**International Journal of Educational Administration, Management, and Leadership**
Volume 5, Number 1, May 2024, Page 128-153
ISSN 2722-0249 (Print) and 2774-6143 (online)

# Artificial Intelligence in Education Management: A Bibliometric Mapping of the Intellectual Structure and Emerging Research Themes

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(**Received**: June-2025; **Reviewed**: August-2025; **Accepted**: September-2025;
**Available Online**: November-2024; **Published**: November-2025)

**ABSTRACT**

This study explores the intellectual structure and emerging research trends of artificial intelligence in education management. It identifies six major research streams: (1) ai-driven educational governance, data-centric decision making, and digital transformation, (2) machine learning-based decision support systems and predictive analytics in education management, (3) data-driven educational intelligence and learning analytics in higher education, (4) ai-enabled educational leadership and sustainable development, (5) institutional effectiveness and ai-supported management systems, and (6) foundational education management as the core conceptual domain. co-word analysis further reveals emerging thematic patterns such as artificial intelligence applications, decision-making systems, machine learning, learning analytics, digital transformation, and information management in educational contexts. in terms of methodology, this study employs a bibliometric approach using data from 91 journal articles indexed in Scopus, applying bibliographic coupling and co-word analysis to examine the structure, evolution, and thematic development of the field. the bibliographic coupling analysis identifies the current intellectual structure of the research domain, while co-word analysis uncovers its conceptual evolution and emerging research directions. the findings confirm that artificial intelligence is a key driver in transforming education management systems into more intelligent, data-driven, and adaptive frameworks. the study contributes to theoretical development in educational management and socio-technical systems by positioning ai as a central enabler of institutional transformation. this research also provides practical insights for policymakers, educational leaders, and administrators in designing effective ai-based decision support and governance systems to enhance educational performance and institutional sustainability.

**Keywords:** Artificial intelligence; education management; bibliometric analysis.

## INTRODUCTION

Amidst the rapid transformation of the global education landscape driven by digital innovation, artificial intelligence has increasingly become a central driver in reshaping education systems and institutional management practices (Serna Gómez et al., 2021). over the

past decade, education systems worldwide have shifted toward data-driven and intelligent decision-making models, where artificial intelligence is increasingly used to support academic planning, institutional governance, and administrative efficiency (J. Zhu & Yang, 2025). empirical evidence shows that AI-based decision support systems significantly improve education management effectiveness by enabling predictive analytics for student performance and institutional optimization (Xolmurotov et al., 2025). in addition, AI integration in education governance has been associated with improved transparency, operational efficiency, and strategic resource allocation in higher education institutions (Jirari et al., 2025). as educational institutions face increasing pressure to enhance quality, accountability, and competitiveness, artificial intelligence has become a key technological foundation for modern education management systems (C. Ma et al., 2025).

Despite the rapid advancement of AI applications in education management, significant challenges remain in understanding its multidimensional impact across institutional contexts. previous studies indicate that AI adoption in education is often fragmented, particularly in integrating predictive analytics, administrative decision-making, and student management systems into a unified framework (X. Wang, 2025). moreover, ethical concerns, data privacy issues, and algorithmic transparency continue to challenge the implementation of AI-driven governance in education systems (Kumar, Shankar, et al., 2025). while digital transformation initiatives have enhanced institutional performance in some regions, disparities in technological readiness and governance structures have led to uneven adoption of AI-based education management systems globally (Asfaw et al., 2023). therefore, this study focuses on systematically mapping the intellectual structure and evolution of artificial intelligence in education management through bibliometric analysis.

In this context, artificial intelligence in education management involves multiple interconnected dimensions, including data-driven decision-making, predictive analytics, institutional governance systems, and student performance management (Berezkin et al., 2024). these components interact within educational ecosystems where administrators rely on AI-generated insights to improve institutional planning, while educators and policymakers use analytics to enhance teaching effectiveness and resource allocation strategies. for instance, AI-based clustering and data mining techniques have been applied to optimize academic management processes and improve institutional efficiency in higher education settings (Inkongngarm et al., 2024). similarly, digital twin and intelligent information systems have been utilized to support real-time monitoring and decision-making in university management structures (Ye & Kuang, 2025). these relationships demonstrate that artificial intelligence does not operate in isolation but functions as an integrated system influencing both operational and strategic levels of education management.

The central concept of this study, artificial intelligence in education management, refers to the application of computational intelligence, machine learning, and data analytics to support decision-making, governance, and institutional optimization in education systems (Allaouia et al., 2026). this concept is grounded in data-driven decision-making theory, which emphasizes the role of analytical insights in improving organizational effectiveness and institutional performance. furthermore, digital transformation theory explains how educational institutions evolve through the integration of intelligent systems into administrative and academic processes (Serna Gómez et al., 2021). in addition, governance and innovation frameworks highlight how trustworthy AI systems can enhance accountability, transparency, and efficiency in education management (Y. Ma, 2025). collectively, these theoretical perspectives demonstrate that AI adoption in education management is not merely technological but also organizational and strategic in nature.

Although a growing body of literature has explored artificial intelligence in education, several important gaps remain. first, existing studies tend to focus on isolated applications such as learning analytics, student modeling, or decision support systems without integrating these dimensions into a unified education management framework (D. Zhu et al., 2022). second, research on AI in education management is highly fragmented across disciplines, including computer science, education, and management, leading to a lack of cohesive theoretical development (Qin et al., 2023). third, although there is a rapid increase in publications on AI in education, systematic mapping of the intellectual structure, collaboration networks, and thematic evolution of this field remains limited (X. Wang & Na-Nan, 2024). fourth, emerging topics such as ethical AI governance, generative AI applications, and intelligent institutional systems are still underexplored in terms of their long-term implications for education management (Kumar, Bapat, et al., 2025). these gaps highlight the need for a comprehensive bibliometric analysis to synthesize existing knowledge and identify future research directions.

This study is motivated by the need to address these limitations by providing a systematic mapping of the intellectual structure and thematic evolution of artificial intelligence in education management. the primary objectives of this research are:

(1) to identify the dominant and emerging research themes in AI-based education management through co-word and bibliographic coupling analysis; and
(2) to analyze the intellectual structure and influential contributions shaping the field using citation-based techniques.

This study makes several important contributions. theoretically, it consolidates fragmented research on AI in education management into a structured knowledge framework, thereby advancing understanding of how AI influences institutional governance and decision-making processes. practically, it provides valuable insights for educational policymakers, institutional leaders, and administrators to improve AI adoption strategies for enhancing efficiency, transparency, and educational quality. by mapping research trends and intellectual structures, this study also identifies future research opportunities in areas such as generative AI, intelligent governance systems, and predictive education management models.

The structure of this paper is as follows. section 1 presents the introduction, background, and research objectives. section 2 describes the bibliometric methodology, including data collection and analytical procedures. section 3 presents the results of performance analysis and science mapping. section 4 discusses theoretical and managerial implications. finally, section 5 concludes the study by highlighting limitations and suggesting directions for future research.

## METHOD

### Bibliometric approach

Bibliometric analysis is a quantitative technique used to examine bibliographic datasets through science mapping methods (Donthu et al., 2022). This approach provides a structured and comprehensive overview of a scientific field and allows the analysis of large volumes of literature compared to traditional systematic literature reviews. One key advantage is the reduction of researcher bias, as the method relies on computational procedures rather than manual article selection and screening (Fini et al., 2018; Freire & Barbosa, 2023).

This analytical framework consists of two main components: performance analysis and science mapping (González-Valiente et al., 2021). Performance analysis evaluates research impact through publication and citation indicators, while science mapping

explores relationships among research elements to reveal the intellectual structure of a field (Bhardwaj et al., 2025; Gomes & Romão, 2018). In this study, bibliographic coupling and co-word analysis are applied to achieve the research objectives.

1. Bibliographic coupling is used to identify the current intellectual structure and research fronts by analyzing shared references between documents. The degree of shared references, known as coupling strength, indicates thematic similarity among studies and helps identify emerging research clusters in a field (Fauzi, 2025; Fauzi et al., 2024; Hasumi & Chiu, 2022).
2. Co-word analysis examines conceptual relationships by analyzing keyword co-occurrence in titles, abstracts, and author keywords. Frequently co-occurring terms represent dominant themes, while emerging patterns indicate future research directions and evolving topics within the field (Eshun-Wilson et al., 2021; Jafari et al., 2023).

Overall, the combination of bibliographic coupling and co-word analysis enables a comprehensive mapping of the intellectual structure and thematic evolution of Artificial Intelligence in Education Management, providing insights into current research streams and future directions.

## Research design and data collection procedure

To gather relevant literature, a specific search query (Table 1) was developed using carefully selected keywords related to *Artificial Intelligence in Education Management*, educational technology, decision-making systems, and related domains. The search strategy was constructed to capture a broad yet focused body of literature encompassing artificial intelligence applications in educational management contexts, including machine learning, intelligent systems, learning analytics, and generative AI combined with educational administration, governance, and decision-support systems.

The search was conducted in the Scopus database using the TITLE-ABS-KEY function, which retrieves documents based on titles, abstracts, and author keywords. Scopus was selected due to its extensive coverage of peer-reviewed scholarly literature across disciplines and its strong bibliometric reliability for systematic and quantitative reviews (Pranckutė, 2021; Donthu et al., 2021). This database is widely recognized in bibliometric studies for ensuring data consistency and high-quality indexed publications.

This study exclusively focuses on journal articles to ensure scientific rigor, methodological quality, and peer-review integrity. Other types of publications such as books, book chapters, conference papers, editorials, notes, and non-peer-reviewed documents were excluded to maintain analytical consistency and reduce publication-type bias.

The initial search in the scopus database was conducted on 13 June 2026. the search yielded a total of 274 documents in the first stage. after applying inclusion criteria limited to journal articles and english-language publications the dataset was refined, and a total of 91 articles were retained for final analysis. the selection process is illustrated in figure 1, which follows a structured PRISMA-inspired flow to ensure transparency and reproducibility in the data collection procedure.

The Scopus database search was conducted on 28 June 2025. The initial search retrieved 274 documents across all document types. After applying filtering criteria to include only journal articles, the dataset was reduced to 91 eligible articles for bibliometric analysis. Further screening ensured relevance to the topic and consistency of inclusion criteria.

The final search string applied in the Scopus database is presented in Table 1.

**Table 1.**
Search string in Scopus database.

| No | Keywords | Justification |
|---|---|---|
| 1. | TITLE-ABS-KEY ( ( "artificial intelligence" OR "artificial intelligence system*" OR "machine intelligence" OR "machine learning" OR "deep learning" OR "computational intelligence" OR "learning analytics" OR "educational data mining" OR "intelligent system*" OR "AI-driven" OR "AI powered" OR "AI-based" OR "smart education" OR "smart learning" OR "intelligent tutoring system*" OR "adaptive learning system*" OR "generative AI" OR "large language model*" OR "chatgpt" ) AND ( "education management" OR "educational management" OR "educational administration" OR "school management" OR "higher education management" OR "academic management" OR "educational leadership" OR "institutional management" OR "university management" OR "educational governance" ) AND ( "decision making" OR "decision support system*" OR "predictive analytic*" OR "data-driven decision making" OR "digital transformation" OR "educational performance management" ) | identify literature related to Artificial Intelligence in Education Management |

The final dataset consists of publications indexed between 1991 and 2025, indicating the long-term development of research in artificial intelligence applications within education management systems. The total number of citations for the selected documents is 2,162 citations, with an average of approximately 23.76 citations per document. The dataset also records an h-index of 20, indicating a moderate level of influential publications within this research domain.

Bibliometric analysis and scientific mapping were conducted using VOSviewer version 1.6.20, which is widely used for constructing and visualizing co-authorship, co-occurrence, and citation networks in scientific literature. This enables the identification of research trends, thematic clusters, and intellectual structures within the field of Artificial Intelligence in Education Management.

Figure 1 illustrates the article selection process, including identification, screening, eligibility, and final inclusion stages. Overall, the systematic procedure ensures transparency, reproducibility, and rigor in the bibliometric dataset preparation, following established guidelines in scientific mapping studies (Zupic & Čater, 2015; Aria & Cuccurullo, 2017).

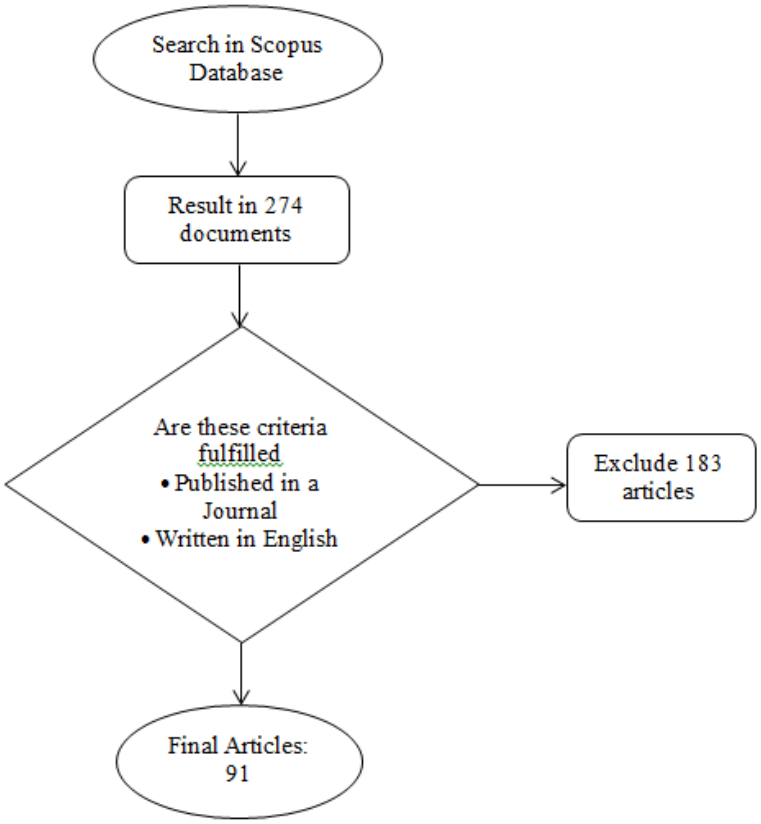


**Figure 1.** Flowchart the process of article selection. Source: authors' own work, 2025.

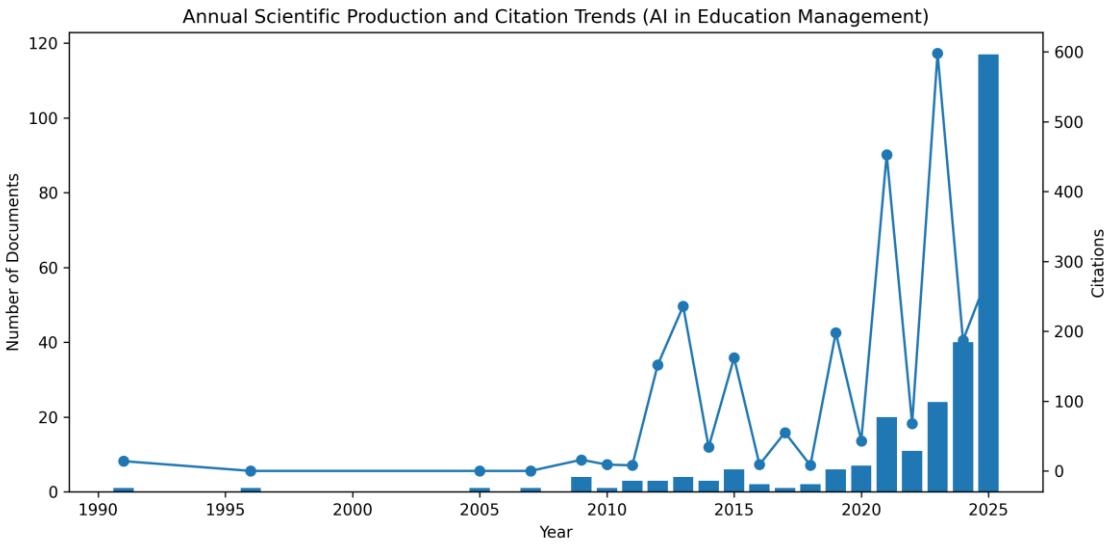


**Figure 2.** Number of publications and citations on Artificial Intelligence in Education Management. Source: Scopus, authors' own work.

## RESULT AND DISCUSSION

### Co-authorship network of institutions

The institutional co-authorship network in the field of *Artificial Intelligence in Education Management* reveals a broad and highly fragmented collaboration structure across global higher education and research institutions. Based on the Scopus dataset (n = 91 documents), a total of 643 institutions were identified across multiple countries. By applying a threshold of minimum 1 document per institution and at least 16 citations, only 59 institutions met the inclusion criteria for visualization in VOSviewer, indicating a relatively selective but meaningful collaboration network concentrated among moderately influential institutions.

The network visualization generated using VOSviewer highlights the presence of several institutional clusters, indicating that research in this field is still evolving and not yet dominated by a single centralized group of universities. Instead, the structure is characterized by distributed collaboration patterns, where institutions tend to form small, localized clusters rather than large, highly interconnected global networks.

Based on the Scopus affiliation data, several institutions emerge as relatively more active contributors within the dataset. The most frequently appearing institutional units include the Department of Computer Science, Faculty of Education, De La Salle University, School of Economics and Management, and Politeknik Negeri Sriwijaya, each contributing multiple publications within the dataset. These institutions represent key nodes in the co-authorship network, indicating their stronger engagement in interdisciplinary research combining artificial intelligence, education, and management systems.

Other notable contributors include Wuhan Business University, Tashkent State University of Economics, Bauman Moscow State Technical University, and Chiang Mai University, which demonstrate cross-regional participation from Asia and Eastern Europe. In addition, institutions such as Ministry of Education-affiliated research units and various faculties of education and computer science also appear repeatedly, highlighting the interdisciplinary nature of this research field.

From a regional perspective, the dataset shows a dominance of Asian institutions, particularly from Indonesia, China, Uzbekistan, and India, alongside contributions from European institutions such as Spain and Russia. For example, Indonesian participation is visible through institutions such as Politeknik Negeri Sriwijaya, indicating active engagement in applied research on educational digital transformation. Similarly, Chinese institutions such as Wuhan Business University reflect strong involvement in AI-driven educational innovation.

Despite this diversity, the co-authorship network indicates that collaboration intensity between institutions remains relatively low, as most institutions appear with limited document counts (mostly 1–4 publications). This suggests that research on Artificial Intelligence in Education Management is still in a developmental stage, where collaboration is emerging but not yet consolidated into strong international research consortia.

The VOSviewer visualization further confirms this pattern, showing loosely connected nodes with limited density between clusters. This implies that although research output is increasing globally, institutional collaboration networks are still fragmented, with limited long-term partnerships between leading universities.

Overall, the findings suggest that while there is growing global participation in AI-based education management research, the field is still characterized by decentralized institutional engagement, with Asia playing a leading role in publication output and Europe contributing selectively through specialized research groups. Strengthening inter-institutional collaboration, particularly between high-output and emerging institutions, may significantly enhance the maturity and impact of this research domain in the future.

**Table 2.**
Top 20 institutions in Artificial Intelligence in Education Management.

| Rank | Institution | Country | Documents | Citations | Total Link Strength |
|---|---|---|---|---|---|
| 1 | Department of CSE, Jawaharlal Nehru Technological University, Andhra Pradesh | India | 1 | 52 | 4 |
| 2 | Department of Education, University of Ioannina | Greece | 1 | 392 | 4 |
| 3 | Department of Economics, University of Bari | Italy | 1 | 392 | 4 |
| 4 | Department of Human Sciences, University of Foggia | Italy | 1 | 392 | 4 |
| 5 | Department of Humanities and Social Sciences, IIT Kharagpur | India | 1 | 52 | 4 |
| 6 | Department of Information Science, Emporia State University | United States | 1 | 392 | 4 |
| 7 | Department of Information Science, University of North Texas | United States | 1 | 392 | 4 |
| 8 | Department of MBA, Koneru Lakshmaiah Education Foundation | India | 1 | 52 | 4 |
| 9 | Faculty of Agriculture, Sri Sri University | India | 1 | 52 | 4 |
| 10 | Vellagapudi Ramakrishna Siddhartha Engineering College | India | 1 | 52 | 4 |
| 11 | Department of Computer, Mathematical and Physical Sciences | Multi-country / Unspecified | 1 | 39 | 3 |
| 12 | National “111 Research Center” Microelectronics & Integrated Circuits | China | 1 | 39 | 3 |
| 13 | School of Industrial Design, Hubei University of Technology | China | 1 | 39 | 3 |
| 14 | School of Science (Chip Industry School), Hubei University of Technology | China | 1 | 39 | 3 |
| 15 | Beijing Normal University | China | 1 | 26 | 2 |
| 16 | Centre for Instructional Technology and Multimedia | Malaysia | 1 | 18 | 2 |
| 17 | College of Vocational Education (Preschool Teachers & Coaches) | China | 1 | 45 | 2 |
| 18 | College of Economics and Management, Nanjing University | China | 1 | 16 | 2 |

| Rank | Institution | Country | Documents | Citations | Total Link Strength |
|---|---|---|---|---|---|
| 19 | L.N. Gumilev Eurasian National University | Kazakhstan | 1 | 20 | 2 |
| 20 | Curriculum and Instruction, An-Najah National University | Palestine | 1 | 26 | 2 |

Source: Vosviewer, authors' own work

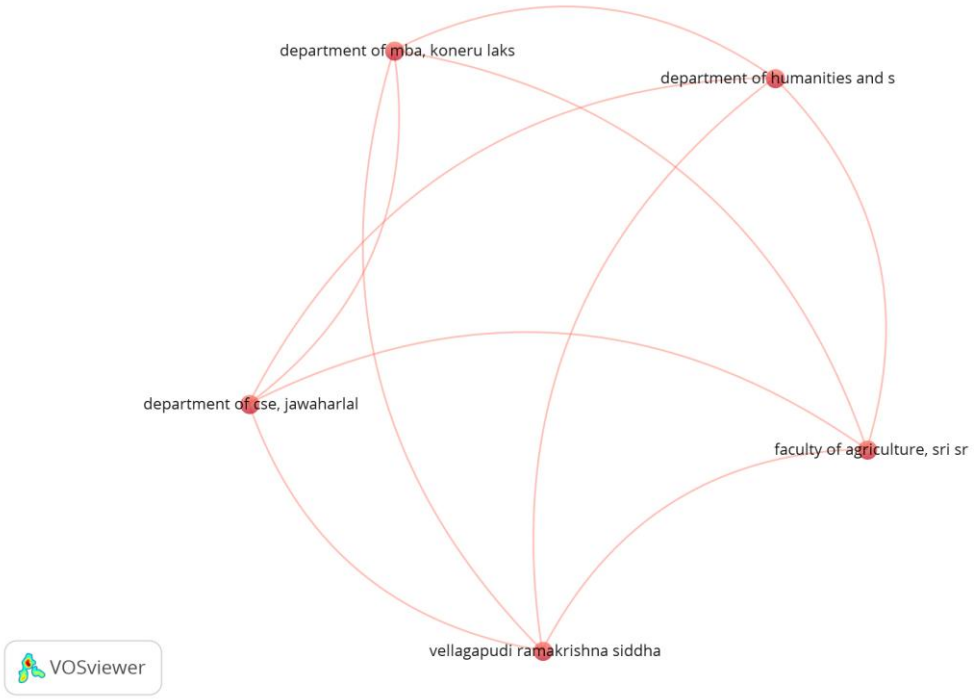


**Figure 3.** Network visualization of Artificial Intelligence in Education Management. Source: Vosviewer, authors' own work.

## Bibliographic coupling

The initial phase of this bibliographic coupling analysis involved setting an appropriate citation threshold to ensure a reliable and meaningful visualization of the network structure in the field of *Artificial Intelligence in Education Management*. The analysis was conducted using the same Scopus database to maintain consistency in data retrieval and coverage. A minimum threshold of 8 citations per document was applied. Out of 338 retrieved documents, 59 documents met the predefined criterion and were therefore selected for further analysis. Several iterations were performed to evaluate different threshold levels in order to obtain the most optimal network representation. It was essential to balance the threshold, as a value set too high could exclude relevant but emerging studies, while a lower threshold could result in overly dense and overlapping clusters, thereby reducing interpretability and analytical clarity (Geng et al., 2020).

The subsequent stage presents the bibliographic coupling network visualization generated from the selected documents. The results indicate that the 59 selected publications form 6

distinct clusters, comprising 28 items, 57 links, and a total link strength of 92, reflecting a moderate level of intellectual connectivity within the field. These clusters represent thematically related research streams, including artificial intelligence applications in educational decision-making, intelligent tutoring systems, learning analytics, and digital transformation in education management. The visualization further suggests that although the field is still developing, clear thematic groupings have already emerged. The cluster structure was interpreted through an inductive process by examining representative documents within each group, and the thematic labels were derived by identifying recurring research patterns that characterize the main intellectual directions of the literature in Artificial Intelligence in Education Management.

**Table 3.**
Top 10 documents in bibliographic coupling analysis

| Rank | Author | Citations | Total Link Strength (TLS) |
|---|---|---|---|
| 1 | (Y. Wang, 2021b) | 129 | 30 |
| 2 | (Y. Wang, 2021a) | 131 | 23 |
| 3 | (Maphosa & Maphosa, 2020) | 8 | 12 |
| 4 | (J. Wang, 2023) | 392 | 9 |
| 5 | (Göçen & Döğer, 2025) | 14 | 8 |
| 6 | (Sayed, 2024) | 11 | 8 |
| 7 | (Karakose, 2024) | 20 | 8 |
| 8 | (Abdalkareem & Min-Allah, 2024) | 19 | 7 |
| 9 | (Sposato, 2025a) | 53 | 7 |
| 10 | (R. Dai et al., 2025) | 39 | 7 |

Source: the author's view is based on the findings derived from the analysis using Vosviewer.

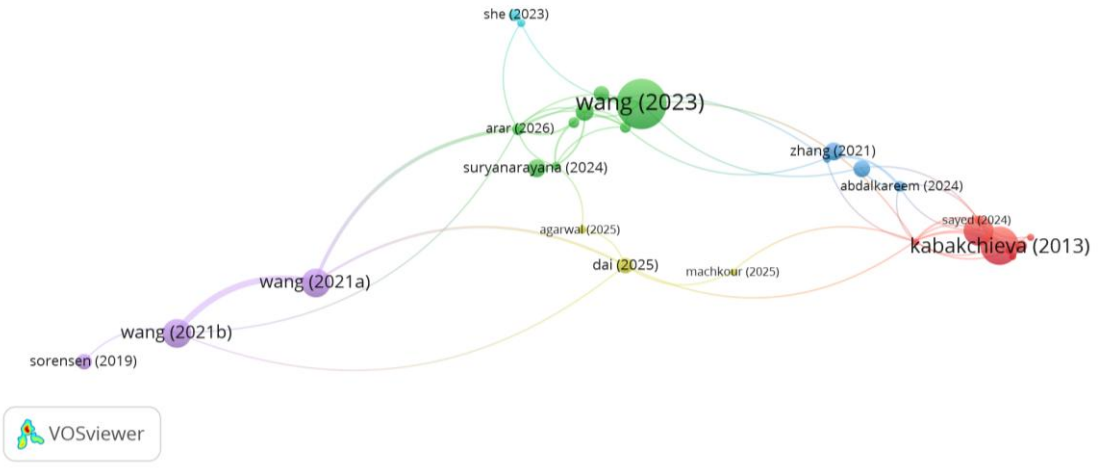


**Figure 4.** Network visualization of bibliographic coupling. Source: vosviewer, authors' own work.

**Table 4.**
Bibliographic coupling analysis.

| Cluster No and color | Cluster label | Number of publications | Representative publication |
|---|---|---|---|
| 1 (red) | Artificial Intelligence Adoption, Learning Analytics, and Data-Driven Educational Decision-Making | 8 | (Arqoub et al., 2022; Buenaño-Fernández et al., 2019; Dawson & Hubball, 2014; Kabakchieva, 2013; Maphosa & Maphosa, 2020; Peró et al., 2015; Sayed, 2024; Wong, 2016). |
| 2 (green) | Ethical AI Integration, Leadership Transformation, and Emerging Digital Governance in Education Management | 8 | (Abdelazim et al., 2025; Arar & Kazaz, 2025; Göçen & Döğer, 2025; Hua Hu, 2023; Karakose, 2024; Sposato, 2025b; Suryanarayana et al., 2024; C. Wang et al., 2023). |
| 3 (blue) | Digital Transformation Strategies, Institutional Innovation, and AI-Enabled Educational Ecosystems | 4 | (Abdalkareem & Min-Allah, 2024; Correa-Peralta et al., 2025; Gaftandzhieva et al., 2023; Zhang & Patrick, 2021) |
| 4 (yellow) | Emerging Artificial Intelligence Applications, Smart Educational Tools, and Next-Generation Learning Innovations | 3 | (Agarwal et al., 2025; L. Dai & Fan, 2025; Machkour & Abriane, 2025) |
| 5 (purple) | Foundational Perspectives on Artificial Intelligence in Education Management and Early Digital Learning System Integration | 3 | (Sorensen, 2019; P. Wang & McCarthy, 2021; S. Wang et al., 2021). |
| 6 (light blue) | Emerging AI Applications in Educational Management Optimization and Intelligent System Enhancement | 2 | (Koukaras et al., 2025; She et al., 2023). |

Source: the authors' own work.

***Cluster 1 (red): Artificial Intelligence Adoption, Learning Analytics, and Data-Driven Educational Decision-Making***

With **8 publications**, the first cluster (in red) is labelled *"Artificial Intelligence Adoption and Data-Driven Decision-Making in Education Management Systems."* This cluster highlights the foundational and evolving role of artificial intelligence in supporting educational management through learning analytics, intelligent systems, and data-driven decision-making processes. Key

studies such as **Dawson (2014)** and **Kabakchieva (2013)** provide the early conceptual and empirical basis for educational data mining and learning analytics in improving institutional decision-making and student performance analysis, while Wong (2016) and Pero (2015) extend these foundations by emphasizing the integration of intelligent systems and data-driven frameworks for enhancing educational planning and administrative efficiency. Furthermore, Buenano-Fernandez et al. (2019) and Maphosa (2020) contribute to the advancement of AI applications in education by exploring machine learning approaches and AI-supported tools for improving learning outcomes and institutional effectiveness, whereas more recent studies such as Arqoub (2022) and Sayed (2024) reflect the growing focus on advanced AI-driven innovation, predictive analytics, and adaptive learning systems that support strategic decision-making in modern education management contexts, collectively demonstrating the central role of artificial intelligence in transforming educational institutions toward more intelligent, efficient, and data-informed systems.

***Cluster 2 (green): Ethical AI Integration, Leadership Transformation, and Emerging Digital Governance in Education Management***

The second cluster (in green) comprises 8 publications and is labelled *"Ethical AI Integration, Leadership Transformation, and Emerging Digital Governance in Education Management."* This cluster focuses on the recent and rapidly evolving discourse surrounding the integration of artificial intelligence into educational leadership practices, institutional governance, and digital transformation strategies. The studies within this cluster collectively emphasize how AI technologies are reshaping managerial decision-making, ethical considerations, and leadership adaptability in modern educational environments. For instance, Wang (2023) and Hua Hu (2023) explore the foundational role of AI-enabled systems in supporting digital governance and enhancing institutional responsiveness, while Suryanarayana (2024) and Karakose (2024) extend this discussion by highlighting the importance of leadership readiness and organizational adaptation in implementing AI-driven educational innovations. Furthermore, more recent contributions such as Abdelazim (2025), Gocen (2025), and Sposato (2025) examine emerging challenges related to ethical AI use, policy development, and strategic integration of intelligent systems in education management, whereas Arar (2026) reflects the most recent direction of research focusing on future-oriented AI governance frameworks and sustainable digital transformation in educational institutions. Collectively, these studies underscore the increasing importance of ethical, managerial, and governance dimensions in shaping the successful adoption of artificial intelligence in education management systems.

***Cluster 3 (blue): Digital Transformation Strategies, Institutional Innovation, and AI-Enabled Educational Ecosystems***

The third cluster (in blue) comprises 4 publications and is labelled *"Digital Transformation Strategies, Institutional Innovation, and AI-Enabled Educational Ecosystems."* This cluster focuses on the strategic and structural transformation of educational institutions through the integration of artificial intelligence, emphasizing innovation capacity, institutional adaptation, and system-level digital development. The studies within this cluster collectively highlight how AI contributes to reshaping organizational structures and improving institutional performance in education management contexts. For instance, Zhang (2021) provides an early foundation by examining how digital technologies and intelligent systems support institutional modernization and enhance administrative efficiency in educational settings. Similarly, Gaftandzhieva (2023) and Correa-Peralta (2025) expand this perspective by focusing on the role of AI-driven

transformation in improving institutional governance, innovation capacity, and educational service delivery in higher education systems. Furthermore, Abdalkareem (2024) emphasizes the application of artificial intelligence in optimizing educational management processes, particularly in enhancing decision-support systems and institutional performance evaluation. Collectively, these studies illustrate the growing importance of digital transformation and AI integration as key drivers of institutional innovation and strategic development in the field of Artificial Intelligence in Education Management.

***Cluster 4 (yellow): Emerging Artificial Intelligence Applications, Smart Educational Tools, and Next-Generation Learning Innovations***

The fourth cluster (in green) comprises 3 publications and is labelled *"Emerging Artificial Intelligence Applications, Smart Educational Tools, and Next-Generation Learning Innovations."* This cluster focuses on the most recent and rapidly developing strand of research that explores how artificial intelligence is being implemented in innovative educational tools, smart learning environments, and next-generation digital education systems. The studies within this cluster collectively highlight the shift toward advanced AI-driven solutions that enhance learning experiences, improve educational efficiency, and support intelligent decision-making in education management. For instance, Dai (2025) examines the integration of AI technologies in modern educational systems, emphasizing their role in improving adaptive learning environments and institutional responsiveness. Similarly, Machkour (2025) explores the development of smart educational solutions supported by artificial intelligence, particularly in optimizing learning processes and enhancing student engagement. Furthermore, Agarwal (2025) contributes to this emerging discourse by focusing on the application of AI-powered tools and intelligent systems in educational management, highlighting their potential to transform traditional educational practices into more data-driven and technology-enhanced frameworks. Collectively, these studies represent a cutting-edge research direction that underscores the growing importance of AI innovation in shaping the future of education management systems.

***Cluster 5 (purple): Foundational Perspectives on Artificial Intelligence in Education Management and Early Digital Learning System Integration***

The fifth cluster (in purple) comprises 3 publications and is labelled *"Foundational Perspectives on Artificial Intelligence in Education Management and Early Digital Learning System Integration."* This cluster represents the foundational and transitional stage of research that bridges early theoretical developments with the emerging application of artificial intelligence in educational management systems. The studies within this cluster collectively emphasize the early conceptualization of AI-supported learning environments, system integration approaches, and the initial adoption of intelligent technologies in educational contexts. For instance, Sorensen (2019) provides an important foundation by examining the role of digital transformation in education systems and highlighting how early AI-driven tools began influencing institutional decision-making processes. Similarly, Wang (2021a) explores the integration of artificial intelligence into educational management frameworks, focusing on system optimization and the enhancement of administrative efficiency through data-driven approaches. Furthermore, Wang (2021b) extends this discussion by analyzing the application of intelligent learning systems and their impact on improving educational processes, particularly in terms of adaptability and performance monitoring. Collectively, these studies form a foundational knowledge base that illustrates the early evolution of artificial intelligence in

education management, marking the transition toward more advanced, data-intensive, and intelligent educational systems.

***Cluster 6 (light blue): Emerging AI Applications in Educational Management Optimization and Intelligent System Enhancement***

The sixth cluster (in light blue) comprises 2 publications and is labelled *"Emerging AI Applications in Educational Management Optimization and Intelligent System Enhancement."* This cluster represents a focused and emerging strand of research that highlights the application of artificial intelligence in optimizing educational management processes and improving the performance of intelligent academic systems. The studies within this cluster collectively emphasize the role of AI in enhancing institutional efficiency, system adaptability, and decision-support capabilities in modern education environments. For instance, She (2023) explores the early application of artificial intelligence in educational management systems, focusing on improving operational efficiency and supporting data-driven institutional decision-making. Similarly, Koukaras (2025) extends this discussion by examining more advanced AI-enabled solutions aimed at optimizing educational processes and strengthening intelligent system integration within academic institutions. Collectively, these studies highlight a highly specialized and emerging research direction that underscores the increasing importance of artificial intelligence in enhancing the effectiveness, efficiency, and responsiveness of education management systems. a summary of the bibliographic coupling analysis is presented in table 4.

**Co-word Analysis**

From the 2,446 keywords, the co-word analysis identified 56 keywords that surpassed the minimum occurrence threshold of 11, which were then grouped into five distinct clusters. The co-word analysis procedure involved selecting keywords that appeared together in titles, abstracts, and author keywords across the dataset. The analysis was conducted using the same Scopus database to ensure consistency in data selection and reliability of results. The clustering process was performed using VOSviewer, where several iterations of the minimum threshold were tested to achieve a robust and meaningful network visualization. The threshold was adjusted iteratively to ensure an optimal balance between inclusiveness and clarity, as excessively high thresholds may exclude relevant thematic elements, while excessively low thresholds may produce overly dense and less interpretable networks. Ultimately, the final configuration resulted in 56 keywords, 5 clusters, 1,078 links, and a total link strength of 5,575, indicating a highly interconnected conceptual structure within the field of Artificial Intelligence in Education Management.

The five clusters that emerged from the analysis represent the main thematic structure of the research field: (1) AI-driven Educational Governance, Data-Centric Decision Making, and Digital Learning Transformation, (2) Machine Learning–Driven Decision Support Systems and Predictive Analytics in Educational Management., (3) Data-Driven Educational Intelligence, Learning Analytics, and Decision-Making Systems in Higher Education, (4) AI-Enabled Educational Leadership, Decision Support Systems, and Sustainable Development in Education Management, and (5) Education management. These clusters are explicitly linked to the objective of understanding how artificial intelligence is shaping modern education management practices through data-driven decision-making, intelligent learning systems, and institutional digital transformation. The first cluster focuses on AI-driven decision-making processes and learning analytics, the second cluster emphasizes personalized and adaptive learning technologies, the third cluster highlights institutional transformation and digital

governance, the fourth cluster reflects emerging innovations in smart education technologies, while the fifth cluster captures foundational and transitional research developments in AI integration within education systems.

**Table 5.**
Top 20 keywords.

| Rank | Keyword | Occurrences | Total Link Strength |
|---|---|---|---|
| 1 | Artificial Intelligence | 153 | 744 |
| 2 | Decision Making | 147 | 891 |
| 3 | Students | 95 | 687 |
| 4 | Information Management | 72 | 521 |
| 5 | Education Computing | 67 | 539 |
| 6 | Teaching | 66 | 492 |
| 7 | Learning Systems | 58 | 457 |
| 8 | Decision Support Systems | 52 | 342 |
| 9 | Engineering Education | 49 | 407 |
| 10 | Educational Management | 49 | 302 |
| 11 | Education Management | 48 | 321 |
| 12 | Digital Transformation | 46 | 218 |
| 13 | Machine Learning | 42 | 257 |
| 14 | E-learning | 39 | 282 |
| 15 | Decisions Makings | 38 | 252 |
| 16 | Data Mining | 38 | 250 |
| 17 | Big Data | 33 | 195 |
| 18 | High Educations | 32 | 229 |
| 19 | Behavioral Research | 24 | 192 |
| 20 | Curricula | 21 | 192 |

Source: authors' own work.

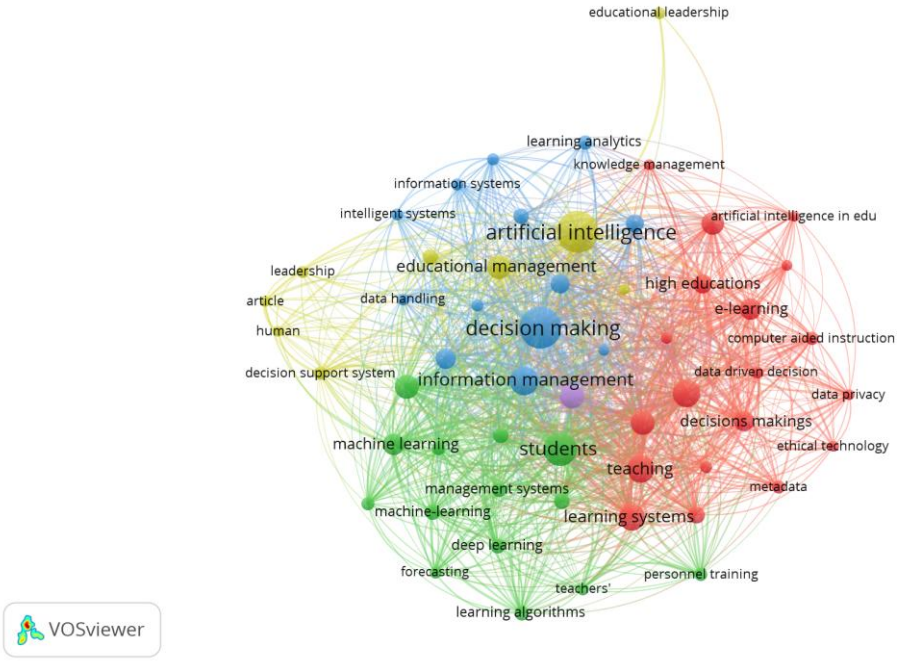


**Figure 5.** Network visualization of co-word analysis. Source: authors' own work.

In addition to the descriptive clustering results, the analysis reveals that keywords such as artificial intelligence, education management, learning analytics, and digital transformation are among the most dominant conceptual elements in the dataset, indicating their central role in shaping the intellectual structure of the field. The strong density of links and high total link strength further suggest a high level of conceptual interconnection among studies, reflecting a mature and rapidly evolving research domain. The prominence of these keywords also indicates that future research may further explore specialized areas such as ethical AI implementation, governance frameworks, and cross-institutional digital transformation strategies in education management. As presented in Figure 6, the network visualization of the co-word analysis reveals five distinct clusters, which are labelled based on an inductive interpretation of representative keywords and thematic patterns within each cluster, providing a comprehensive mapping of the intellectual structure of Artificial Intelligence in Education Management research.

**Table 6.**
Summary of co-word analysis on

| Cluster No and color | Cluster label | No. of keywords | Representative Keywords |
|---|---|---|---|
| 1 (red) | AI-driven Educational Governance, Data-Centric Decision Making, and Digital Learning Transformation. | 19 | artificial intelligence in education, behavioural research, computer-aided instruction, data-driven decision, data privacy, decision making, digital |

| | | | |
|---|---|---|---|
| | | | transformation, e-learning, education computing, educational institutions, engineering education, ethical technology, higher education, human resource management, knowledge management, learning systems, metadata, teaching, and decision making/decisions makings |
| 2 (green) | Machine Learning–Driven Decision Support Systems and Predictive Analytics in Educational Management. | 14 | curricula, decision support systems, decision support, decision trees, deep learning, forecasting, learning algorithms, machine learning, machine-learning, management systems, personnel training, predictive analytics, students, and teacher |
| 3 (blue) | Data-Driven Educational Intelligence, Learning Analytics, and Decision-Making Systems in Higher Education | 13 | big data, data handling, data mining, decision making, decision theory, educational data mining, higher education, higher education institution, information management, information systems, intelligent systems, learning analytics, and information use |
| 4 (yellow) | AI-Enabled Educational Leadership, Decision Support Systems, and Sustainable Development in Education Management | 9 | article, artificial intelligence, decision support system, education, educational leadership, educational management, human, leadership, and sustainable development |
| 5 (purple) | Education management | 1 | Education management |

Source: Authors' own work.

***Cluster 1 (red): AI-driven Educational Governance, Data-Centric Decision Making, and Digital Learning Transformation.***

With 19 keywords, cluster one (in red) is labelled *"AI-driven Educational Governance, Data-Centric Decision Making, and Digital Learning Transformation."* This cluster emphasizes the central role of artificial intelligence in reshaping educational management through data-driven governance, intelligent decision-support systems, and the integration of digital learning technologies within institutional settings. The cluster comprises keywords such as artificial

intelligence in education, behavioural research, computer-aided instruction, data-driven decision, data privacy, decision making, digital transformation, e-learning, education computing, educational institutions, engineering education, ethical technology, higher education, human resource management, knowledge management, learning systems, metadata, teaching, and decision making/decisions makings, which collectively illustrate the strong interconnection between technological innovation and educational administrative processes. Studies within this cluster highlight how AI-enabled systems support decision-making efficiency, enhance data privacy and ethical considerations, and improve institutional performance through intelligent learning systems and digital transformation strategies. Furthermore, the prominence of terms such as *digital transformation*, *learning systems*, and *knowledge management* indicates a strong focus on the modernization of educational governance structures, where AI is increasingly embedded into teaching, administrative operations, and organizational decision-making processes. Overall, this cluster reflects the foundational role of AI in enabling data-centric, adaptive, and technology-enhanced education management systems.

***Cluster 2 (green): Machine Learning–Driven Decision Support Systems and Predictive Analytics in Educational Management.***

Cluster two (in green) comprises 14 keywords and is labelled *"Machine Learning–Driven Decision Support Systems and Predictive Analytics in Educational Management."* This cluster highlights the central role of machine learning and predictive analytics in strengthening decision-making processes and improving the efficiency of educational management systems. The cluster includes keywords such as curriculum, decision support systems, decision support, decision trees, deep learning, forecasting, learning algorithms, machine learning, machine-learning, management systems, personnel training, predictive analytics, students, and teacher, which collectively demonstrate the strong integration between computational intelligence techniques and educational decision-making structures. Studies within this cluster emphasize how machine learning models and decision tree approaches are applied to improve forecasting accuracy, support curriculum planning, and enhance the effectiveness of teaching and learning processes through data-driven insights. Furthermore, the presence of terms such as *predictive analytics*, *management systems*, and *personnel training* reflects the increasing importance of AI-enabled tools in optimizing both institutional administration and human resource development within educational environments. Overall, this cluster illustrates the growing transformation of education management into a more predictive, intelligent, and algorithm-supported system driven by machine learning and advanced analytics technologies.

***Cluster 3 (blue): Data-Driven Educational Intelligence, Learning Analytics, and Decision-Making Systems in Higher Education***

Cluster three (in blue) comprises 13 keywords and is labelled *"Data-Driven Educational Intelligence, Learning Analytics, and Decision-Making Systems in Higher Education."* This cluster emphasizes the increasing importance of data-centric approaches in supporting intelligent decision-making and information management within educational institutions. The cluster includes keywords such as big data, data handling, data mining, decision making, decision theory, educational data mining, higher education, higher education institution, information management, information systems, intelligent systems, learning analytics, and information use, which collectively reflect the strong integration of data science techniques and information systems in educational management contexts. Studies within this cluster highlight

how big data analytics and educational data mining are applied to extract meaningful insights from institutional data, enabling more informed decision-making processes and improved governance in higher education settings. Furthermore, the presence of terms such as *learning analytics*, *information systems*, and *intelligent systems* indicates a strong focus on leveraging digital infrastructures to enhance institutional efficiency, optimize learning outcomes, and support evidence-based policy development. Overall, this cluster illustrates the critical role of data-driven intelligence and analytics in transforming traditional education management into a more adaptive, predictive, and information-oriented system.

***Cluster 4 (yellow): AI-Enabled Educational Leadership, Decision Support Systems, and Sustainable Development in Education Management***

With 9 keywords, cluster four (in yellow) is labelled *"AI-Enabled Educational Leadership, Decision Support Systems, and Sustainable Development in Education Management."* This cluster highlights the integration of artificial intelligence within leadership practices, decision-support systems, and sustainability-oriented educational governance. The cluster includes keywords such as article, artificial intelligence, decision support system, education, educational leadership, educational management, human, leadership, and sustainable development, which collectively reflect the interaction between technological advancement and human-centered leadership in education systems. Studies within this cluster emphasize how AI-based decision support systems enhance managerial effectiveness, strengthen leadership capabilities, and improve strategic decision-making processes in educational institutions. Furthermore, the inclusion of *sustainable development* and *human* as key terms indicates that AI adoption in education management is not only driven by technological efficiency but also shaped by ethical, social, and long-term institutional sustainability considerations.

***Cluster 5 (purple): Education Management***

Cluster five (in purple) consists of a single keyword, namely "education management." This cluster represents the core conceptual foundation of the entire co-word network, functioning as the central thematic node that connects all other clusters within the analysis. The presence of this singular but highly central keyword indicates that *education management* serves as the primary domain underpinning the development of artificial intelligence applications, decision-support systems, leadership strategies, and data-driven educational transformation. Although it does not form a thematic sub-group like other clusters, its strong centrality highlights its role as the fundamental anchor of the research field, around which all other technological, managerial, and analytical themes are structured. Table 6 displays the results of the co-word analysis, organized by cluster labels and representative keywords.

## Discussion

The study aims to address two key objectives: (1) to identify the dominant and emerging research themes in AI-based education management through co-word and bibliographic coupling analysis; and (2) to analyze the intellectual structure and influential contributions shaping the field using citation-based techniques. The results of the bibliometric analysis reveal five major research streams: (1) AI-driven educational governance, data-centric decision making, and digital learning transformation, (2) machine learning–driven decision support systems and predictive analytics in educational management, (3) data-driven educational intelligence, learning analytics, and decision-making systems in higher education, (4) AI-

enabled educational leadership, decision support systems, and sustainable development in education management, and (5) education management as the foundational conceptual core of the field. These findings indicate that Artificial Intelligence in Education Management is increasingly characterized by the integration of intelligent systems, data-driven decision-making, and digital transformation strategies that collectively enhance institutional governance, learning processes, and administrative efficiency.

The co-word analysis further strengthens these findings by identifying the conceptual structure and thematic relationships within the field. From 2,446 keywords, the analysis identified 56 keywords that met the predefined threshold of a minimum of 11 occurrences, forming 5 distinct clusters with 1,078 links and a total link strength of 5,575. This reflects a highly interconnected and mature knowledge structure in the field of Artificial Intelligence in Education Management. The most dominant keywords, including "decision making," "artificial intelligence," "students," "information management," "learning systems," and "education management," demonstrate that research in this field is strongly centered on AI-enabled decision systems, learning analytics, and digital educational transformation. The density of linkages between keywords further indicates strong thematic convergence across studies, particularly in the areas of predictive analytics, machine learning applications, and intelligent educational systems.

Overall, the integration of bibliographic coupling and co-word analysis shows a clear evolution of the field from foundational education management systems toward advanced AI-driven, data-intensive, and predictive educational frameworks. The findings also suggest that while significant progress has been made in developing AI-based educational systems, future research should further investigate ethical governance, transparency of AI algorithms, and policy frameworks for sustainable implementation in education management. By combining both analytical approaches, this study provides a comprehensive mapping of the intellectual structure of the field and highlights emerging directions for future research in intelligent and adaptive education systems.

## Theoretical implication

This study makes several theoretical contributions to the discourse on Artificial Intelligence in Education Management by providing an integrated bibliometric perspective based on bibliographic coupling and co-word analysis. First, it advances the understanding of how artificial intelligence reshapes the intellectual structure of education management research by identifying five dominant thematic streams, including AI-driven educational governance, machine learning–based decision support systems, data-driven educational intelligence, AI-enabled leadership, and foundational education management concepts. These findings reinforce the theoretical perspective that AI is not merely a technological tool but an integral component of modern educational governance systems that supports data-driven decision-making, predictive analytics, and digital transformation (Dawson, 2014; Kabakchieva, 2013; Wang, 2021). Second, the study extends the socio-technical systems perspective by illustrating how human, technological, and institutional factors interact within AI-enabled education ecosystems, particularly in relation to leadership, ethical governance, and sustainable development in education management (Karakose, 2024; Suryanarayana, 2024). Third, by applying a bibliometric approach, this research contributes methodologically by offering a structured, data-driven mapping of the field, which enhances previous qualitative and conceptual studies. The integration of co-word and bibliographic coupling analyses provides a more robust framework for understanding knowledge evolution, thematic concentration, and intellectual linkages in AI-based education management research.

## Managerial implications

The findings of this study provide several important implications for policymakers, educational leaders, and institutional managers in higher education. The dominance of themes such as decision support systems, predictive analytics, and machine learning indicates that educational institutions should prioritize the integration of artificial intelligence technologies to enhance administrative efficiency, improve decision accuracy, and strengthen strategic planning processes. In practical terms, university leaders are encouraged to adopt AI-based systems for curriculum development, student performance monitoring, and institutional governance to support evidence-based decision-making (Wang, 2023; Gocen, 2025). Furthermore, the findings highlight the importance of leadership readiness and organizational transformation in ensuring successful AI adoption in education management systems (Karakose, 2024). Educational institutions should also invest in capacity building, digital literacy, and continuous professional development programs to ensure that educators and administrators are equipped to effectively utilize AI-driven tools. Additionally, policymakers should develop regulatory frameworks that address ethical considerations, data governance, and transparency in the use of artificial intelligence in educational environments to ensure sustainable and responsible implementation.

## Limitation

Despite its contributions, this study has several limitations that should be acknowledged. First, the analysis is based on a single bibliographic database, which may limit the comprehensiveness of the findings and exclude relevant studies indexed in other databases such as Scopus or Web of Science. Second, the study primarily relies on bibliometric techniques, which focus on quantitative patterns and may not fully capture the qualitative depth and contextual complexity of artificial intelligence applications in education management. Third, the dynamic and rapidly evolving nature of AI research means that recent developments published after the dataset collection period may not be included in the analysis, potentially affecting the timeliness of the findings. Finally, the study does not deeply examine country-specific or institutional-level differences in AI adoption, which may influence the generalizability of the results. Therefore, future research is recommended to incorporate multiple databases, mixed-method approaches, and longitudinal analyses to provide a more comprehensive and updated understanding of AI in education management.

# CONCLUSION

This study offers a comprehensive mapping of the intellectual landscape of Artificial Intelligence in Education Management through bibliographic coupling and co-word analyses. Using a dataset of 91 journal articles indexed in Scopus, the study identified six interconnected thematic clusters from the bibliographic coupling analysis: (1) AI-driven educational governance, data-centric decision making, and digital learning transformation, (2) machine learning–driven decision support systems and predictive analytics in educational management, (3) data-driven educational intelligence and learning analytics in higher education, (4) AI-enabled educational leadership and sustainable development, (5) AI-supported educational governance and institutional effectiveness, and (6) intelligent educational ecosystems and emerging AI applications. Furthermore, the co-word analysis revealed five major thematic clusters comprising 56 keywords that met the predefined threshold, highlighting the growing prominence of artificial intelligence, decision making, learning analytics, machine learning,

information management, and educational leadership within the field. Collectively, these findings demonstrate that Artificial Intelligence in Education Management has evolved into a multidisciplinary research domain that integrates educational governance, intelligent systems, predictive analytics, and digital transformation to improve institutional performance and educational outcomes.

Theoretically, the findings contribute to the advancement of socio-technical systems theory, educational leadership theory, and data-driven decision-making perspectives by positioning artificial intelligence as a strategic enabler of educational transformation rather than merely a technological tool. The identified clusters illustrate how AI facilitates institutional decision-making, supports adaptive learning environments, strengthens educational leadership, and promotes evidence-based governance practices. Methodologically, this study contributes a systematic and reproducible science-mapping approach that complements existing conceptual and empirical studies by providing a comprehensive overview of the intellectual structure, thematic evolution, and emerging research directions in AI-based education management. Practically, the results offer valuable insights for policymakers, educational leaders, and institutional managers regarding the adoption of AI-driven decision support systems, predictive analytics, and intelligent management platforms to enhance operational efficiency, strategic planning, and educational quality.

The global publication structure also reveals that research contributions are concentrated in a limited number of countries and institutions, particularly China, the United States, and several European nations, indicating disparities in research productivity and collaboration across regions. While the field has experienced significant growth, participation from developing countries remains comparatively limited. This imbalance highlights the need for broader international collaboration, capacity-building initiatives, and context-sensitive AI implementation strategies that consider diverse educational environments. Strengthening global knowledge exchange and collaborative research networks will be essential to ensuring that the benefits of artificial intelligence in education management are distributed more equitably across different regions and institutional contexts.

Future research on Artificial Intelligence in Education Management may explore several promising directions. First, studies could investigate the integration of emerging technologies such as generative artificial intelligence, large language models, and adaptive learning systems into educational governance and institutional decision-making processes. Second, future research should examine ethical issues related to algorithmic transparency, data privacy, bias mitigation, and responsible AI implementation in educational settings. Third, comparative studies across countries and educational systems could provide deeper insights into contextual factors influencing AI adoption and effectiveness. Additionally, longitudinal research is needed to assess the long-term impact of AI-driven management systems on educational performance, organizational change, and institutional sustainability. Finally, greater attention should be given to developing inclusive AI frameworks that support equitable access, digital readiness, and sustainable educational transformation in both developed and developing countries.

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