



# Bibliometric analysis of scientific publications on artificial intelligence in educational management and leadership: Web of Science and Scopus sources between 1986-2026

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## ABSTRACT

This study aims to map the academic literature at the intersection of artificial intelligence (AI) and educational management/leadership through bibliometric methods, using a dataset of 1,072 articles retrieved from the Web of Science and Scopus databases. Analyses conducted with R software and the Biblioshiny package reveal that the field is exceptionally young and dynamic, with an average document age of only 2.7 years, and that scientific output has increased substantially in the post-2020 period. This dynamic structure can be attributed to the COVID-19 pandemic and the widespread diffusion of generative AI tools. The geographical distribution of publication output indicates orientation towards new geographical directions with a growing concentration along a Eurasian axis. At the institutional level, Kazan Federal University (99 publications) and RUDN University (62 publications) emerge as dominant contributors, while China holds a global leadership position in citation impact (1,885 citations). This result should be cautiously handled as the database bias and publication concentration effects might have influenced the search outputs. In terms of conceptual structure, “artificial intelligence” and “machine learning” appear as dominant terms, and the thematic map identifies these concepts— together with “education management”—as motor themes. This finding suggests that the field has moved beyond purely theoretical debates and is transitioning into the mainstream of data-driven educational management. Considering this transformation, it is recommended that policymakers and leadership-development programs urgently integrate modules on data literacy and AI ethics. Overall, the study concludes that the discipline is undergoing a transition period, where future leaders will be responsible for governing algorithmic resources alongside human resources.

**Keywords:** artificial intelligence, bibliometric, education, leadership, management

## INTRODUCTION

In the first quarter of the 21<sup>st</sup> century, educational technologies have evolved from simple digitization of instructional materials into holistic, data-driven systems that reshape institutional management and leadership. Rapid advances in artificial intelligence (AI) have transformed both pedagogical and administrative dimensions of schooling (Zawacki-Richter et al., 2019). AI now functions not merely as a “teaching assistant” but as a strategic “management partner” that enhances institutional efficiency, resource allocation, and decision-making (Popenici & Kerr, 2017).

This study is theoretically anchored in established educational leadership frameworks. Instructional leadership theory (Hallinger, 2011) emphasizes leaders’ core responsibility for curriculum, instruction, and student outcomes—functions that AI can significantly augment through predictive analytics and personalized learning pathways. Distributed leadership theory (Hartley, 2007; Lumby, 2013; Timperley, 2005) highlights leadership as a shared, collective practice distributed across individuals and tools, offering a lens for

understanding human-AI collaboration in school administration. In the context of digital transformation, digital leadership frameworks (Anwar & Saraih, 2024; Gledson et al., 2024; Hensellek, 2020; Gurr, 2015; Raman et al., 2019) further illuminate how educational leaders must integrate technology ethically and strategically to support school improvement. These frameworks collectively position AI not as a “black box” but as a transparent, explainable mechanism aligned with educational theory (Göçen & Aydemir, 2020).

Although prior research has examined AI in higher education and learning analytics (Chen et al., 2020; Martin et al., 2024; Yufei et al., 2020), the managerial and leadership dimensions—particularly at the K-12 level—remain underexplored. Systematic reviews that combine quantitative bibliometric mapping with explicit links to leadership theory are especially scarce. The present study, therefore, employs bibliometric analysis to map the intellectual structure, developmental trajectories, and conceptual interrelations of the literature at the intersection of AI and educational management/leadership.

A review of the literature indicates that research on the use of AI in education has predominantly focused on higher education and learning analytics, whereas the managerial and leadership dimensions at the K-12 level have been addressed to a comparatively limited extent (Yufei et al., 2020).

Contemporary research in educational technology focuses not only on the adoption of new technological tools but also on how these tools are integrated in alignment with educational theories. It is essential for educational leaders to position AI not as a “black box” but as a transparent and explainable mechanism that supports school improvement theories. Göçen and Aydemir (2020) emphasize that the use of AI in educational administration may enable school leaders to shift away from routine administrative tasks and toward more intensive human-centered interactions and visionary leadership roles. Therefore, there is a growing need to systematically analyze the intellectual structure, developmental trajectories, and conceptual interrelations of the emerging literature situated at the intersection of educational technology and educational management. The synthesis formed at this convergence point does not merely represent a technical integration; it also entails a theoretical reconceptualization of school leadership in the digital.

The rapid expansion and interdisciplinary interaction observed in the literature necessitate a holistic examination of the field’s conceptual structure and developmental dynamics. Although several systematic review studies addressing the relationship between AI and education exist (Chen et al., 2020; Martin et al., 2024), comprehensive investigations that specifically focus on *educational management and leadership*, employ quantitative analyses, and utilize scientific mapping techniques remain limited.

Focusing on theoretical approaches, research trends, and developments in the field of educational technology, the study seeks to:

- (1) reveal publication performance and growth patterns within the field,
- (2) identify the most influential authors, institutions, and collaboration networks, and
- (3) visualize the conceptual and thematic transformation of the domain through keyword analyses.

The findings obtained from these analyses are expected to provide a comprehensive overview of the current state of theoretical work in educational technology, while also offering evidence-based guidance on AI integration for educational leaders and policymakers operating in practical settings.

Bibliometrics is a quantitative analytical approach that employs mathematical and statistical methods to evaluate the relationships and impacts of publications within a specific research domain (Liu et al., 2024). Bibliometric studies encompass empirical methods that focus on quantitative examinations of the literature (Ding et al., 2001). As a powerful tool for analyzing knowledge domains and uncovering their cognitive-epistemological structures (Van Eck & Waltman, 2010), bibliometrics enables researchers to view large bodies of academic work from a macroscopic perspective. This method systematically reveals the prominent studies, authors, journals, institutions, and countries within a given field (De Carvalho Pereira et al., 2015)

In this context, the present study employs the Web of Science (WoS) and Scopus databases for bibliometric analysis. Indeed, WoS provides access to detailed research data for each indexed publication, including author information, sources, cited references, keywords, and related bibliographic elements. Furthermore, the literature on AI in educational management and leadership retrieved from WoS and Scopus is systematically analyzed using the Bibliometrix and Biblioshiny software packages available in the R environment.

Therefore, there is a growing need to systematically analyze the intellectual structure and developmental trajectories of the emerging literature situated at the intersection of educational technology and educational management. Although several systematic review studies addressing the relationship between AI and education exist (Chen et al., 2020; Martin et al., 2024), comprehensive investigations that specifically focus on the managerial dimensions and utilize quantitative scientific mapping techniques remain limited. Specifically, questions regarding how AI technologies are reshaping the fundamental scope of educational management, in which geographical contexts this transformation is most pronounced, and how the conceptual boundaries of the field are evolving have yet to be clearly answered. Within this framework, the primary aim of the study is to examine the academic literature shaped around the key concepts of “artificial intelligence” and “educational management/leadership” through bibliometric analysis methods.

The following scientific research questions (RQs) guide this research:

1. **RQ1.** What are the longitudinal publication trends in the field of AI within educational management and leadership?
2. **RQ2.** How do key stakeholders—authors, institutions, and countries—interact and collaborate in this research domain?
3. **RQ3.** Which core keywords dominate the field, and how are these concepts thematically clustered?
4. **RQ4.** What key components, patterns, and themes characterize the global evolution of the AI literature in educational management and leadership?

The bibliometric analysis conducted within this scope provides structured knowledge on the field of AI in educational management and leadership, offering a comprehensive assessment of the existing literature. The analysis identifies current gaps, noteworthy insights, and emerging trends for researchers working in this domain. The significance and contribution of the study lie in its ability to elucidate the position of AI within educational management and leadership and to systematically examine the evolution of the literature up to the present day.

## METHODOLOGY

### Data Collection

In this study, the WoS and Scopus databases were employed for the bibliometric analysis. According to Baas et al. (2020), Scopus constitutes a reliable bibliometric data source by selecting its extensive collection of journals, book series, and conference proceedings through a rigorous evaluation process. Conversely, the WoS database was preferred due to its wide array of tools for processing search results, along with its general search, citation search, and advanced search functionalities (Cancino et al., 2015; Gaviria-Marin, 2018; Mongeon & Paul-Hus, 2015).

On 2 December 2025, a comprehensive search was conducted across all fields in the WoS and Scopus databases using the following query: as keywords, (*“artificial intelligence” or “AI” or “machine learning” or “deep learning” or “educational AI” or “intelligent systems” or “learning analytics”*) **AND** (*“educational leadership” or “education leadership” or “school leadership” or “instructional leadership” or “academic leadership” or “educational management” or “education management” or “school management” or “administrative management” or “education administration” or “school administration”*). The string formation and keyword search was determined through two peer reviewers’ contributions, one from education technology field, and the other from education management. Following the discussion with peer reviewers, eliminated sets were as such *“Generative AI” OR “GenAI” OR “Large Language Models” OR “LLMs” OR “Foundation Models” OR “AI Chatbots” OR “AI Copilot” OR “AI Agent” OR “AI Governance” OR “AI Literacy” OR “AI Readiness” OR “Digital Transformation” OR “Algorithmic Accountability” OR “Algorithmic Bias” OR “Predictive Modeling” OR “Data-Driven Decision Making” OR “Human-in-the-loop” OR “AI Ethics” OR “Responsible AI” OR “School Governance” OR “Institutional Leadership” OR “Principalship” OR “Enrollment Management” OR “Administrative Efficiency” OR “Early Warning Systems” OR “Technostress” OR “Automated Feedback” OR “Policy Frameworks”*.

For the bibliometric analysis of scientific publications on AI in educational management and leadership, searches were conducted in both the WoS and Scopus databases. In the WoS database, the relevant concepts

The screenshot shows the Web of Science search results page. At the top, it displays "950 results from Web of Science Core Collection for:" followed by a search bar containing the query: "artificial intelligence" OR "AI" OR "machine learning" OR "deep learning" OR "educational AI" OR "intelligent systems" OR "learning anal...". There is a "Copy query link" button to the right. Below the search bar, there are two rows of search criteria. The first row has a dropdown menu set to "All Fields" and a search box containing the same query. The second row has a dropdown menu set to "All Fields" and a search box containing: "educational leadership" OR "education leadership" OR "school leadership" OR "instructional leadership" OR "academic leadership" OR "educational m...". There are buttons for "+ Add row" and "+ Add date range". At the bottom right, there are "Clear" and "Search" buttons.

**Figure 1.** WoS search screen (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

The screenshot shows the Scopus search results page. At the top left is the Scopus logo. On the right, there are navigation links for "Search", "Sources", "SciVal", and a user profile icon labeled "AY". Below the navigation, there is a search bar with the query: "artificial intelligence" OR "AI" OR "machine learning" OR "deep learning". Below the search bar, there is a dropdown menu set to "AND" and another search box containing: "educational leadership" OR "education leadership" OR "school leadership". There are buttons for "Save search", "Set search alert", "+ Add search field", "Reset", and "Search". At the bottom, it displays "776 documents found" and a link to "Analyze results".

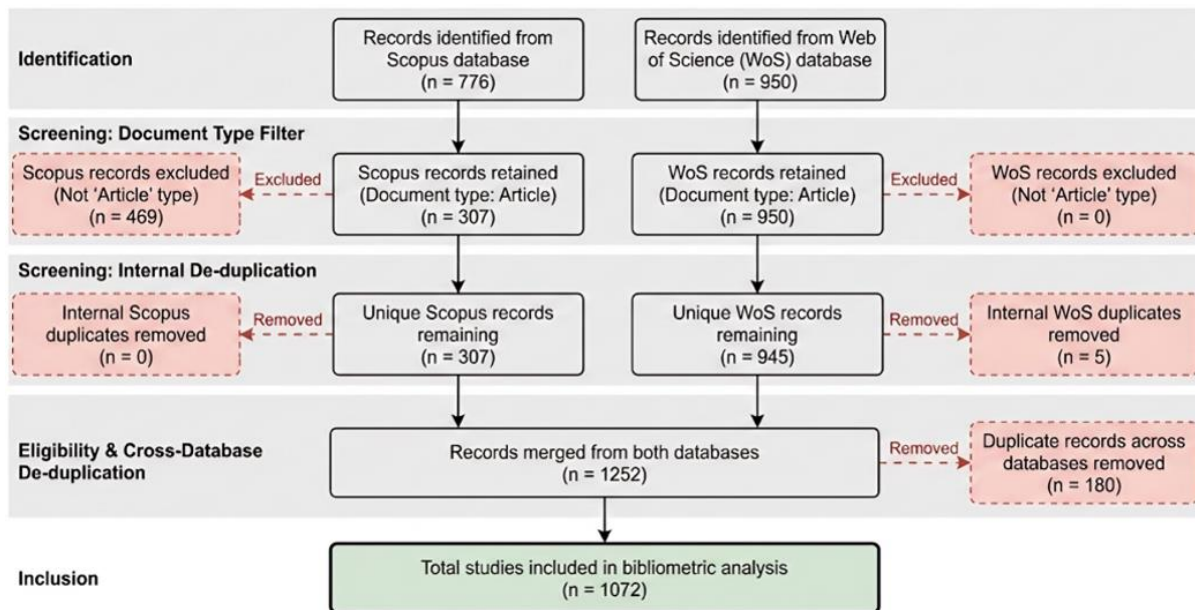
**Figure 2.** Scopus search screen (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

were queried, and the initial search yielded 950 records (Figure 1). When the document type was restricted to "article," no change was observed in the dataset, which remained at 950 records. After checking for duplicates within this dataset, five duplicated entries were identified; thus, a total of 945 WoS records were included in the analysis.

Subsequently, the same search concepts were queried in the Scopus database, resulting in 776 records (Figure 2). When filtered by the document type "article," the dataset decreased to 307 records. A check for internal duplicates revealed no duplicated entries; therefore, all 307 Scopus records were included in the analysis. After restricting both databases to the document type "article," the datasets were merged. Prior to merging, cross-database duplication was examined, and 180 articles were found to appear in both WoS and Scopus. Consequently, a total of 1,072 unique records from both databases were included in the final analysis. The workflow of the study is illustrated in Figure 3.

## Bibliometric Analysis

Bibliometric analysis is a methodological approach that utilizes published research outputs and offers a quantitative lens for examining academic literature. The method was first introduced in 1969 (Broadus, 1987; Liu et al., 2024). In this study, bibliometric analysis was employed to explore the potential of AI within the field of educational administration and leadership. This approach systematically processes large volumes of literature and provides a comprehensive overview of a given research domain. In doing so, it enables a broad perspective on the existing scholarship and facilitates the quantitative and objective depiction of research themes from past to present (Azman et al., 2025). Bibliometric analysis also investigates developmental trends across various scientific fields and allows researchers to construct scientific knowledge maps that represent the intellectual structure of a domain, subsequently assessing their characteristics through statistical and mathematical techniques (Ding et al., 2001; Godin, 2006; Say, 2023). In this respect, bibliometric analysis



**Figure 3.** Flowchart of the study (Source: Generated by Gemini V. 3)

serves as a robust methodological tool for systematically revealing the accumulated body of research while identifying future scientific trends, research gaps, and emerging areas of inquiry.

In the present study, the construction of knowledge maps was conducted using Biblioshiny, the graphical web interface built on Bibliometrix 3.0 (<https://www.bibliometrix.org>), which operates within and is fully compatible with the R software and RStudio environment. R is regarded as a dynamically programmable and interpretable language that supports statistical analysis and data processing procedures (Aslam & Ullah, 2023; Diez-Vial & Montoro-Sanchez, 2017; Donoho, 2017; Li, 2018).

The Bibliometrix R package occupies a central position in scientific methodology through its comprehensive suite of tools designed for quantitative research. Developed within the open-source R programming environment, the package provides numerous practical statistical algorithms, access to high-quality numerical data, and integrated data-visualization capabilities, thereby offering significant advantages for scientific computing (Aria & Cuccurullo, 2017). In the present study, the literature retrieved from the WoS and Scopus databases was examined using the bibliometric analysis procedures available in the Bibliometrix environment. The knowledge maps generated and the findings obtained from these analyses are presented in the relevant section.

## FINDINGS

### Longitudinal Publication Trends

This section addresses the **RQ1** by examining the historical evolution and growth patterns of scientific production in the field of AI-supported educational management. An overview of the dataset is presented in **Figure 4**.

An examination of **Figure 4** indicates that the analysis covers the period from 1986 to 2026 and includes 1,072 academic works published across 541 different sources. Although the annual growth rate is 2.78%, the mean age of the documents is relatively low at 2.7 years. The literature comprises contributions from a total of 4,204 authors, and the limited number of single-authored publications ( $n = 139$ ) alongside the high average number of authors per document (4.86) highlights the predominance of a collaborative research culture in this field. Furthermore, the international co-authorship rate of 23.6% suggests that the topic is addressed on a global scale and through extensive cross-border collaborations.

As seen in **Figure 4**, a total of 1,072 documents were produced within the analysis period of 1986-2026. The relatively low average document age of 2.7 years indicates that the field is still in a nascent stage and remains highly dynamic.



Figure 4. Main information (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

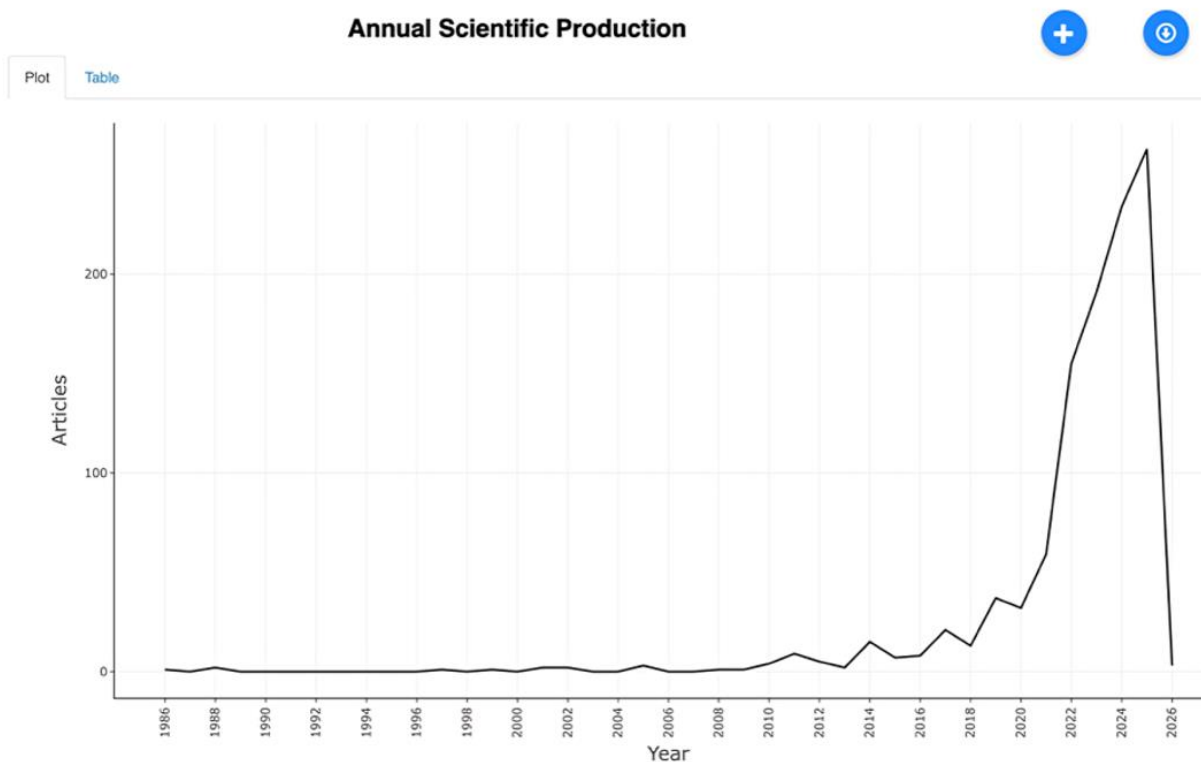


Figure 5. Annual scientific production (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

The evolutionary trajectory of the field is further illustrated in the annual scientific production graph provided in [Figure 5](#). An examination of [Figure 5](#) reveals that the number of publications remained low and stable between 1986 and 2010, but entered an exponential growth trend after 2020, reaching its peak in 2024-2025. This pattern indicates that the vast majority of the literature in this field has been produced within the last five years, confirming that the topic has recently emerged as a highly dynamic and rapidly growing area of scientific interest. An examination of [Figure 5](#) reveals that the literature remained relatively stagnant between 1986 and 2010 but entered a phase of exponential growth post-2020. The peak observed in the 2024-2025 period can be attributed to the accelerated digitalization necessities following the COVID-19 pandemic and the widespread adoption of generative AI tools. These findings suggest that the domain has shifted from a niche area of theoretical debate to a rapidly expanding mainstream field.

An examination of [Figure 6](#) indicates that the literature in this field exhibits a highly dynamic structure. The exponential increase in annual scientific output and in the average number of citations per article after 2020 confirms that the topic has emerged as a new focal point of scholarly interest.

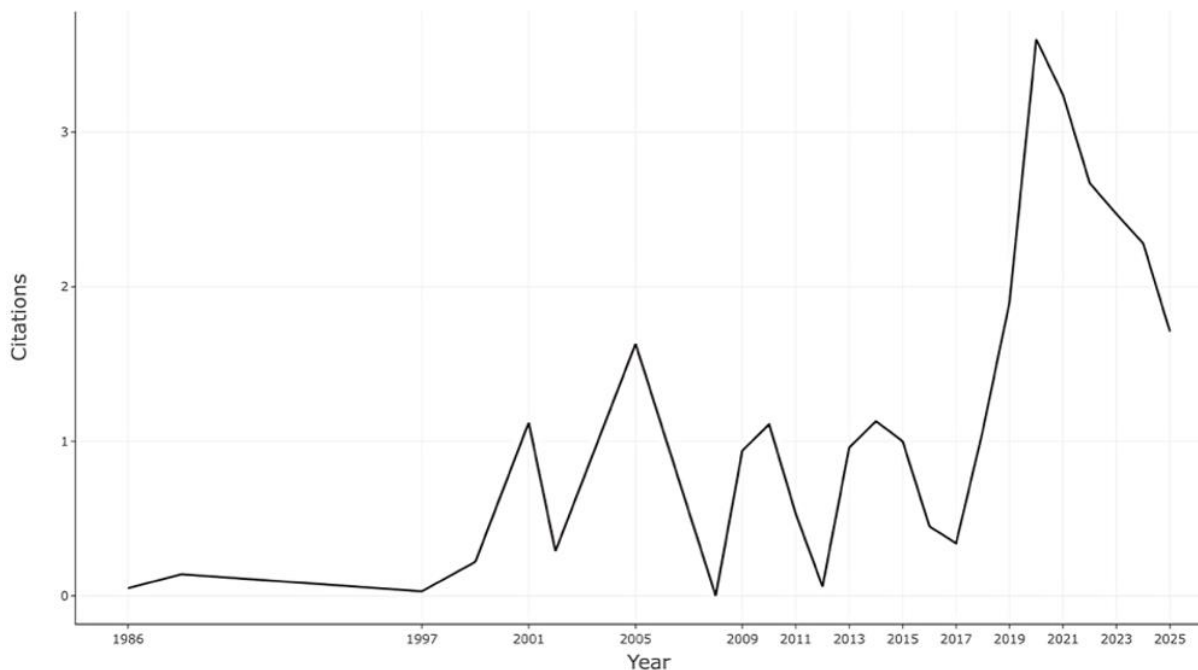


Figure 6. Average citations per year (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

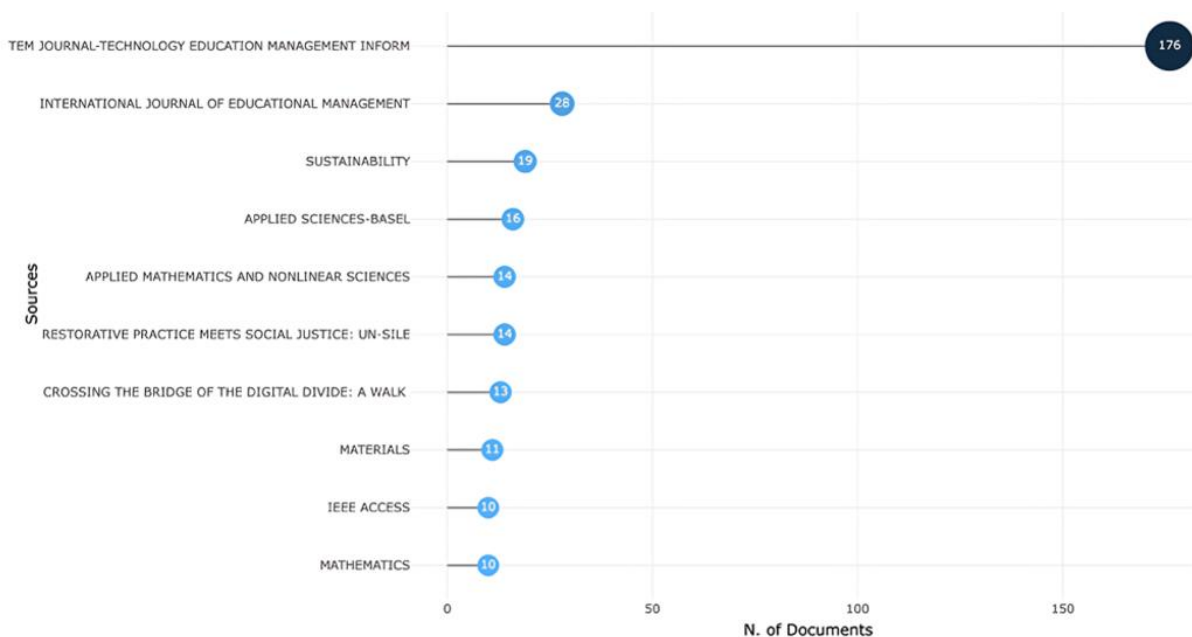


Figure 7. Most relevant sources (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

### Key Stakeholders and Collaboration Networks

This section addresses the **RQ2** by analyzing the primary actors (authors, institutions, and countries) driving productivity in the field and the collaboration networks among them.

An examination of the most relevant publication sources (Figure 7) reveals that the *TEM Journal-Technology Education Management Inform* is by far the most dominant outlet, with 176 articles. This finding indicates that research output is strongly centralized within specific platforms where the themes of technology, education, and management intersect.

According to Figure 7, the exponential growth in annual scientific output post-2020 and the significant increase in the average annual number of citations since that date confirm that the topic is rapidly evolving

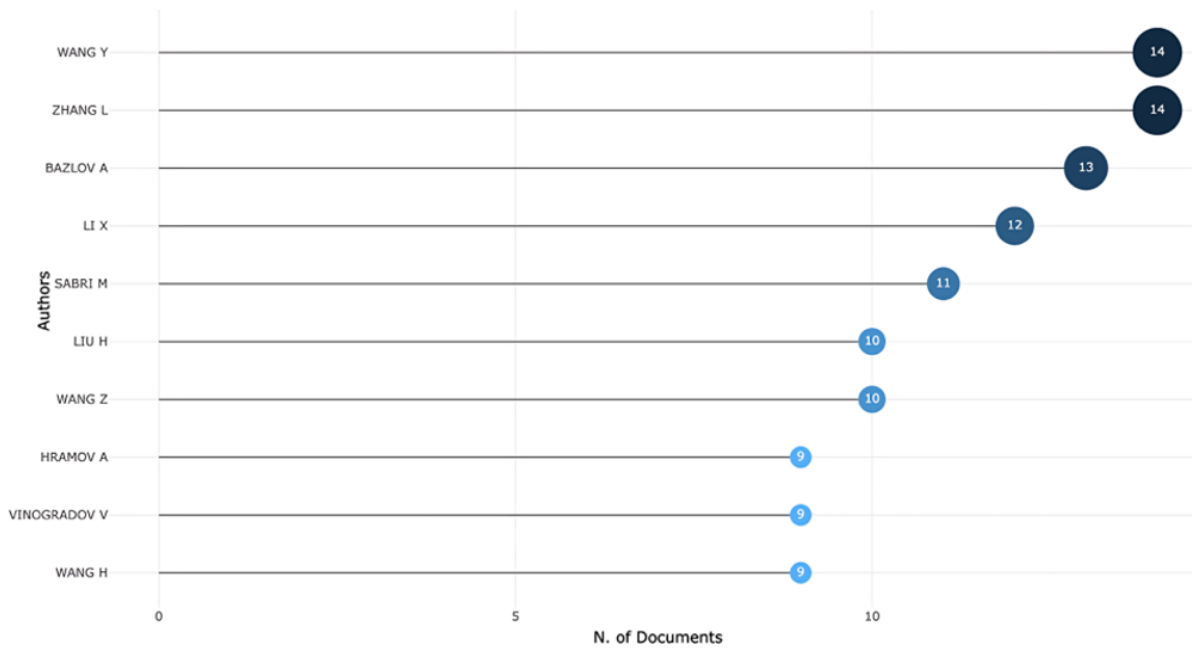


Figure 8. Most relevant authors (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

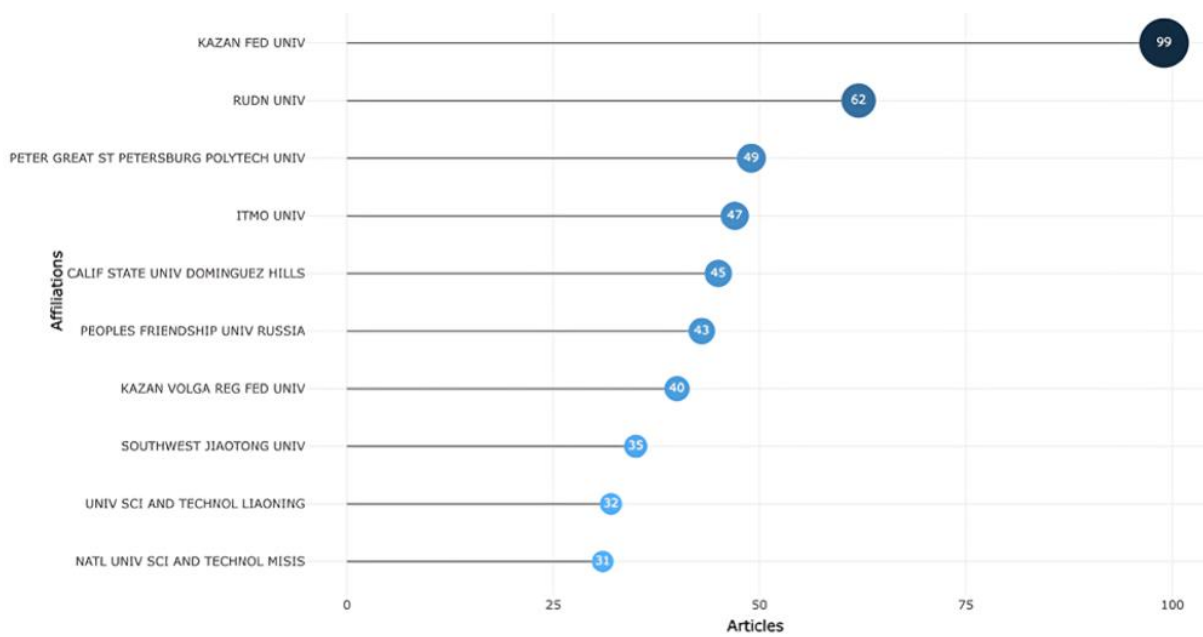
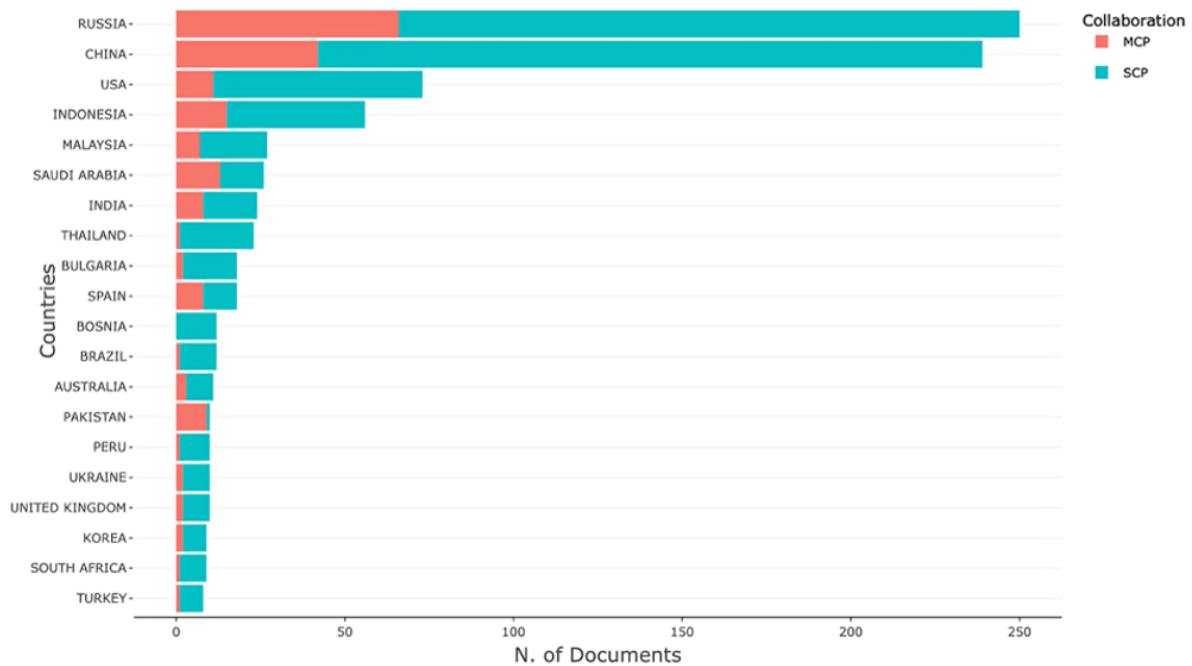


Figure 9. Most relevant affiliations (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

into a new focal point of academic interest. Regarding the distribution of output among sources, a major concentration is not observed; however, the journal *TEM Journal-Technology Education Management Inform* assumes a clearly dominant role as the most relevant publication source with 176 documents. This finding suggests that a substantial portion of the research is strongly centralized around the themes of technology, education, and management.

Regarding author productivity (Figure 8), the literature appears to be dominated by a small core group of authors, led by Wang, Y. and Zhang, L. At the institutional level (Figure 9), Kazan Federal University (99 publications) and RUDN University (62 publications) emerge as the highest contributors to the field. These results need to be interpreted with care, as they may be skewed by inherent database biases and trends in publication frequency.



**Figure 10.** Corresponding author's countries (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

Upon examination of [Figure 8](#), it is understood that publications are dominated by a small core of authors led by names such as Wang, Y. and Zhang, L., and that knowledge in the field is strongly centralized both thematically (technology/management) and geographically around a specific resource and expert group.

According to [Figure 9](#), Kazan Federal University stands out by a wide margin, producing 99 publications and surpassing all other institutions in the field. It is followed by RUDN University (62 publications) and Peter the Great St. Petersburg Polytechnic University (49 publications).

Institutions in the mid-range group—such as ITMO University, California State University Dominguez Hills, and Peoples' Friendship University of Russia—demonstrate comparable levels of productivity, with approximately 43-47 publications each.

In contrast, institutions at the lower end of the ranking (for example, Southwest Jiaotong University and the National University of Science and Technology MISIS) exhibit publication outputs in the range of 31-35 studies.

The geographical distribution of the field ([Figure 10](#)) demonstrates that academic production is recently oriented towards a Eurasian axis. While Russia leads in total publication volume, China holds the global leadership position in terms of citation impact ([Figure 11](#)), with 1,885 citations. Due to potential irregularities in database indexing and concentrated publication patterns, these results should be viewed as preliminary.

According to [Figure 10](#), an examination of the geographical distribution of research on AI in educational management and leadership shows that Russia, China, and the United States are the most active countries in the field. Russia occupies a leading position in both single-institution and multi-institution publications, indicating a high level of domestically driven research production. China ranks second in total publication output but places greater emphasis on international and multi-institution collaboration. The United States follows in third place, displaying a balanced distribution between single-institution studies and collaborative research.

Countries at the mid-level—such as Indonesia, Malaysia, Saudi Arabia, and India—emerge as rising contributors that have recently begun investing in AI-related research within educational leadership, with international partnerships playing a significant role in their scholarly output. The relatively limited number of publications from European and South American countries, as well as from some highly developed nations, suggests that research activity in this area is concentrated within specific geographic regions.

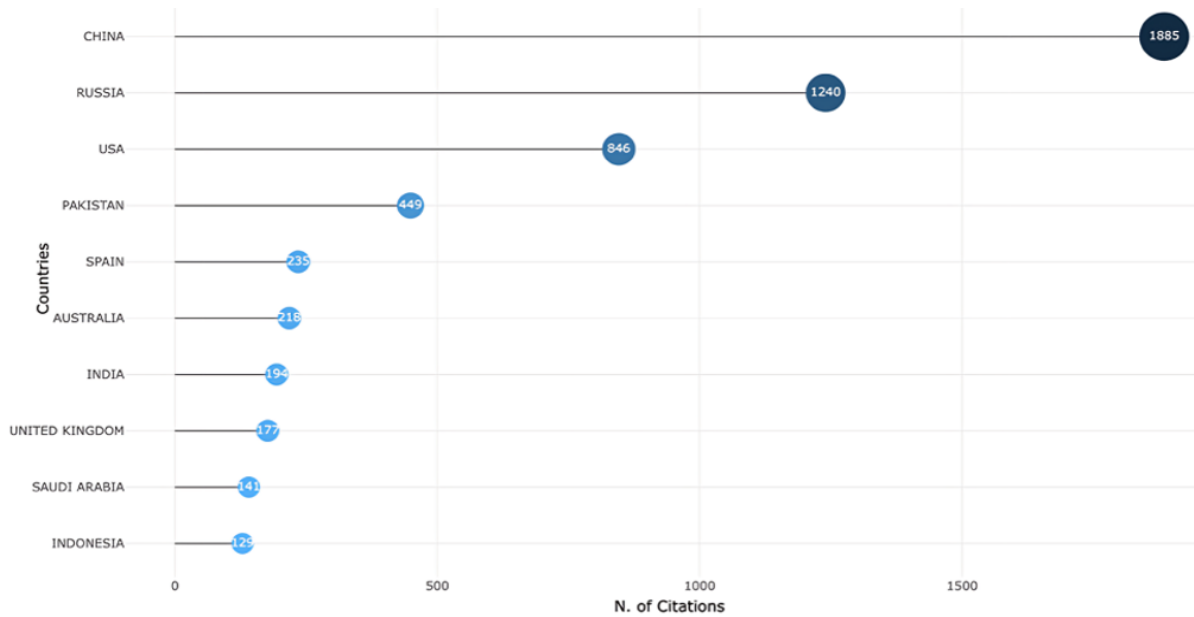


Figure 11. Most cited countries (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

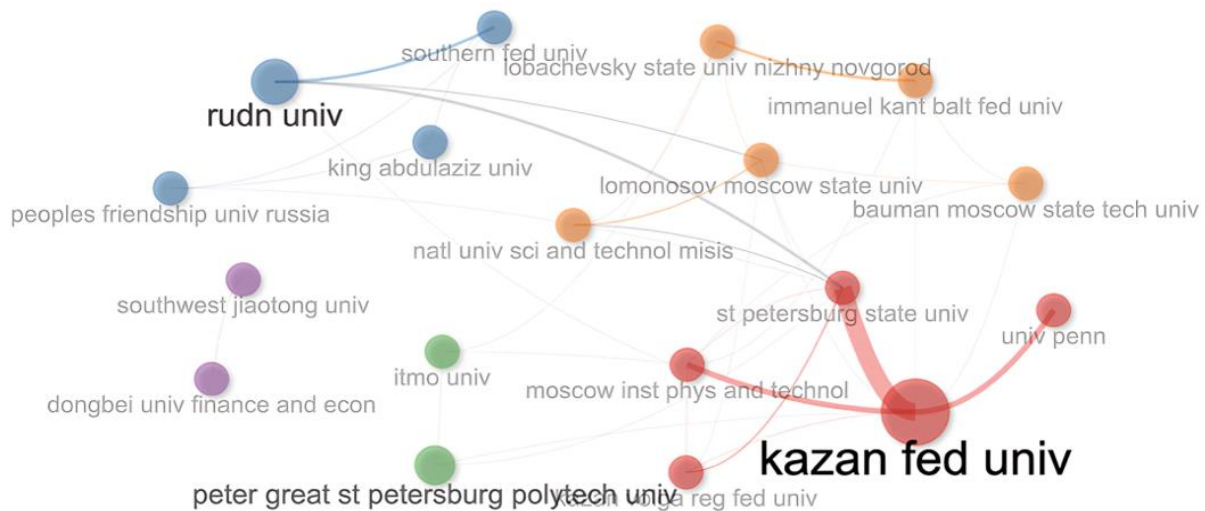
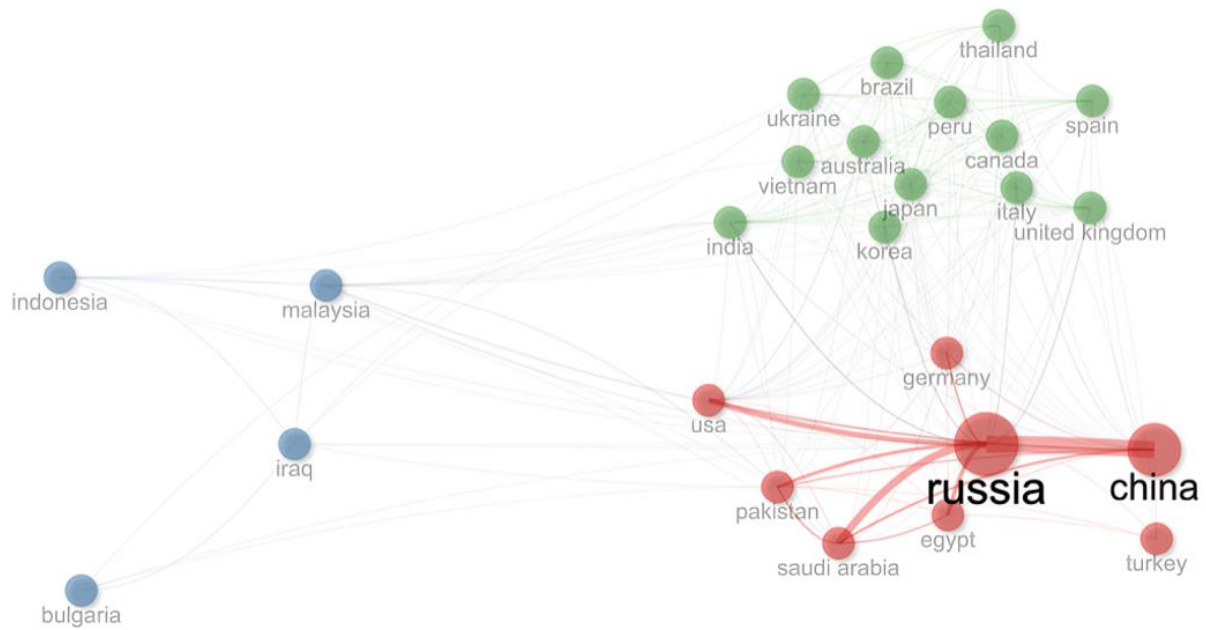


Figure 12. Collaboration network: Affiliations (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

Overall, the geographical concentration of the literature on AI in educational management and leadership is particularly pronounced along the Eurasia axis, while multi-institutional and international collaborations appear to be increasing across the field. The reliability of these outputs may be compromised by systematic database bias; thus, a cautious analytical approach is recommended.

According to Figure 11, China is clearly the most highly cited country in the field. With 1,885 citations, China stands at the top of the list, demonstrating its dominant position in global academic output and influence. Following China, Russia (1,240 citations) and the United States (846 citations) rank second and third, respectively, indicating their substantial impact on the scholarly landscape. The citation counts of these three countries show a marked concentration when compared to other nations. Pakistan ranks fourth with 449 citations, reflecting a notable—though considerably lower—level of contribution relative to the leading countries. Examination of the remaining countries shows that Spain (235), Australia (218), India (194), the United Kingdom (177), Saudi Arabia (141), and Indonesia (125) each fall below the 500-citation threshold, placing them in the lower half of the distribution. This pattern indicates that citation density within the academic landscape is geographically concentrated, with China, Russia, and the United States occupying a globally dominant position in this research domain.



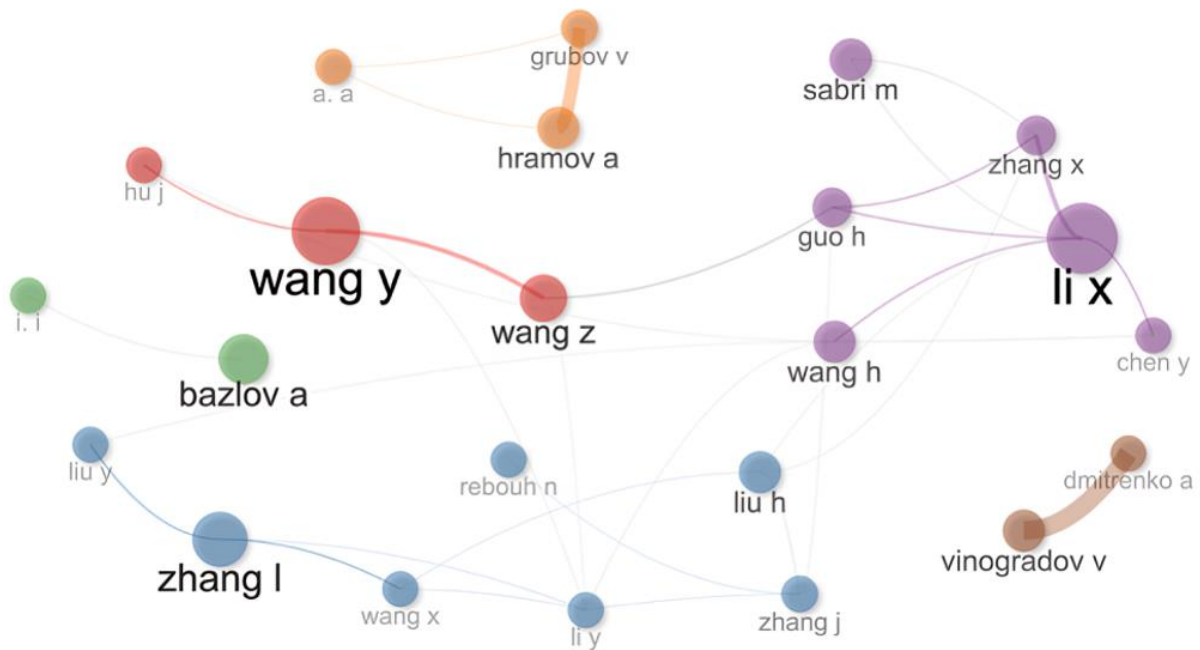
**Figure 13.** Collaboration network: Countries (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

An analysis of the collaboration networks illustrating interactions between stakeholders (**Figure 12** and **Figure 13**) shows that Russia and China occupy the center of the network, establishing strong ties with countries such as the United States and Pakistan. Notably, the high connection density of Kazan Federal University in the institutional network map confirms that research activities are clustered around specific academic hubs.

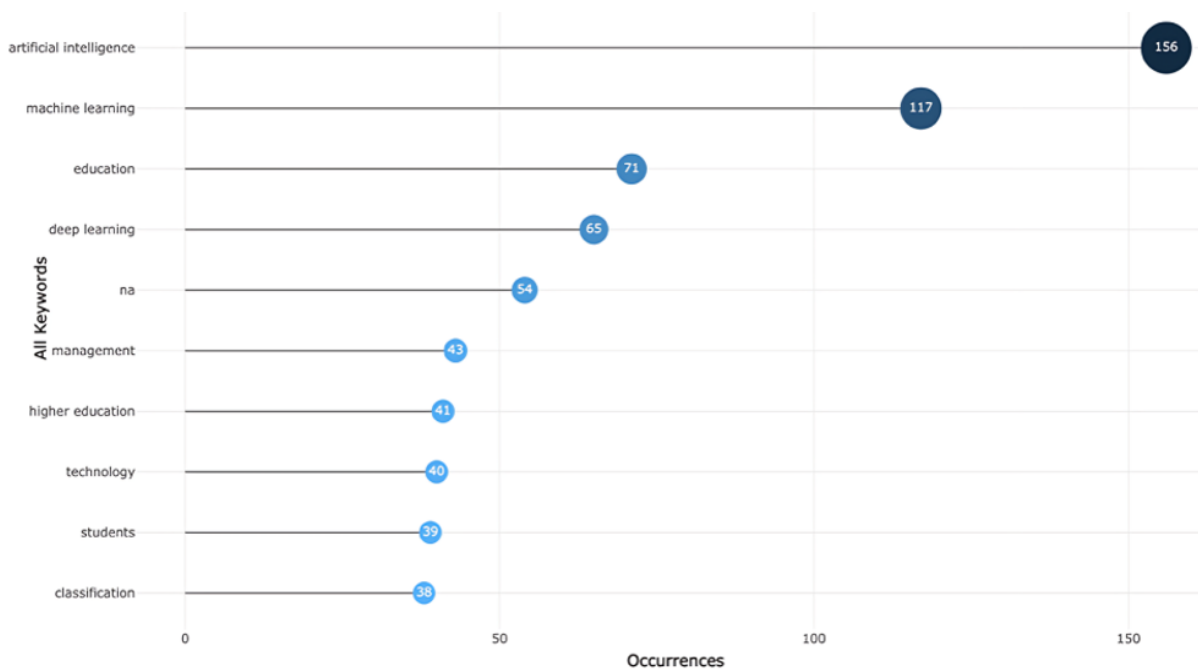
When the inter-institutional collaboration network is examined, Kazan Federal University (Kazan Fed Univ) in Russia emerges as the most dominant actor in the entire network in terms of node size and connection density. Kazan Federal University maintains significant collaborations—with strong linkages—with institutions such as St Petersburg State University (St Petersburg State Univ) and the University of Pennsylvania (Univ Penn). Likewise, RUDN University (RUDN Univ) occupies a central position in another collaboration cluster, establishing connections with other Russian and international institutions, including Southern Federal University (Southern Fed Univ). This distribution indicates that academic productivity and collaboration are concentrated around certain key Russian universities, which also demonstrate a strong tendency to engage in international partnerships. These results might be affected by how the data was collected or which studies get published most often.

The country-level collaboration map reveals the emergence of three major clusters in global academic interaction. Russia and China stand out as the most central actors in the network, characterized by their large node sizes and the thick connecting line between them, which reflects the strongest collaboration intensity. These two countries also form extensive connections—indicated by dense red linkages—with the United States, Pakistan, Saudi Arabia, and Egypt, thereby constituting the core of a dominant collaboration bloc. In contrast, the green cluster, consisting of countries such as Brazil, Thailand, Canada, and Spain, and the blue cluster, including Indonesia and Malaysia, are distinguished either by weaker ties to the main hub or by stronger intra-cluster collaborations. These results are subject to systematic skews originating from database selection and the disproportionate representation of certain publication types.

The author-level collaboration network reveals that authors such as Li, X. and Wang, Y., who possess the largest nodes within the network, have the highest publication counts and occupy central positions (**Figure 14**). The strong ties established by Li, X. with Zhang, X., Wang, H., and Guo, H., as well as Wang, Y.'s intensive collaboration with Wang, Z., indicate that these authors serve as the key figures within their respective clusters. The network is divided into several distinct clusters, and the high density of intra-cluster connections suggests that authors frequently co-publish with one another, thereby forming some of the most influential publishing groups within the field.



**Figure 14.** Collaboration network: Authors (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

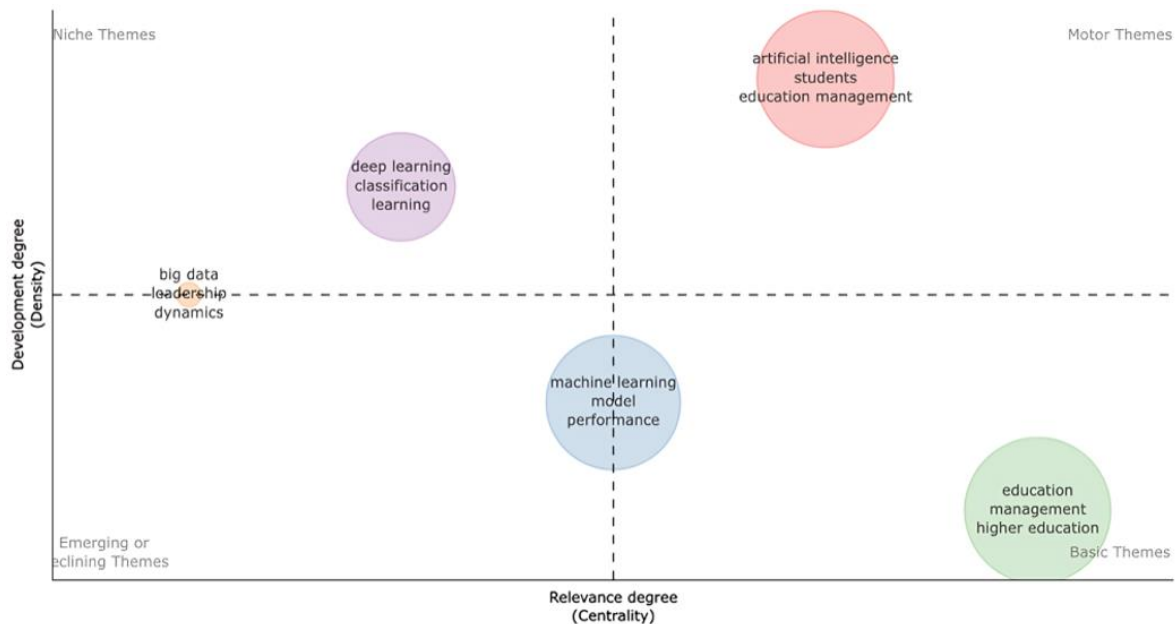


**Figure 15.** Most frequent words (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

### Conceptual and Thematic Structure

Within the scope of the **RQ3**, the dominant conceptual structure of the field and the frequency distribution of these concepts were examined. The analysis of the most frequently used keywords is presented in **Figure 15**. An examination of **Figure 15** reveals that the findings are shaped at the intersection of technology and educational management. In this context, the most frequently occurring term is “artificial intelligence”, with a frequency of 156, followed by “machine learning” with a frequency of 117. The clear prominence of these two concepts demonstrates that the examined literature does not merely engage in theoretical educational discussions; rather, it is grounded in intensive technological and algorithmic applications.





**Figure 17.** Thematic map (Source: Generated by R Biblioshiny Package V. 2025, Aria & Cuccurullo, 2026)

The map reveals that the concepts of “artificial intelligence,” “students,” and “education management” are located in the motor themes quadrant. Exhibiting both high density and high centrality, these topics constitute the most developed and mainstream research lines in the field.

In contrast, concepts such as “deep learning” and “classification” are situated in the niche themes quadrant. This suggests that while deep learning applications are technically well-developed, they remain a specialized subfield rather than a central topic of debate widespread across educational management. “Machine learning” and “higher education” are identified as basic themes, representing the foundational yet still-evolving areas of the domain.

## DISCUSSION AND CONCLUSION

This study aimed to map the scholarly work in the field of *AI in educational management and leadership* using bibliometric methods. In determining the scope of the study, an interdisciplinary approach was adopted, and the intersection of three core conceptual clusters was searched across major databases (Scopus and WoS):

1. Technology dimension: “artificial intelligence,” “AI,” “machine learning,” “deep learning,” “educational AI,” “intelligent systems,” “learning analytics.”
2. Leadership dimension: “educational leadership,” “education leadership,” “school leadership,” “instructional leadership,” “academic leadership.”
3. Management dimension: “educational management,” “education management,” “school management,” “administrative management,” “education administration,” “school administration.”

Using the combination of these keywords, a total of 1,072 academic works were identified, and the findings obtained from this dataset led to the following critical conclusions:

### Conceptual Transformation: From Management to Data Science

Thematic mapping confirms that “artificial intelligence,” “students,” and “education management” are motor themes (high centrality and density). This finding indicates that AI-supported management has moved beyond experimental applications to become a core element of educational practice (Adigüzel et al., 2026). Social-science concepts of leadership and management are now inextricably linked with technical constructs such as machine learning and learning analytics. Educational leaders are therefore transitioning from intuition-based decision-making to evidence-based, algorithmically informed governance, consistent with

instructional leadership's emphasis on data-informed instruction (Bulut, 2026; Bulut et al., 2026a, 2026b; Hallinger, 2011; Yurdunkulu et al., 2025).

### Digital Disruption and the Accelerating Momentum of the Literature

The exponential growth post-2020 aligns with the dual catalysts of the COVID-19 pandemic and the widespread adoption of generative AI tools. These external shocks accelerated the demand for remote administrative tools and real-time decision support systems, thereby redefining leadership practice in informal settings (Birgili et al., 2025; M. H. Kaya et al., 2026; Rahman et al., 2026; V. H. Kaya et al., 2026) and formal settings (Adigüzel et al., 2026; Göçen & Bulut, 2024; Popenici & Kerr, 2017).

The bibliometric analysis reveals a field in a rapid transition period, characterized by a post-2020 surge driven by generative AI and pandemic-era shifts (Rahman et al., 2026), yet this evolution must be interpreted through the lens of inherent structural biases. While the emergence of a Eurasian axis, led by institutions like Kazan Federal and RUDN University, suggests a geographical redirection of accumulated literature, this trend is inextricably linked to publication concentration and database indexing biases, particularly visible in the disproportionate influence of specific outlets like *TEM Journal* and the author productivity patterns defined by Lotka's law. China's significant citation impact further underscores this shift, aligning with the identification of "machine learning" and "artificial intelligence" as motor themes that signal a definitive move from theoretical debate toward data-driven educational management (González-Reyes et al., 2026). Ultimately, the study's findings are limited by the algorithmic preferences of the WoS and Scopus databases; however, they emphasize a critical need for leadership programs to urgently prioritize data literacy and AI ethics as future administrators move from managing human capital to governing complex algorithmic resources.

## STRATEGIC IMPLICATIONS AND RECOMMENDATIONS

The findings carry clear implications for educational leadership theory and practice. Digital leadership frameworks (Gurr, 2015; Raman et al., 2019) suggest that future leaders must govern both human skills and self-regulation (Adigüzel et al., 2023a, 2023b; M. H. Kaya et al., 2026) and algorithmic resources.

- **For policymakers:** The integration of AI into school administration requires a shift from traditional supervision to data-driven governance. Therefore, professional development programs for educational administrators should urgently incorporate modules on data literacy, AI ethics, and human-AI collaboration, rather than solely focusing on classical leadership theories.
- **For researchers:** Although the relationship between AI and management is well established in the literature, topics such as ethics, data privacy, and algorithmic bias have yet to emerge as fully developed motor themes. Future research is therefore encouraged to shift from purely technical applications toward a deeper exploration of the ethical and managerial dimensions of these technologies, specifically examining how educational managers can effectively navigate the challenges of algorithmic decision-making.

Although technical applications (machine learning, deep learning) are well represented, ethical, privacy, and equity dimensions remain underdeveloped. Future studies should move beyond bibliometric mapping to examine how educational leaders actually navigate algorithmic decision-making in real school contexts, using qualitative or design-based approaches (Karanfiloğlu & Bulut, 2025).

In conclusion, the field of educational management is undergoing a historic transformation transition period driven by AI. Future leaders will be responsible not only for managing human resources but also for overseeing algorithmic resources in ways that align with established leadership theories and ethical imperatives.

## LIMITATIONS AND FUTURE RESEARCH

Despite its contributions, this study has certain limitations. First, the data were retrieved exclusively from the WoS and Scopus databases. While these are comprehensive sources, they may introduce a linguistic bias, potentially overlooking significant studies published in local languages or indexed in regional databases. Second, as a bibliometric study, the analysis provides a macroscopic map of the field but does not offer the

qualitative depth of a systematic content analysis. Third, although the intersection of AI and educational leadership was broadly mapped, studies specifically focusing on K-12 settings remain limited in the existing literature, and the present dataset does not allow for a granular distinction between K-12 and higher education contexts. Future research could address these limitations by incorporating qualitative methods, targeting school-level studies more specifically, and exploring the pedagogical effectiveness of the identified AI applications in greater detail.

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