International Journal of Learning, Teaching and Educational Research
Vol. 25, No. 6, pp. 732-751, June 2026
https://doi.org/10.26803/ijlter.25.6.31
Received Apr 24, 2026; Revised May 27, 2026; Accepted May 29, 2026

Digital Transformation in Educational Finance and School Management: A Bibliometric Analysis of Global Trends

Nuryadin Ali Mustofa*, Agus Pahrudin, Ahmad Fauzan and Laila Maharani
Universitas Islam Negeri Raden Intan Lampung, Indonesia

Abstract. This study examined global research trends in the digital transformation of educational finance and school management through a bibliometric analysis of publications indexed in the Scopus database from 2016 to 2025. Data were collected from the Scopus database on April 14, 2026, using a structured TITLE-ABS-KEY search query. The search initially identified 1,059 documents, which were refined to 162 relevant publications through PRISMA-based inclusion and exclusion criteria. Bibliometric mapping and performance analyses were conducted using Biblioshiny (R) and VOSviewer, supported by data cleaning and standardization through OpenRefine and a thesaurus file. The results showed a significant increase in global research output on digital transformation in educational finance and school management, particularly after 2020. This trend reflects growing scholarly and institutional attention to the role of digital technologies in educational governance and financial administration. Conference proceedings remained the dominant publication source, while journal publications continued to grow. China emerged as the leading contributor, supported by strong institutional productivity and collaboration networks. Thematic analysis identified major research clusters in financial management, information systems, data-driven decision-making, artificial intelligence, e-learning, and educational technology. Recent studies also emphasized sustainability, economic analysis, blockchain, and decentralized finance. This study contributes to the literature by providing a comprehensive global research map and offering policy insights to advance technology-driven, sustainable educational management practices.

Keywords: Digital transformation; educational finance; educational technology; school management; financial management systems

Citation: Mustofa, N. A., Pahrudin, A., Fauzan, A., & Maharani, L. (2026). Digital Transformation in Educational Finance and School Management: A Bibliometric Analysis of Global Trends. *International Journal of Learning, Teaching and Educational Research*, *25*(6), 732–751. https://doi.org/10.26803/ijlter.25.6.31

*Corresponding author: Nuryadin Ali Mustofa; *nuryadinam@gmail.com*

1. Introduction

Digital transformation has become a major driver of change across sectors, particularly in education, including educational finance and school management. The integration of digital technologies enhances efficiency, transparency, and accountability in the management of educational resources. This integration includes budget planning, fund management, and electronic financial reporting (De Oliveira & Silveira, 2018; Hartikayanti et al., 2018). In addition, digitalization promotes more adaptive and data-driven school management models that support more accurate decision-making (Nurhayati et al., 2023; Yuan & Du, 2022). Digital transformation also supports the improvement of competency-based learning and training systems through technology-assisted evaluation and adaptive learning approaches (Mauzino & Costa, 2025). In this context, digital transformation is not only a technical necessity but also a key strategy for improving the overall quality of educational governance (Vorontsova et al., 2021).

However, the implementation of digital transformation in educational finance and school management continues to face several challenges. These include infrastructure gaps and limited digital literacy (Tabira & Otieno, 2017). Furthermore, the integration of policy, technology, and managerial practices has not been fully optimized (Dombrowski et al., 2019; Sinervo et al., 2023). Another issue is the fragmentation of knowledge and the lack of comprehensive mapping of research developments in this field. This situation makes it difficult to identify trends and research directions. Therefore, a bibliometric analysis approach is needed to provide a systematic overview of the global research landscape on digital transformation in educational finance and school management.

Several previous studies have examined various aspects related to digital transformation and educational finance. These studies demonstrate diverse approaches to understanding the issue. Al-Maadeed and Yesuf (2025) conducted a systematic review and identified various financing mechanisms in entrepreneurial universities. The study also emphasized the importance of financial innovation and strategic partnerships. Dietze and Frimpter (2025) identified that cost and effectiveness aspects in education, particularly in continuing health education, remain underexplored. This finding indicates limitations in the literature related to the economic evaluation of education. Furthermore, Vorvornator and Midiniso (2025) highlighted challenges in managing entrepreneurial education, including weak financial management and institutional governance. In addition, Ramasu and Kanakana-Katumba (2024) discussed the limitations of free higher education funding from policy and economic capacity perspectives.

Despite these contributions, a significant research gap remains. There are limited bibliometric studies that map the relationships among digital transformation, educational finance, and school management on a global scale. Previous studies have mainly focused on case studies, limited systematic reviews, or sectoral analyses without fully integrating the dimension of digitalization. Only a few studies simultaneously identify publication trends, key actors, geographic distribution, and thematic developments within a single integrated analytical

framework. The novelty of this study lies in its use of a bibliometric approach to reveal the global research landscape during 2016–2025. This approach integrates scientific performance analysis, such as annual publications, journals, institutions, and countries, with keyword-based thematic analysis to identify research directions and future opportunities.

This study aims to analyze global trends in research on digital transformation in educational finance and school management using a bibliometric approach. Specifically, it examines the development of annual scientific publications, relevant journal sources, contributing institutions, countries of corresponding authors, and the most frequently cited documents. In addition, this study conducts a thematic analysis of keywords to identify core research themes, emerging topics, and potential future research directions. The study is expected to provide an empirical foundation for further research. Moreover, the findings may serve as a strategic reference for policymakers in designing more effective and sustainable digital-based education policies. The following two research questions guide this study:

1. What are the global landscape and research trends related to digital transformation in educational finance and school management based on bibliometric analysis?
2. What is the thematic structure and the development of research topics in this field based on keyword analysis?

2. Methodology

2.1 Research Design

This study employed a bibliometric approach to analyze global research trends on digital transformation in educational finance and school management. Bibliometric analysis enables the systematic mapping of scientific publications, including patterns of productivity, impact, and thematic development within a research field (Donthu et al., 2021; Zupic & Čater, 2015). This approach is suitable for identifying the intellectual structure and evolution of interdisciplinary topics involving technology, finance, and education.

2.2 Data Collection Procedure

Data were retrieved from the Scopus database on April 14, 2026. Scopus was selected owing to its extensive coverage of peer-reviewed international publications and standardized metadata, which support reliable bibliometric analysis (Meiliati et al., 2026; Sitepu et al., 2026). Its indexing system enables comprehensive exploration of research outputs across education, technology, and management domains. The analysis focused on publications from 2016 to 2025 to capture developments over the past decade.

This study carefully considered keyword selection to retrieve relevant documents and minimize bias in search results. A structured search was conducted in the Scopus database using the TITLE-ABS-KEY field. The search query was as follows: "("education** finance" OR "education** financing" OR "education** funding" OR "school** funding" OR "school** finance" OR "education** budget**" OR "school** budget**" OR "education** expenditure**" OR

"education** cost**" OR "education** investment" OR "financial management") AND ("digital transformation" OR "digitalization" OR "digitization" OR "digital innovation" OR "technology adoption" OR "ICT integration" OR "information system**" OR "digital system**" OR "education** technology" OR "e-government" OR "automation" OR "big data" OR "artificial intelligence") AND ("education** OR school**" OR "education** system**" OR "education* management" OR "school** management")".

The initial search yielded 1,059 documents. A series of inclusion and exclusion criteria was applied to refine the dataset. First, the publication period was limited to 2016–2025, resulting in 522 documents. Second, document types were restricted to articles, review papers, conference papers, and conference reviews, reducing the dataset to 411 documents. Third, source types were limited to journals and conference proceedings, yielding 383 documents.

A manual screening process was conducted to ensure metadata completeness and topic relevance. This step verified key information, including authors, affiliations, and abstracts, and ensured alignment with the topic of educational financial management. After this process, 162 documents were retained as the final dataset. The selection process followed the PRISMA framework for transparent reporting (Moher et al., 2015), as illustrated in Figure 1.

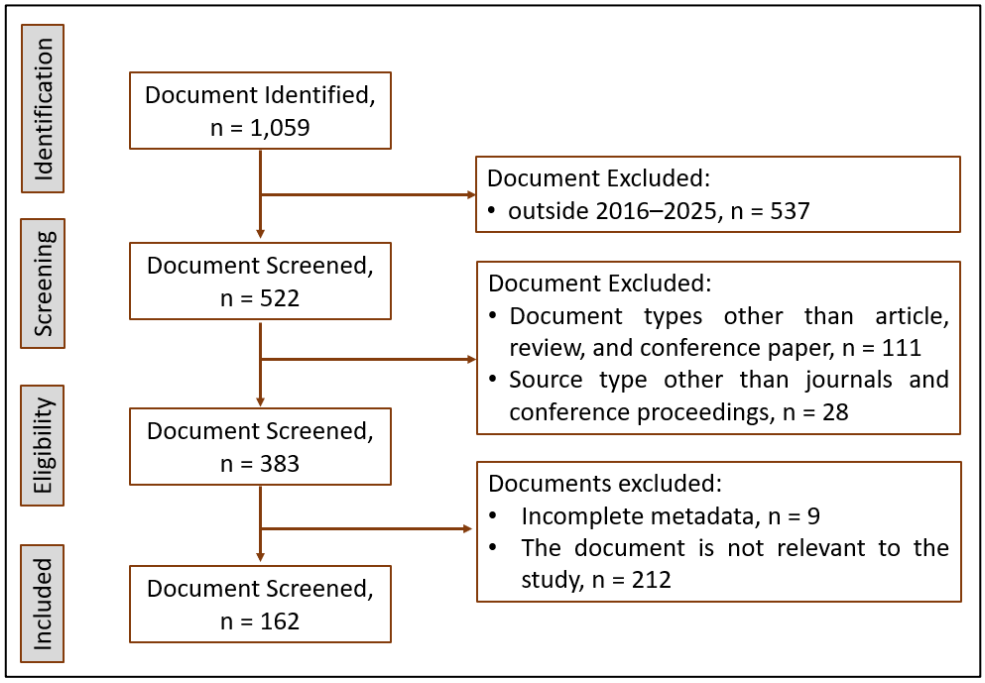

Figure 1: PRISMA flowchart of the document selection process

2.3 Data Analysis

The data analysis in this study focused on examining performance and thematic aspects of the research field of digital transformation in educational finance and school management. Descriptive bibliometric analysis was conducted to identify annual scholarly output, leading journals, productive institutions, countries of corresponding authors, and highly cited documents. These indicators provide

insights into research productivity and scholarly impact (Gandasari et al., 2024; Melisa et al., 2025).

The analysis was conducted using Biblioshiny (R package) and VOSviewer. Biblioshiny was used for descriptive analysis and performance metrics, including publication trends and citation analysis. Prior to analysis, the dataset was cleaned using OpenRefine to ensure consistency in author names, institutional affiliations, and keyword variations. VOSviewer was then used to perform keyword co-occurrence analysis and to visualize the thematic structure. A minimum threshold of three keyword occurrences was applied to ensure robustness in the network visualization. In addition, a thesaurus file was used to standardize terms and remove irrelevant or duplicate keywords. The analysis generated network and overlay visualizations to identify dominant themes, emerging topics, and potential research directions.

The results were interpreted systematically to ensure validity and reliability. Findings were reviewed through iterative analysis and cross-checking to maintain consistency and minimize bias. This process supported a comprehensive understanding of the global research landscape on digital transformation in educational finance and school management.

3. Results

3.1 Global Research Landscape and Trends in Digital Transformation in Educational Finance and School Management (2016-2025)

This section presents an overview of the global research landscape based on bibliometric analysis. The results of the analysis of annual publication trends are presented in Figure 2.

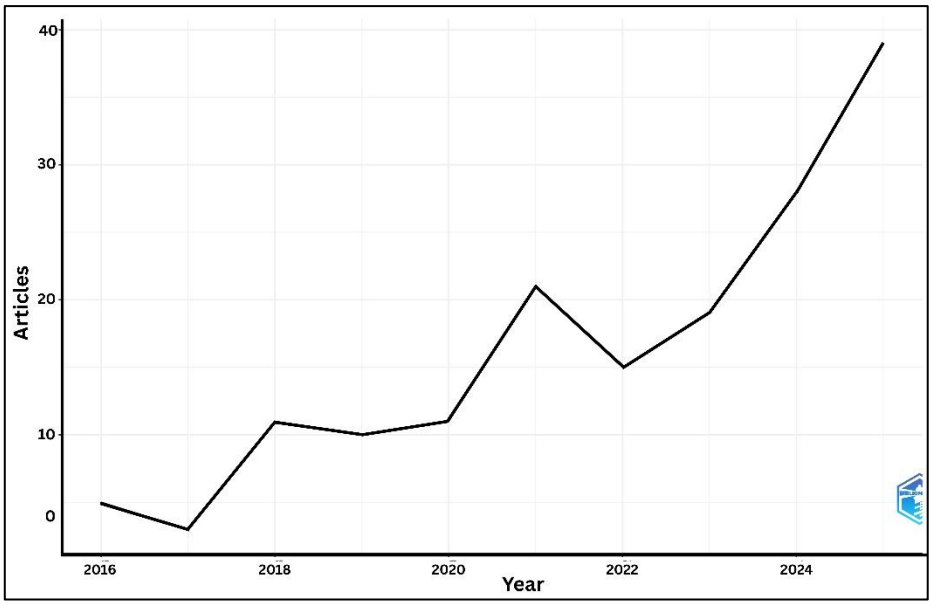

Figure 2: Annual scientific production in digital transformation in educational finance and school management

Based on Figure 2, the number of publications shows an overall increasing trend during the period 2016–2025, although several fluctuations are observed. At the beginning of the period, the number of publications was very low and even declined in 2017 before increasing sharply in 2018. Growth then remained relatively stable until 2020, followed by a significant increase in 2021. Although a decline occurred in 2022, the trend subsequently increased consistently, reaching its peak in 2025 with the highest number of publications. This pattern indicates that research interest in digital transformation in educational finance and school management has strengthened in recent years. Furthermore, the increasing publication trend is closely related to the diversity of publication sources that support the dissemination of research in this field. The analysis of the most relevant publication sources in this field is presented in Figure 3.

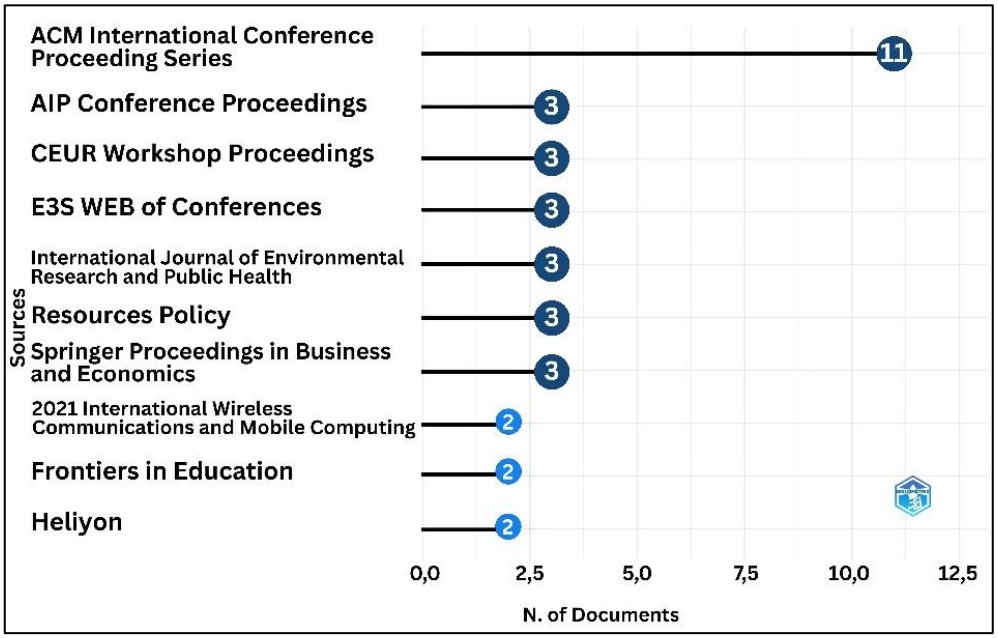

Figure 3: Top 10 sources of publications

Figure 3 shows that publication sources in this field are dominated by conference proceedings, with the *ACM International Conference Proceedings Series* as the leading contributor with 11 documents. Other sources show relatively balanced contributions, including *AIP Conference Proceedings, CEUR Workshop Proceedings, E3S Web of Conferences, International Journal of Environmental Research and Public Health, Resources Policy*, and *Springer Proceedings in Business and Economics,* each with three documents.

In addition, several sources, such as the *2021 International Wireless Communications and Mobile Computing, Frontiers in Education*, and *Heliyon,* contribute fewer publications, with two documents each. This pattern indicates that research dissemination in this field is still largely conducted through conference forums, although contributions from reputable journals are increasing. Moreover, the distribution of publication sources is also associated with the institutional productivity driving research development in this area. The analysis of the ten most productive institutions is presented in Figure 4.

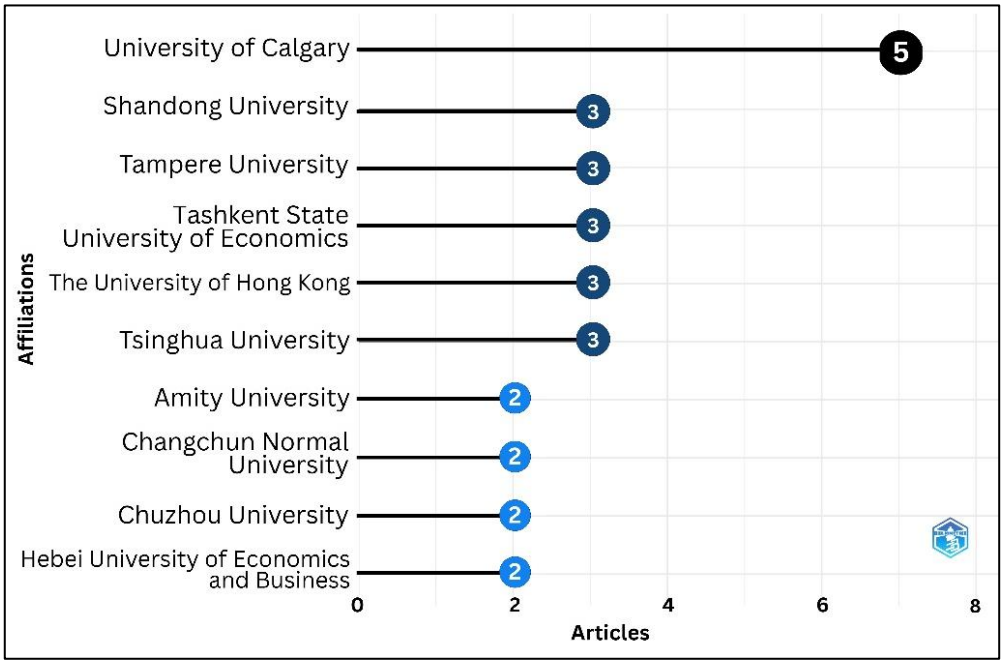

Figure 4: Top 10 productive institutional affiliations

Based on Figure 4, the University of Calgary ranks first as the most productive institution with five publications. Several other institutions, including Shandong University, Tampere University, Tashkent State University of Economics, the University of Hong Kong, and Tsinghua University each produced three publications. Meanwhile, Amity University, Changchun Normal University, Chuzhou University, and Hebei University of Economics and Business show lower contributions, with two publications each. This distribution indicates that institutional contributions remain dispersed, with no single institution showing strong dominance, although several universities are relatively more active in this field. In addition, institutional productivity is closely connected to the geographical distribution of research contributions across countries. The distribution of contributions based on the countries of corresponding authors is presented in Figure 5.

Figure 5 shows that China is the leading contributor, with publication output significantly exceeding that of other countries. Indonesia and the United States follow, while India and Canada show moderate contributions. Other countries, including Malaysia, Spain, Ukraine, Colombia, and Uzbekistan, contribute relatively fewer publications. The collaboration pattern further indicates that most studies are produced through single-country collaboration (SCP), although multiple-country collaboration (MCP) is also evident in several countries.

Furthermore, a comparison between Figure 4 and Figure 5 demonstrates a close relationship between institutional productivity and national research contributions. The dominance of countries such as China is consistent with the strong contributions of institutions from those countries, including Tsinghua University and several others. This finding suggests that research productivity in digital transformation in education is concentrated in specific regions, although

global participation remains broadly distributed. In addition to productivity and collaboration patterns, citation analysis provides further insight into the publications that have had the greatest academic influence in this field. Table 1 presents the ten most influential documents based on citation analysis.

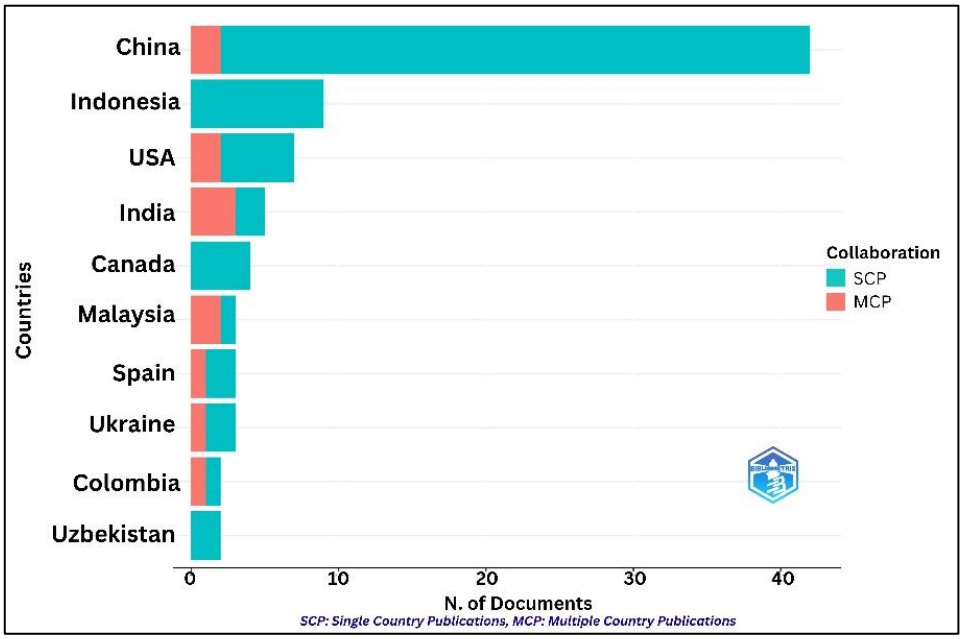

Figure 5: Top 10 countries of corresponding authors

Table 1: Top 10 cited documents in innovation-oriented training management research in schools (2016–2025)

Paper	DOI	TC	TC/Y	NTC
Huang et al. (2016), *PLoS One*	10.1371/journal.pone.0154509	64	5,8	2,99
Vasile et al. (2021), *IJERPH*	10.3390/ijerph182010938	57	9,5	8,55
Lalani et al. (2025), *IJLE*	10.1080/13603124.2021.1988716	40	20	21,37
Walker et al. (2016), *Interact Learn Environ*	10.1080/10494820.2013.867888	38	3,5	1,76
Magazzino et al. (2024), *Environ Pollut*	10.1016/j.envpol.2024.123807	27	9	5,95
Ari et al. (2022), *Electronics (Switzerland)*	10.3390/electronics11040585	25	5	3,75
Jin et al. (2024), *Resour Policy*	10.1016/j.resourpol.2023.104532	23	7,7	5,07
Yakovenko et al. (2019), *Int. J. Mech. Eng. Technol.*	-	23	2,9	3,19
Canché, (2018), *RHE*	10.1353/rhe.2018.0001	22	2,4	2,14
Carney et al. (2018), *Fam Med*	10.22454/FamMed.2018.829131	21	2,3	2,04

Note. *TC: Total Citations; TC/Y: Total Citations per Year; NTC: Normalized Total Citations*

As shown in Table 1, the publication with the most citations is the article by Huang et al. (2016), with 64 citations. This publication is followed by those of Vasile et al. (2021) with 57 citations and Lalani et al. (2025) with 40 citations, both of which also show the highest citations per year. Other influential articles include

those by Walker et al. (2016) with 38 citations, Magazzino et al. (2024) with 27 citations, Ari et al. (2022) with 25 citations, and Jin et al. (2024) and Yakovenko et al. (2019) each with 23 citations. In addition, Canché (2018) and Carney et al. (2018) are also included in the top ten, with 22 and 21 citations, respectively. These findings indicate that influential contributions originate from both earlier and more recent publications.

Furthermore, the citation patterns provide insight into the growing influence of recent studies within the field. Based on citations per year and normalized total citations, more recent articles such as those by Lalani et al. (2025), Vasile et al. (2021), and Magazzino et al. (2024) demonstrate relatively high impact within a short period. This finding indicates an acceleration in the influence of recent research in digital transformation in educational finance and school management. Overall, the citation distribution reflects a mix of established foundational works and emerging publications that continue to shape research direction.

3.2 Thematic Structure and Topic Development Based on Keyword Analysis

The results of the keyword co-occurrence network analysis are presented in Figure 6.

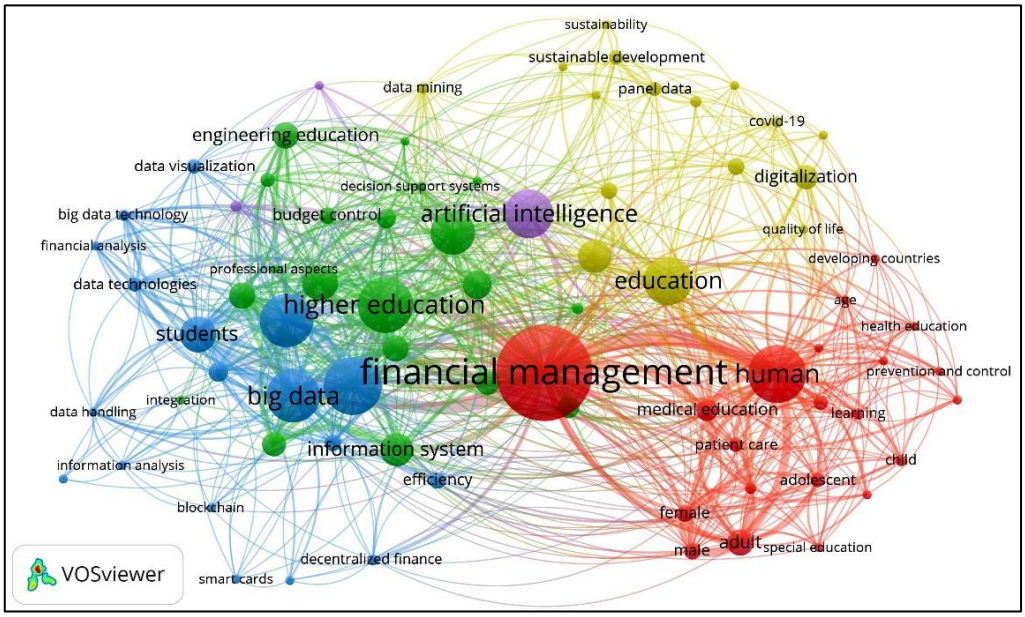

Figure 6: Network visualization of keyword co-occurrence

Based on Figure 6, the co-occurrence analysis was conducted using a minimum threshold of three keyword occurrences, resulting in 78 items grouped into five clusters. Several general research terms and country names were excluded to maintain analytical relevance. The first cluster (red) consists of 21 items, with dominant keywords such as financial management, human, medical education, adult, male, female, adolescent, and organization and management. This cluster focuses on the managerial and human aspects of educational finance, particularly in health and social education contexts.

The second cluster (green) consists of 20 items and focuses on the higher education context and technology integration. Keywords such as higher education, investment, teaching, curriculum, economics, education computing, engineering education, information systems, digital transformation, and educational technology indicate a strong link between digital transformation and learning processes. The third cluster (blue) consists of 18 items and emphasizes the role of data technologies in financial systems. This pattern is reflected in keywords such as information management, big data, finance, students, financial management systems, efficiency, management systems, data technologies, data visualization, and blockchain. These clusters indicate that technology integration and data management are central to improving the efficiency and quality of educational management.

Furthermore, the fourth cluster (yellow) consists of 16 items related to digital transformation and sustainability. Keywords include education, e-learning, digitalization, digitization, machine learning, sustainable development, and data mining. This cluster indicates a research direction that links digitalization with sustainability and educational quality. The fifth cluster (purple) is the smallest and includes artificial intelligence, human resource management, and process automation. This cluster reflects a shift toward automation and the application of artificial intelligence in educational management. Overall, the thematic structure indicates that research is evolving toward the integration of advanced technologies with more adaptive and data-driven educational management. The analysis of shifts in research trends is presented in Figure 7.

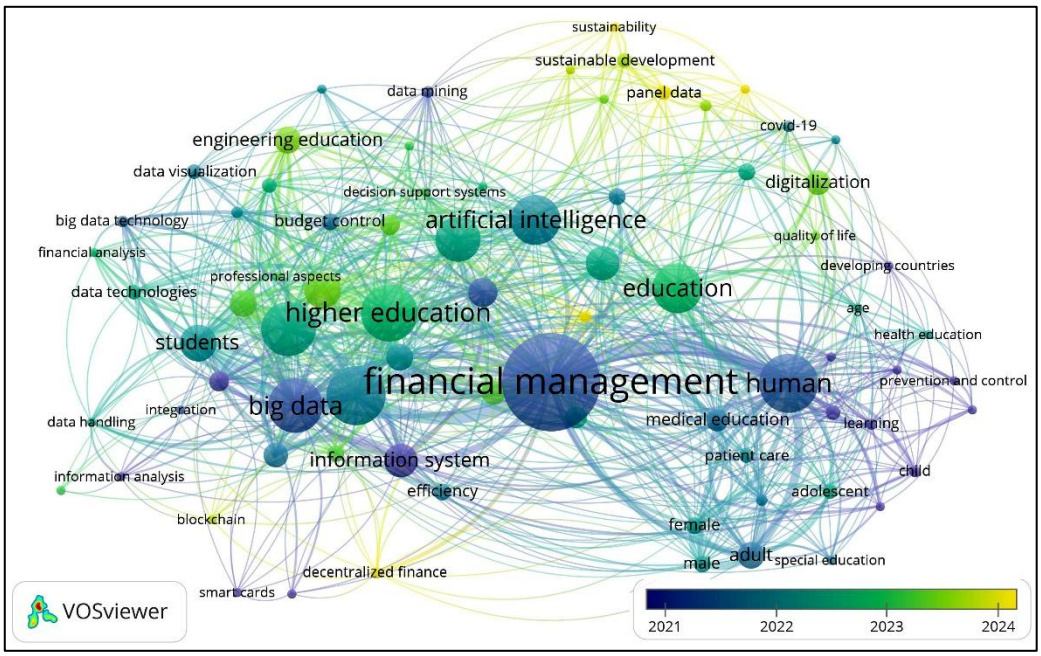

Figure 7: Overlay visualization of keyword evolution

Based on Figure 7, the overlay visualization illustrates the evolution of research topics over time through color gradients. Keywords that appeared earlier, up to around 2021, are marked in dark blue. These include financial management,

human, big data, information system, financial management systems, economics, and adult. These keywords reflect an early research focus on fundamental aspects of financial management, information systems, and data use in education.

In the intermediate period, around 2022 to 2023, marked by green nodes, a shift in research focus is observed. Keywords such as finance, higher education, artificial intelligence, education, investment, e-learning, students, information management, curriculum, educational technology, digitization, and machine learning become more prominent. This period indicates increased integration of digital technologies in educational processes and management, along with the growing application of artificial intelligence and digital learning technologies.

In the most recent period, from around 2024 to the present, keywords marked in yellow indicate current research directions. Keywords such as sustainability, sustainable development, natural resources, public education, education expenditure, economic analysis, panel data, blockchain, decentralized finance, and resource allocation become dominant. This pattern indicates that research is shifting toward sustainability issues, more advanced economic analysis, and the application of digital financial technologies in educational management.

4. Discussion

4.1 Interpreting the Global Research Landscape and Publication Trends (2016–2025)

The increasing attention to digital transformation in educational finance and school management is not coincidental. It is driven by the accelerated adoption of digital technologies in the global education sector. Previous studies show that technologies such as big data and information systems have enabled broader, more complex interdisciplinary research. This expansion of interdisciplinary research is especially evident in resource management and data-driven decision-making (Huang et al., 2016). In addition, the COVID-19 pandemic accelerated digital transformation, particularly in online learning and digital financial systems. This situation increased the demand for research in this field (Lalani et al., 2025; Vasile et al., 2021). These conditions explain the surge in publications after 2020, as the urgency of technological adaptation in education increased.

On the other hand, fluctuations in publication trends reflect structural challenges in implementing digital transformation. These challenges stem from institutional readiness and funding constraints. Studies indicate that the adoption of educational technologies is often hindered by costs, limited human resource competencies, and unequal access to technology across regions (Tabira & Otieno, 2017). In addition, issues related to the efficiency of educational financial management and the need for integrated information systems influence research dynamics in this field (Kostić et al., 2019). Therefore, the increasing yet fluctuating publication trend reflects the interaction between technological innovation and persistent implementation challenges in educational practice.

The dominance of conference proceedings as publication sources indicates that this field remains dynamic and exploratory. Conference forums often serve as the main platform for introducing early-stage innovations, especially in technology-driven areas such as big data, artificial intelligence, and financial education systems. Several studies confirm that integrating technologies such as big data into financial management and education has led to new learning and management models. These models are still being tested and refined, which explains their frequent presentation at conferences (Yao et al., 2020; Zhu, 2024).

Other studies show that technology-based instructional design is rapidly evolving, particularly in higher education (Lin & Yu, 2023). In addition, research on open data systems and machine learning demonstrates strong innovation in educational decision-making. Such studies are often presented in scientific forums before reaching conceptual maturity (De Oliveira & Silveira, 2018). Data-driven approaches are also increasingly used to support more adaptive and evidence-based education policies (Silva et al., 2024).

However, there is a growing contribution from reputable journals, indicating a shift toward more mature, evidence-based research. Journal publications tend to focus more deeply on implementation effectiveness in real-world contexts. The use of financial information systems has been shown to improve efficiency in educational management and enhance data-driven decision-making (Lutilsky & Ćorić, 2018). Other studies also indicate that digital-based budgeting systems can improve operational efficiency and the accuracy of educational financial management (Fadloil et al., 2024).

The distribution of institutional affiliations indicates that productivity is driven by research capacity and a focus on technology integration in education. The University of Calgary, for example, stands out through its contributions to data-driven policy analysis across education and public service sectors (Russell et al., 2021, 2022). Shandong University and Tsinghua University strengthen their roles through the development of intelligent management systems and data integration in higher education (Gao et al., 2024; Liu et al., 2024).

Tampere University and Tashkent State University of Economics also contribute to the development of curricula and digital-based decision-making models (Sinervo et al., 2023; Xakimova et al., 2025). In addition, cross-institutional collaboration is evident in the involvement of the University of Hong Kong and Tsinghua University in artificial intelligence-based research. This pattern of cross-institutional collaboration indicates the emergence of increasingly interconnected international research networks (Wang et al., 2025).

Furthermore, the dominance of certain countries in publications, particularly China, is consistent with the high number of productive institutional affiliations from that country. This dominance is associated with strong research funding and policies that support the integration of technologies such as big data and artificial intelligence in education (Huang et al., 2016; Zhao et al., 2022). Other studies indicate that strengthening financial information systems and digital

transformation in higher education are key factors in improving efficiency and the quality of educational management (Yuan & Du, 2022; Zhu, 2024). Contributions from other countries, such as the United States, Canada, and Indonesia, indicate that the research landscape remains globally distributed. However, most collaborations still occur within single countries, while international collaboration remains relatively limited. Some studies, however, show emerging cross-country collaboration in developing technology-based education systems.

The findings on the most cited documents indicate that the development of this field is shaped by a combination of early foundational studies and more recent contextual research. Huang et al. (2016) emphasize the importance of funding and interdisciplinary approaches in developing big data-based research, which forms a foundation for technology integration in education. Walker et al. (2016) show that investment in learning technologies in higher education has developed gradually and still faces challenges in pedagogical implementation. Other studies, such as Canché, (2018) and Carney et al. (2018), broaden the perspective by highlighting the dynamics of education systems and innovation in instructional design. These studies show that transformation is not only technological but also structural.

More recent publications reflect a shift toward digitalization, sustainability, and inclusion. Vasile et al. (2021) highlight disparities in access to digital financial inclusion, particularly after the pandemic, which is relevant to global inequality. Lalani et al. (2025) demonstrate the role of leadership in adopting educational technologies during crises, emphasizing the importance of institutional factors in digital transformation. In addition, Ari et al. (2022) and Jin et al. (2024) emphasize the link between digital transformation, educational finance, and sustainability. Yakovenko et al. (2019) highlight the potential of technologies such as blockchain to support more efficient education systems. Magazzino et al. (2024) also connect digitalization with environmental issues and public policy, thereby expanding the scope of research. Overall, this pattern aligns with the dominance of certain countries in publications, as countries with strong research capacity tend to produce work that is both high in volume and highly cited.

4.2 Interpreting Thematic Structures and Emerging Research Topics

The identified thematic structure shows that research in this field is not limited to technological aspects but also includes human and governance dimensions. The first cluster highlights the interaction among financial management, medical education, and individual characteristics within education systems. This finding aligns with evidence that digital transformation in education is influenced by social and inclusion factors, such as access gaps and the needs of vulnerable groups (Vasile et al., 2021). In addition, studies on medical education and curriculum development indicate that managerial and organizational reforms remain essential for improving the quality of educational services (Carney et al., 2018).

The second and third clusters demonstrate a strong convergence among higher education, digital transformation, and data utilization. The integration of

technologies such as big data, information systems, and analytics provides a foundation for decision-making and efficiency improvements in educational institutions. This finding is supported by studies showing that big data development is interdisciplinary and drives cross-sector innovation, including in education (Huang et al., 2016). Furthermore, the implementation of financial information systems and digital platforms in higher education improves organizational performance and management quality (Hartikayanti et al., 2018; Nurhayati et al., 2023). In the learning context, integrating technologies such as e-learning, chatbots, and industry-based systems enhances learning effectiveness and workforce readiness (He et al., 2023; Shabelnyk et al., 2020).

The fourth and fifth clusters highlight more recent research directions, particularly the links among digitalization, sustainability, and artificial intelligence. Recent studies indicate that the digitalization of education supports sustainable development by improving resource management and enabling data-driven policies (Jin et al., 2024; Li et al., 2024). At the same time, the use of artificial intelligence and automation is transforming administrative processes and decision-making in educational institutions. This shift increases system efficiency and adaptability (Anysiadou & Gkliati, 2025; Domingo-Alejo, 2024). Overall, this pattern indicates a transition from using technology as a supporting tool to its strategic integration in educational management.

The temporal development of research topics indicates a systematic shift from conventional approaches to the integration of technology and sustainability issues. In the early phase, up to around 2021, research focused on fundamental themes such as financial management, information systems, and big data. This pattern emphasizes the development of basic infrastructure for financial and data management in education. This finding is consistent with that of Huang et al. (2016), who identify big data as an interdisciplinary field that serves as the foundation for early innovation across sectors, including education. In addition, strengthening financial information and accounting systems was a priority for improving institutional performance during this stage (Hartikayanti et al., 2018; Nurhayati et al., 2023).

In the intermediate period (2022–2023), research shifted toward integrating digital technologies into educational processes and management. The emergence of keywords such as artificial intelligence, e-learning, educational technology, and machine learning indicates a focus on more applied digital transformation with direct impacts on learning. This shift is supported by Firmansyah and Maulana (2021), who show that e-learning significantly improves financial literacy and learning effectiveness. Hong et al. (2021) also emphasize the role of technologies such as artificial intelligence and big data in shaping more adaptive online education ecosystems. This phase represents an acceleration of digitalization that connects technology with pedagogical and managerial needs.

In the most recent period, research trends increasingly emphasize integrating technology, advanced economic analysis, and sustainability. The dominance of keywords such as sustainability, education expenditure, blockchain, and

decentralized finance indicates a focus on sustainable development. Jin et al. (2024) show that education expenditure, natural resources, and digitalization are closely related to environmental quality and economic growth. Yakovenko et al. (2019) highlight the potential of blockchain to improve transparency and efficiency in educational management.

Based on these developments, several potential research themes can be proposed. First, future studies may examine the integration of artificial intelligence for predictive decision-making in educational management. This research can focus on optimizing resource allocation and strategic planning. Second, future research may explore the use of blockchain and decentralized finance in managing educational finance. This line of inquiry can focus on improving transparency, accountability, and efficiency in digital financial systems. Finally, research can develop sustainability-oriented education policy models. These models should examine the relationship between education expenditure and long-term environmental and social impacts. These themes reflect the need for multidisciplinary approaches that integrate advanced technologies, economic analysis, and sustainability principles in modern education systems.

4.3 Study Implications for Research and Educational Policy

The findings of this study provide important implications for future research, particularly in strengthening interdisciplinary approaches that integrate digital technologies, financial management, and education policy. Emerging research directions indicate that the use of technologies such as big data, artificial intelligence, and information systems is no longer optional. Instead, these technologies have become core elements in modern educational management. This finding aligns with those of Huang et al. (2016), who emphasize the role of big data as a foundation for cross-sector innovation, and Hong et al. (2021), who show that digital technology integration improves the effectiveness of online education systems. In addition, future research should give greater attention to the context of developing countries and promote stronger international collaboration, given the limited cross-country collaboration observed in the existing literature.

From a policy perspective, this study's results highlight the need for adaptable education policies that are oriented toward sustainability and the digital transformation. Governments and educational institutions need to develop transparent, technology-based financial systems supported by regulations that encourage innovation. Vasile et al. (2021) show that digital financial inclusion is a key factor in reducing access disparities, while Jin et al. (2024) highlight the link between education expenditure and sustainable development. Therefore, future education policies should integrate technology, economic efficiency, and sustainability. This integration is essential to address global challenges and to improve the quality of educational governance.

5. Conclusion

This study aims to map and analyze global developments in research on digital transformation in educational finance and school management using a

bibliometric approach. The findings show an increasing publication trend over the past decade, with contributions concentrated in certain countries and institutions, particularly China. Publication sources are still dominated by conference proceedings, reflecting the field's rapidly evolving nature, while contributions from reputable journals are increasing. In addition, citation analysis indicates that knowledge development is shaped by a combination of early foundational studies and more recent contextual and applied research.

From a thematic perspective, this study identifies that core themes remain centered on educational financial management, information systems, and data use in decision-making. Emerging themes indicate the integration of digital technologies in education, including the use of artificial intelligence, e-learning, and educational technology, to improve efficiency and learning quality. More recent themes focus on sustainability, economic analysis in education, and the use of technologies such as blockchain and decentralized finance in educational governance. Future research may develop areas such as the integration of artificial intelligence for predictive decision-making, the enhancement of technology-based financial transparency, and the development of education policies that link digitalization with social and environmental sustainability.

However, this study has several limitations. The data were obtained only from the Scopus database, which may limit the coverage of the analyzed literature. In addition, the approach did not include a systematic literature review, with the analysis focusing more on quantitative mapping than on an in-depth evaluation of research content. Therefore, future studies can be expanded by incorporating a systematic literature review to synthesize relevant studies and clarify the evolving context. This approach may also include multiple databases to reduce potential bias.

6. Acknowledgments

The authors sincerely thank Raden Intan State Islamic University of Lampung for its supportive academic environment and commitment to fostering collaborative research and scientific publication. This study was conducted as part of the first author's doctoral requirements, and the University's support was essential in completing this manuscript for submission to an international journal.

Conflict of Interest

The authors declare that no conflicts of interest exist regarding the preparation, authorship, and publication of this study.

7. AI Use Declaration

The authors disclose the use of AI-based tools, including ChatGPT (version 5.2) and Grammarly, to improve linguistic quality, clarity, and readability. These tools were not used for data analysis or interpretation, and all AI-assisted content was carefully reviewed and revised by the authors to ensure accuracy and consistency.

8. References

Al-Maadeed, S. A., & Yesuf, A. J. (2025). Exploring financing mechanisms for entrepreneurial universities: A systematic review of current practices and future trends. *Educational Process: International Journal*, *14*, e2025074. https://doi.org/10.22521/edupij.2025.14.74

Anysiadou, M., & Gkliati, A. (2025). An experimental analysis of Greek school leaders' readiness for ai integration. *Leadership and Policy in Schools*, *24*(1), 155–177. https://doi.org/10.1080/15700763.2024.2439833

Ari, R., Altinay, Z., Altinay, F., Dagli, G., & Ari, E. (2022). Sustainable management and policies: The roles of stakeholders in the practice of inclusive education in digital transformation. *Electronics (Switzerland)*, *11*(4). https://doi.org/10.3390/electronics11040585

Canché, M. S. G. (2018). Geographical network analysis and spatial econometrics as tools to enhance our understanding of student migration patterns and benefits in the US higher education network. *Review of Higher Education: Journal of the Association for the Study of Higher Education*, *41*(2), 169–216.

Carney, P. A., Eiff, M. P., Waller, E., Jones, S. M., & Green, L. A. (2018). Redesigning residency training: Summary findings from the preparing the personal physician for practice (P4) project. *Family Medicine*, *50*(7), 503–517. https://doi.org/10.22454/FamMed.2018.829131

De Oliveira, E. F., & Silveira, M. S. (2018). Open government data in Brazil: A systematic review of its uses and issues. *Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age*. https://doi.org/10.1145/3209281.3209339

Dietze, D. T., & Frimpter, J. (2025). Considering the cost-effectiveness of accredited continuing medical education: A landscape analysis of economic concepts in continuing medical education research. *Journal of Continuing Education in the Health Professions*, *45*(3), 170 – 177. https://doi.org/10.1097/CEH.0000000000000577

Dombrowski, T., Dazert, S., & Volkenstein, S. (2019). Strategies of digitized learning. *Laryngo- Rhino- Otologie*, *98*. https://doi.org/10.1055/a-0803-0218

Domingo-Alejo, J. (2024). AI integrated administration tool design with ML technology for smart education system. *2024 4th International Conference on Advance Computing and Innovative Technologies in Engineering, ICACITE 2024*, 1423–1428. https://doi.org/10.1109/ICACITE60783.2024.10616455

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Fadloil, F., Widyanto, R. A., & Arumi, E. R. (2024). Budget planning information system using the rapid application development method case study: SMK Negeri 1 Magelang Indonesia. *E3S Web of Conferences*, *500*, 01010. https://doi.org/10.1051/e3sconf/202450001010

Firmansyah, M. F., & Maulana, H. Z. (2021). Empirical study of e-learning on financial literacy and lifestyle: A millennial urban generations cased study. *International Journal of Engineering, Science and Information Technology*, *1*(3), 75–81. https://doi.org/10.52088/ijesty.v1i2.99

Gandasari, D., Tjahjana, D., Dwidienawati, D., & Sugiarto, M. (2024). Bibliometric and visualized analysis of social network analysis research on Scopus databases and VOSviewer. *Cogent Business and Management*, *11*(1), Article 2376899. https://doi.org/10.1080/23311975.2024.2376899

Gao, P., Rong, Y., Cao, Y., Zhang, Q., & Sun, H. (2024). Regional climate risks and government education expenditure: Evidence from China. *Frontiers in Energy Research*, *12*. https://doi.org/10.3389/fenrg.2024.1374065

Hartikayanti, H. N., Bramanti, F. L., & Gunardi, A. (2018). Financial management information system: An empirical evidence. *European Research Studies Journal*, *21*(2), 463–475. https://doi.org/10.35808/ersj/1015

He, Z., Chen, L., & Zhu, L. (2023). A study of inter-technology information management (ITIM) system for industry-education integration. *Heliyon*, *9*(9). https://doi.org/10.1016/j.heliyon.2023.e19928

Hong, Y., Yang, J., Chen, Y., & Dong, H. (2021). Research on the development of online education in the age of AI and 5G. *Proceedings - 2021 2nd International Conference on Education, Knowledge and Information Management, ICEKIM 2021*, 233–237. https://doi.org/10.1109/ICEKIM52309.2021.00058

Huang, Y., Zhang, Y., Youtie, J., Porter, A. L., & Wang, X. (2016). How does national scientific funding support emerging interdisciplinary research: A comparison study of big data research in the US and China. *PLoS One*, *11*(5). https://doi.org/10.1371/journal.pone.0154509

Jin, Y., Zhou, B., Zhang, P., & Li, T. (2024). How education expenditures, natural resources, and GDP interact with load capacity factor in the presence of trade diversity index under COVID-19 perception: Evidence from G-7 nations. *Resources Policy*, *88*. https://doi.org/10.1016/j.resourpol.2023.104532

Kostić, M. D., Jovanović, T., & Jurić, J. (2019). Cost management at higher education institutions - cases of Bosnia and Herzegovina, Croatia and Slovenia. *Central European Public Administration Review*, *17*(1), 131–148. https://doi.org/10.17573/cepar.2019.1.07

Lalani, K., Crawford, J., & Butler-Henderson, K. (2025). Academic leadership during COVID-19 in higher education: Technology adoption and adaptation for online learning during a pandemic. *International Journal of Leadership in Education*, *28*(1), 1–17. https://doi.org/10.1080/13603124.2021.1988716

Li, D., Ge, F., & Li, T. (2024). Empirical analysis of solutions for metal ore mining sustainability. *Resources Policy*, *88*. https://doi.org/10.1016/j.resourpol.2023.104387

Lin, Q., & Yu, Y. (2023). Teaching design and application of Python in management accounting-taking cost-volume-profit analysis as an example. *ACM International Conference Proceeding Series*, 571–576. https://doi.org/10.1145/3660043.3660145

Liu, S., Wang, W., Jia, C., & Liu, J. (2024). Evolution of instrument and equipment management models in universities and innovation in smart management. *Experimental Technology and Management*, *41*(3), 272–278. https://doi.org/10.16791/j.cnki.sjg.2024.03.035

Lutilsky, I. D., & Ćorić, J. (2018). Assessing the cost information usage at higher education institutions - case study in Croatia and Bosnia and Herzegovina. In A. Karasavvoglou, S. Goić, P. Polychronidou, & P. Delias (Eds.), *Springer Proceedings in Business and Economics* (pp. 769–784). Springer Science and Business Media. https://doi.org/10.1007/978-3-319-70377-0_53

Magazzino, C., Madaleno, M., Waqas, M., & Leogrande, A. (2024). Exploring the determinants of methane emissions from a worldwide perspective using panel data and machine learning analyses. *Environmental Pollution*, *348*. https://doi.org/10.1016/j.envpol.2024.123807

Mauzino, A., & Da Costa, H. (2025). Evaluation of the effectiveness of cadet training programs in competency development and learning in Timor-Leste. *Arshaka: Pedagogy and Learning Review*, *1*(2), 95–102. https://doi.org/10.65779/arshaka.v1i2.59%20

Meiliati, R., Djodding, I. M., Aswin, A., Salido, A., Husain, D. S., Tahir, T., & Hidayati, U. (2026). Exploration problem-based learning in mathematics learning in higher education: A bibliometric review. *Social Sciences & Humanities Open*, *13*, 102345. https://doi.org/10.1016/j.ssaho.2025.102345

Melisa, R., Dakka, L. N., Nurdiansa, E. S., & Wardani, W. O. S. (2025). English language learning in primary schools: A bibliometric review of trends, collaboration, and future research directions. *Primary Education Insight*, *1*(1), 14–26. https://doi.org/10.65779/pedi.v1i1.18

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, *4*(1). https://doi.org/10.1186/2046-4053-4-1

Nurhayati, I., Azis, A. D., Setiawan, F. A., Yulia, I. A., Riani, D., & Endri, E. (2023). Development of the digital accounting and its impact on financial performance in higher education. *Journal of Educational and Social Research*, *13*(2), 55–67. https://doi.org/10.36941/jesr-2023-0031

Ramasu, T., & Kanakana-Katumba, G. (2024). Exploring the potential for tuition-free higher education in South Africa: A scoping review. *F1000Research*, *13*, 526. https://doi.org/10.12688/f1000research.150265.2

Russell, M. J., Scott, C. W. M., Murias, K., Gibbard, W. B, Cui, X., Tough, S., & Zwicker, J. D. (2021). Cross-ministry data on service use and limitations faced by children in special education. *Disability and Health Journal*, *14*(4). https://doi.org/10.1016/j.dhjo.2021.101118

Russell, M. J., Scott, C. W. M., Berrigan, P., Murias, K., Gibbard, W. B., Cui, X., Tough, S., & Zwicker, J. D. (2022). The transition to adult income supports for youth that received special education in British Columbia, Canada: A cohort study. *Health and Social Care in the Community*, *30*(6), e4363–e4374. https://doi.org/10.1111/hsc.13829

Shabelnyk, T. V, Krivenko, S. V, Rotanova, N. Y., Diachenko, O. F., Tymofieieva, I. B., & Kiv, A. E. (2020). Integration of chatbots into the system of professional training of masters. *CEUR Workshop Proceedings*, *2879*, 212–220. https://doi.org/10.55056/cte.233

Silva, M., Ferreira, A., Alves, K., Valenca, G., & Brito, K. (2024). A new perspective for longitudinal measurement and analysis of public education in Brazil based on open data and machine learning. *ACM International Conference Proceeding Series*, 130–138. https://doi.org/10.1145/3680127.3680216

Sinervo, L.-M., Kork, A.-A., & Hasanen, K. (2023). Challenges in curriculum development process aimed at revising the capabilities of future public financial managers. *Teaching Public Administration*, *41*(2), 243–256. https://doi.org/10.1177/01447394211051878

Sitepu, M. S., Prasojo, L. D., Hermanto, H., Salido, A., Nurhakim, L., Setyorini, E., Disnawati, H., & Wiratsongko, B. (2026). Mapping and exploring strategies to enhance critical thinking in the artificial intelligence era: A bibliometric and systematic review. *European Journal of Educational Research*, *15*(1), 305–322. https://doi.org/10.12973/eu-jer.15.1.305

Tabira, Y., & Otieno, F. X. (2017). Integration and implementation of sustainable ICT-based education in developing countries: Low-cost, en masse methodology in Kenya. *Sustainability Science*, *12*(2), 221–234. https://doi.org/10.1007/s11625-017-0422-8

Vasile, V., Panait, M., & Apostu, S.-A. (2021). Financial inclusion paradigm shift in the postpandemic period. Digital-divide and gender gap. *International Journal of Environmental Research and Public Health*, *18*(20). https://doi.org/10.3390/ijerph182010938

Vorontsova, A., Vasylieva, T., Lyeonov, S., Artyukhov, A., & Mayboroda, T. (2021). Education expenditures as a factor in bridging the gap at the level of digitalization. *Proceedings - International Conference on Advanced Computer Information Technologies, ACIT*, 242–245. https://doi.org/10.1109/ACIT52158.2021.9548338

Vorvornator, L., & Midiniso, J. (2025). Entrepreneurship education in higher institutes of learning in South Africa: Challenges and opportunities. *Educational Process: International Journal*, *17*. https://doi.org/10.22521/edupij.2025.17.359

Walker, R., Voce, J., & Jenkins, M. (2016). Charting the development of technology-enhanced learning developments across the UK higher education sector: A longitudinal perspective (2001–2012). *Interactive Learning Environments*, *24*(3), 438–455. https://doi.org/10.1080/10494820.2013.867888

Wang, D., Zhen, Y., Shan, D., Zhang, C., Kao, B., & Chen, G. (2025). More investment, more engagement? Analyzing dialogic behavior in online one-to-one tutoring among different payment mechanisms. *International Journal of Educational Development*, *117*. https://doi.org/10.1016/j.ijedudev.2025.103366

Xakimova, M., Xakimova, X., Asatova, S., Begmatov, D., Eshonkulova, N., Xasanova, Z., & Raximova, S. (2025). Distributed knowledge systems for resource allocation and management in higher education a decision making model. *ACM International Conference Proceeding Series*, 33–39. https://doi.org/10.1145/3726122.3726129

Yakovenko, I., Kulumbetova, L., Subbotina, I., Zhanibekova, G., & Bizhanova, K. (2019). The blockchain technology as a catalyst for digital transformation of education. *International Journal of Mechanical Engineering and Technology*, *10*(1), 886–897.

Yao, X., Wei, Q., & Zhang, Q. (2020). Innovation of undergraduate education mode of the financial management major in big data era. *ACM International Conference Proceeding Series*, 43–49. https://doi.org/10.1145/3404649.3404656

Yuan, L., & Du, J. (2022). Research on intelligent financial information framework and smarter university campus. *International Journal of Knowledge-Based Development*, *12*(3–4), 409–423. https://doi.org/10.1504/IJKBD.2022.128913

Zhao, Y., Li, J., Liu, K., & Wang, J. (2022). Analyzing the spatio-temporal characteristics and influencing factors of "AI + education" network attention in China. *Mathematical Problems in Engineering*, *2022*. https://doi.org/10.1155/2022/5101967

Zhu, C. (2024). Research on intelligent financial construction in colleges and universities based on big data technology. *ACM International Conference Proceeding Series*, 356–362. https://doi.org/10.1145/3695080.3695142

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429–472. https://doi.org/10.1177/1094428114562629