Keon Tan, who, despite having authored only one article, have had a significant impact on research in this field with the highest number of citations (241 citations). Their study analyzes in Chapter 7 the impact of AI on education management, emphasizing the benefits generative technologies can bring to both students and educational leaders by improving decision-making skills and enabling the rapid implementation of suitable solutions for each area of activity (Goralski & Tan, 2019).

4.4 Countries/Regions and Collaboration Networks

The third research question focused on collaboration networks between countries, identifying 59 countries involved in this topic. Of these, only 15 countries met the following criteria: at least two publications and at least one citation. The results show that the United States (34 publications), China (14 publications), and Australia (9 publications) are the most productive countries, generating approximately 45% of all articles. However, when analyzing the impact of studies based on citation numbers, the United States ranks first (403 citations), followed by Australia (207 citations) and Malaysia (76 citations).

The Most Productive Countries

Table 5

Country	Articles	%	Citations
The United States of America	34	26.77	403
China	14	11.02	56
Australia	9	7.08	207
Germany	8	6.29	64
Malysia	6	4.72	76
India	6	4.72	22
Romania	6	4.72	13
Pakistan	6	4.72	12
Indonezia	5	3.93	9
Canada	4	3.14	15
Saudi Arabia	4	3.14	8
Spain	4	3.14	3
England	3	2.36	63
Total	109	83.41	1140

Source: Authors' own research, based on data extracted from WoS

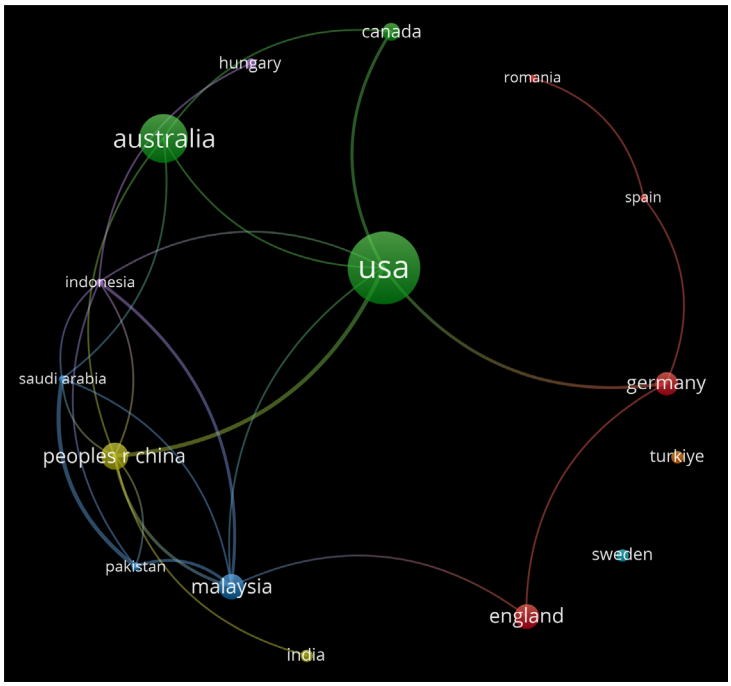

Figure 4. Network of Co-authorship by Country (weights: citation)
Source: Authors' own research, based on data extracted from Wosviewer

Regarding the collaboration network between these countries, this can be observed in Figure 4, which includes 15 countries grouped into 7 clusters. the most important cluster is the green one, with only 3 countries (USA, Australia and Canada), but totaling a very large number of citations (625 citations) The most extensive collaboration network is represented by the red cluster: England, Germany, Spain and Romania. An important aspect in the coauthorship network, regarding an interconnection with all 7 clusters, is Malaysia from the blue cluster. In conclusion, we observe that Australia has particularly attracted attention with a very high number of citations, suggesting that despite having a small number of articles (9 studies), the high citation count of these articles creates strong connections with all other clusters, indicating research quality.

It should be noted that researchers from various countries have increasingly focused on the consequences of artificial intelligence development on educational leadership, particularly over the last three years. Thus, we can mention studies from countries with established academic traditions such as the USA, Australia, and England, as well as growing interest from authors in less scientifically prominent countries like Malaysia, India, Pakistan, and Indonesia. Additionally, the Romanian academic community has demonstrated concerns about how higher education leadership addresses generative technological challenges, with six articles included in this bibliometric analysis, the most notable contributions being those by Nicolae and Nicolae (2018) and Tanasciuc (2024).

4.5 Scientific Collaborations between Institutions and Universities

Scientific collaboration among diverse educational institutions and organizations is also crucial for analyzing AI's impact on pedagogical leadership. The large number of organizations identified through this bibliometric effort (286 organizations) reflects both the high level of global concern and the extensive collaboration among diverse academic communities across different countries. To provide the clearest possible picture of these collaboration networks, we applied two additional criteria: a minimum of two publications and at least two citations. The analysis identified the top 14 institutions, presented in Table 6.

The most Prolific and Influential Organizations

Table 6

University	Country	Articles	Citations
University Sains	MALAYSIA	3	64
Colorado University	USA	3	14
Calgary University	CANADA	3	7
Bucharest University of Economic Studies	ROMANIA	3	2
Monash University	AUSTRALIA	2	191
Tasmania University	AUSTRALIA	2	191
Qatar University	QATAR	2	41
East China Normal University	CHINA	2	36
Zejiang University of Technology	CHINA	2	36
Riphah International University	PAKISTAN	2	10
University Adelaide	AUSTRALIA	2	9
University South	AUSTRALIA	2	9
Arizona University	USA	2	2
Prince Sultan	Saudi Arabia	2	2

Source: Authors' own research, based on data extracted from WoS

The most prolific institutions each have three articles on this topic, but with varying citation counts. A significant contribution comes from the quantitative analysis by Luo and Wang (2024) at Colorado University, which examines the impact of teachers' digital leadership based on smart learning on organizational culture and curriculum integration. The most important study from Universiti Sains Malaysia belongs to Wang et al. (2024), offering novel perspectives for university leadership on building an effective educational ecosystem, emphasizing students' cognitive literacy in AI ethics. The analysis identified particular attention paid to the topic within universities in Australia (Monash University, University of Tasmania, University of Adelaide and University of South Australia), China (East China Normal University Zejiang University of Technology) and the USA (The University of Arizona, Colorado University).

The collaboration network between organizations on the topic of AI and leadership (Figure 5) is very complex, comprising both strongly interconnected centers such as those at the University Sains in Malaysia, but also top institutions in this field, such as the University of Colorado recognized for innovative initiatives, strategic partnerships, research and training programs (AI Strategy and Leadership course).

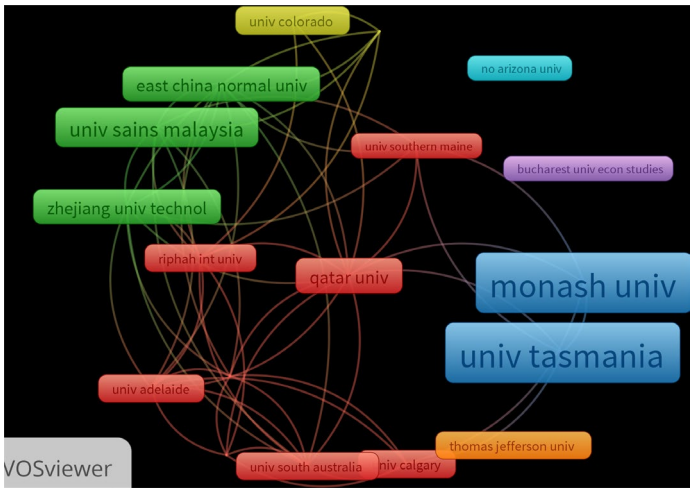

Figure 5. The Collaboration Network between the Organizations
Source: Authors' own research, based on data extracted from Wos

Figure 5 shows the main 18 organizations identified by the Bibiographical coupling method, which measures the degree of similarity between documents based on the common references they cite. Of the 7 clusters, we mention 3 larger clusters: the red cluster with 8 items with Qatar University (41 citations) in the center, the green cluster (3 items) around the University Sains in Malaysia (64 citations) and the blue cluster comprising 2 institutions in Australia: Monash University (191 citations), Tasmania University (191 citations). The identified networks suggest the approach of similar topics or related themes, as well as the mutual influence of researchers within these institutions.

We note that among the most influential institutions are two educational organizations in Australia (Monash University and Tasmania University). The peak of citations is reached in 2023 through the articles of Crawford from Monash University and Allen Kelly-Ann from the University of Tasmania. From a chronological point of view, the topic was analyzed in the period 2019-2021 by researchers from the Universities of Calgary (Canada) and University Adelaide (Australia). We mention in the recent period, the emergence of an increased interest in the subject within the academic environment in China (East China Normal University, Zejiang University of Technology) but also in university centers in the Arab area such as Qatar University, or Prince Sultan University (Saudi Arabia).

Among the most prolific institutions, we note a presence from the Romanian academic environment, the Academy of Economic Studies of Bucharest (purple cluster), although it does not present a collaboration network with other institutions. The contribution of the Bucharest Academy of Economic Studies consists of an original and unique D-VUCAD analysis that highlights the crucial role of educational leaders in Romanian higher education in adapting education to the realities and challenges generated by AI (Tanasciuc, 2024). The approach to the topic by renowned universities from the USA (University of Maine, Thomas Jefferson University, Colorado State University), Australia (Monash University, University Adelaide), and China (Zejiang University of Technology), along with lesser-known academic institutions from Pakistan (Riphah International University) or Malaysia (University Sains), highlights the global interest in the challenges of artificial intelligence on educational leadership.

The efforts in the global academic environment to present opportunities and risks generated by artificial intelligence on teachers aim to develop effective and reality-based pedagogical leadership.

5. Conclusions

The results of this research consisted in identifying relevant studies in terms of challenges related to redefining the role of pedagogical leadership under the impact of artificial intelligence. The main identified authors showed that educational leaders must integrate technological advances to capitalize on their potential and increase pedagogical efficiency, but without neglecting certain risks and ethical implications (Fullan et. al. 2023).

The information obtained by analyzing the most prolific authors, countries and institutions, reveals that artificial intelligence is a catalyst for transformation, balancing technological integration with teacher training and ethics. Most of the studies presented within this bibliometric approach conclude on the role of generative technologies in the administrative and pedagogical efficiency of educational leaders. Also, new research directions were identified regarding the role of teachers in the AI era, the effects of dehumanization of learning, the reduction of the creative contribution of educators, the need to develop new skills for teachers and the adoption of pedagogical methods appropriate to technological challenges.

This overview of the existing literature on the integration of new technologies in the work of educational leaders highlights the need for psychological, emotional or political transformations of the entire educational climate (D'Agostino, 2023). Consequently, the effort to synthesize the main conclusions of scientific research on the integration of AI in education aims to improve the adaptation process of educational leadership to technological innovations.

In conclusion, the 127 studies analyzed bibliometrically postulate that new generative technologies have the potential to have a significant impact on

educational leadership at a global level, but the exploration of this phenomenon scientifically is only at its beginning.

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