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## Digital Leadership in Educational Institutions: A Bibliometric Analysis using Scopus Database (2020 – 2025)

Ika Damayanti\*, Rugaiyah, Desi Rahmawati, Kamaludin

Educational Faculty, Jakarta State University, East Jakarta, 13220, Indonesia

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#### \* Corresponding author:

E-mail: ikadamayanti844@gmail.com

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### ABSTRACT

The post-COVID-19 pandemic era and the rapid advancement of artificial intelligence (AI) have driven significant transformations in education; however, gaps remain in understanding the conceptual framework, trends, and scholarly collaboration of digital leadership, thus requiring a comprehensive analysis to identify current developments and future research directions. This study aims to analyze publication gaps, trends, and influential authors related to digital leadership in educational institutions using bibliometric analysis on the Scopus database for the period January 2020–January 2025. The data sources were Scopus journal articles selected through inclusion criteria and exclusion criteria, resulting in eight articles after the PRISMA flowchart process and manual selection. The analytical methods involved a descriptive review of study characteristics, identification of bias risks, and VOSviewer visualization for co-word and co-authorship mapping. The main findings reveal gaps in the integration of digital competence, Industry 4.0, and bibliometrics with digital leadership, highlight recent trends in digital learning environments, and identify influential authors such as Yuan Ying from global collaborations; the studies were dominated by mixed-methods in developing countries with sampling and local context biases. These conclusions underscore the need for a mature, inclusive, and human-centered digital leadership framework.

## 1. Introduction

The COVID-19 pandemic era and the rapid advancement of artificial intelligence (AI) have driven fundamental transformations in the global education ecosystem, making digital leadership a strategic imperative for organizational effectiveness. Digital transformation in educational institutions is not merely about adopting new technologies; it requires fundamental changes in leadership practices that integrate technological competencies with traditional leadership approaches. This shift demands that educational leaders develop capacities in leading digital change,

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facilitating virtual collaboration, leveraging data analytics for decision-making, and fostering a digital culture open to innovation. Although academic interest in digital leadership continues to grow, there remains a profound gap in understanding its intellectual framework, thematic evolution, and cross-disciplinary collaboration dynamics.

The post-pandemic era shows a shift in research focus toward the integration of AI and digital transformation; however, specific areas such as digital leadership in the K-12 sector remain underdeveloped. A bibliometric analysis of 338 Scopus-indexed documents from 1993–2024 reveals a significant increase in publications after 2010, peaking in 2023, before declining in 2024—possibly indicating saturation or a shift in research priorities. These findings affirm that digital leadership has been recognized as a crucial and evolving field of study in educational research, yet a comprehensive understanding of its conceptual evolution and social structures remains inadequate (Dasruth et al., 2024)

Other studies, such as “Digital Leadership and Innovation: A Systematic Review of Theoretical Foundations, Research Focus, and Methodological Approaches”—a systematic literature review (SLR) analyzing 43 Scopus-indexed articles from 2015–2025—identify that the Theory–Context–Method (TCM) framework has not yet been fully optimized, with survey-based Structural Equation Modeling (SEM) dominating and limiting methodological diversification (Gunawan et al., 2025). Based on previous research, literature reviews indicate that although the number of publications on digital leadership continues to grow, there remains a research gap concerning the themes, trends, and authors of digital leadership in the 2020–2025 period. Addressing this gap is necessary to enrich the literature on digital leadership. Therefore, a broader database such as Scopus is required.

Scopus was chosen because it covers more journals than Google Scholar, thereby reducing the risk of missing important articles. The 2020–2025 timeframe was deliberately selected to capture the latest developments in digital leadership influenced by the pandemic and AI advancements, ensuring that the findings can inform current policy and practice. Bibliometric analysis not only highlights the rapid growth of publications reaching a peak, but also reveals gaps, trends, and authors during this period. This study aims to analyze the gaps, trends, and authors related to digital leadership, leading to the following research questions:

- What are the publication gaps related to digital leadership in 2020–2025?
- What are the publication trends related to digital leadership in 2020–2025?
- Who are the influential authors in digital leadership publications in 2020–2025?

These questions are designed to comprehensively uncover the multidimensional dynamics of digital leadership, integrating quantitative dimensions (publication trends and gaps) and network dimensions (global collaboration) to produce a holistic synthesis. This approach accommodates the need for understanding that is not only descriptive but also prescriptive in guiding future research development and policy.

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## 2. Methodology

### *Study Design*

The present study employs bibliometric analysis to explore prevailing trends, recent publication gaps, and global author collaborations over the past five years. By examining a broad time span, this research provides an in-depth overview of the historical evolution in the field and how research topics have shifted over time. Through bibliometric analysis, the study aims to systematically map the scientific knowledge base with a more focused approach while highlighting long-term trends and developments related to Digital Leadership. Therefore, bibliometric analysis is considered an appropriate method to address the research questions.

### *Data Collection*

The data collection utilized the Scopus database via Elsevier to gather articles published between January 2020 and January 2025. Data collection was conducted in November 2025. To avoid inconsistencies in the number of records due to potential database updates, all searches and downloads were performed on the same day. Several reasons underlie the choice of Scopus over other databases such as Google Scholar or Web of Science, notably its broader coverage, which reduces the risk of bias and omissions that may arise from relying on the scope of other journal database. Table 1 shows the inclusion and exclusion criteria with figure 1 shows the prisma flow chart.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Year	Documents published from January 2020 to January 2025	Documents published before after January 2025
Articles type	Articles of Digital leadership	Non Articles of digital leadership
Source Type	Journal	Conference Proceedings, Books
Documents type	Related to educational institutions	Not related to educational institutions

### *Inclusion and Exclusion Criteria*

The inclusion and exclusion criteria are presented in the table above. The inclusion criteria focus on selecting articles published in scientific journals between January 2020 and January 2025, with titles centered on “digital leadership.” The bibliometric analysis is limited to Scopus journal articles, as such publications undergo rigorous peer-review processes and are considered reliable sources of scientific knowledge.

### *Data Analysis*

The selected article samples were retrieved from the Scopus database via Elsevier using the keyword “digital leadership.” Subsequently, bibliometric analysis was

conducted using VOSviewer to gain deeper bibliometric insights. This study established various bibliometric parameters, including publication trends, publication gaps, and global author collaborations over the past five years. Two analytical methods were employed: descriptive review analysis and science mapping. The descriptive review analysis focused on bibliometric parameters, while science mapping was conducted using VOSviewer to generate visual representations of keyword connections and their relationships.

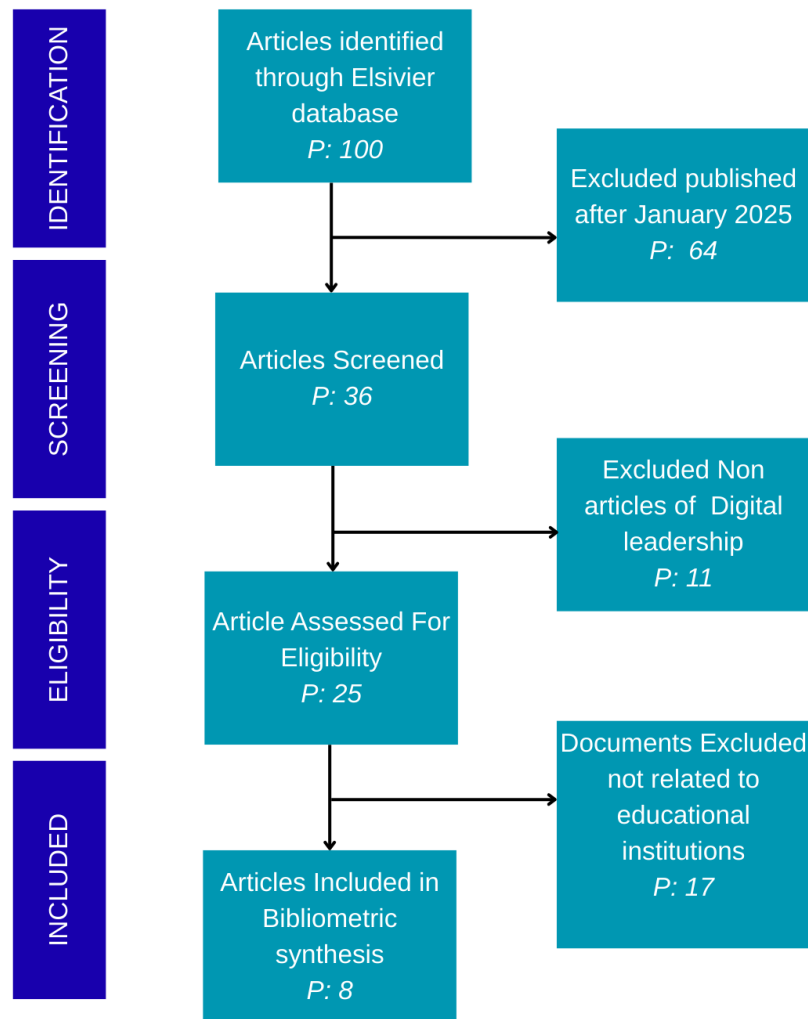


Figure 1. PRISMA Flow Chart

### 3. Results and Discussion

#### *Result*

Based on the eight articles analyzed bibliometrically, several characteristics of publication studies were identified:

Table 2. Characteristics of Publication Studies

No	Location	Year of Publication	Number of Participants	Research Design
1.	Cyprus, Kenya, Yunani, Israel, Indonesia, USA, UK, Thailand, India, Jepang, Korea, Kanada, Selandia dll	2022	6-1270 students	Mixed methods
2.	Hongkong	2023	204 respondents	Qualitative Approach
3.	Spain, Pakistan, China, Australia, Afrika Selatan, India	2023	2262 Lecturers	Bibliometric, survey dan systematic review
4.	Global	2023	-	Conceptual study, literature analysis
5.	India	2023	40 participants	Mixed methods
6.	China	2024	600 students	Quantitative, scale development and validation
7.	Eropa	2024	300 lecturers and students	Quantitative survey, regression analysis
8.	Negara berkembang	2024	200 teachers	Descriptive quantitative survey

Based on the characteristics of these publication studies, several risks of bias were identified in each article:

Table 3. Risk of Bias

No	Title	Types of Bias
1.	Leading digital transformation and eliminating barriers for teachers to incorporate artificial intelligence in basic education in Hong Kong	Sampling bias, respondent roles, perception, local context, technology definition, statistical methodology
2.	Digital transformation in education: Critical components for leaders of system change	Technology access bias, socio-economic factors, vulnerable groups, policy and leadership, data and analytics
3.	Exploring Digital Agility and Digital Transformation Leadership	Methodological bias, respondent bias, contextual and interpretive bias
4.	Teachers' perceptions of principals' digital leadership practices in a school district in a developing country	Contextual bias, sampling bias, perception bias, researcher bias, infrastructure bias
5.	Digital competence of lecturers and its impact on student learning value in higher education	Geographic and cultural bias, sampling bias, self-report bias, methodological bias, publication bias, generalization bias
6.	The development of a digital intelligence quotient scale: A new measuring instrument for primary school students in China	Data selection bias, instrument bias, response bias, publication bias, confirmation bias
7.	Research hotspots and trends in digitalization in higher education: A bibliometric analysis	Methodological bias, language bias, temporal bias, geographic bias, citation bias, interpretive bias

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8. A systematic review and framework for digital leadership research maturity in higher education	Definition bias, methodological bias, perspective bias, geographic and language bias, publication bias
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Based on the characteristics and types of bias identified in several articles, a bibliometric analysis was also conducted using VOSviewer to address the research questions are:

**Publication Gaps and Trends in Digital Leadership (2020–2025)**

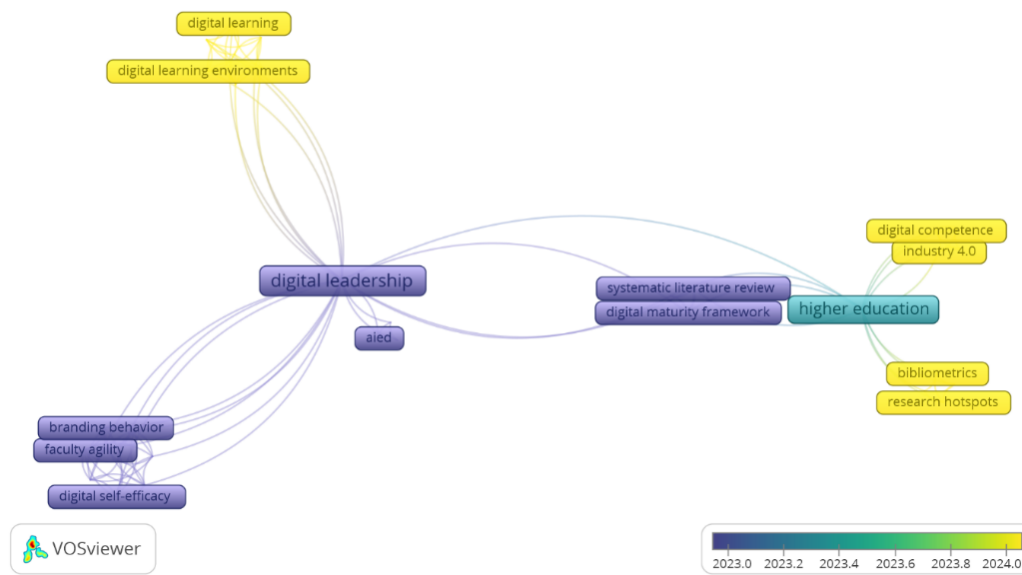


Figure 2. Publication Gaps and Trends in Digital Leadership (2020–2025)

The figure above presents a conceptual map visualization generated through bibliometric analysis using VOSviewer, mapping the interconnections of digital leadership issues in educational institutions during January 2020 – January 2025. The visualization reveals several research gaps that can be explored in future studies, such as topics related to digital competence, Industry 4.0, research hotspots, and bibliometrics, which have not yet been directly linked to digital leadership. In addition, several recent publication trends in digital leadership in educational institutions during January 2020 – January 2025 are highlighted in yellow, indicating the most recent publications, including digital competence, Industry 4.0, research hotspots and bibliometrics, digital learning, and digital learning environments.

**Influence Authors in Digital Leadership Publications (2020–2025)**

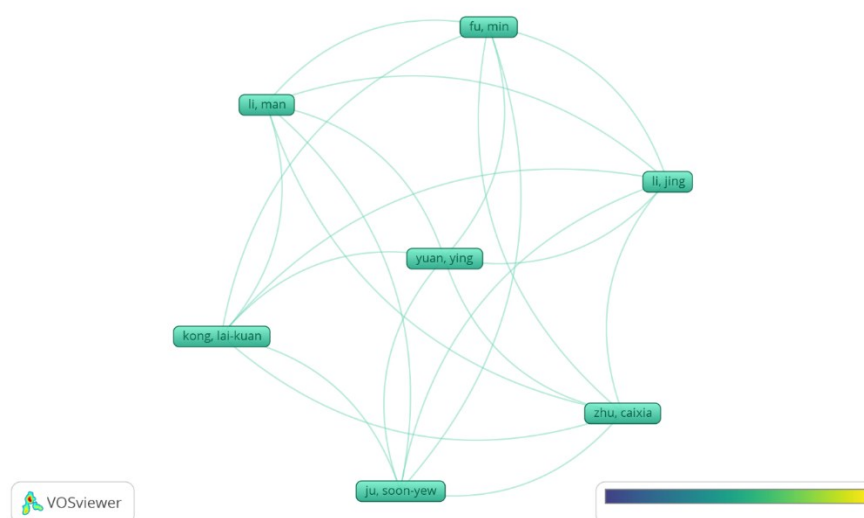


Figure 3. Influence Authors in Digital Leadership Publications (2020–2025)

The figure above also presents a conceptual map visualization generated through bibliometric analysis using VOSviewer, mapping global author collaborations related to digital leadership in educational institutions during January 2020 – January 2025. The visualization shows several global author collaborations that significantly influence digital leadership publications, notably the author Yuan, Ying.

### **Discussion**

Based on the findings above, the research by (Cheng & Wang, 2023) states that digital leadership is a decisive factor in overcoming both internal and external biases among teachers. Strong empirical evidence shows that without visionary leadership, the integration of AIED will be hindered. Its relevance to practice and policy lies in the need for a holistic approach, including teacher capacity development, infrastructure support, curriculum policy, and a clear ethical framework. Aligns with (Cheng & Wang, 2023) emphasize on ethical frameworks and infrastructure support for sustainable AI integration, research by (Adams & Thompson, 2025) that school leaders must proactively mitigate risks such as bias in AI outputs, cybersecurity, and ethical concerns.

The research by (McCarthy et al., 2023) emphasize that in the digital transformation of education, visionary leadership, human development, a secure technological ecosystem, and inclusive learning experiences are core components. The existing evidence is strong enough to assert that policies must focus on balancing technology and human aspects, while addressing access bias to ensure that transformation is truly fair and sustainable. Align with (McCarthy et al., 2023) research by (Tawil & Miao, 2024) main focus are human-centered, approach with contra techno-solutionism.

The research by (Srivastava et al., 2023) argue that transformational digital leadership and self-efficacy are the strongest factors in shaping agility, while internal branding needs to be strategically directed so as not to become a barrier. These findings are relevant for higher education policy in the era of digital transformation. Supporting (Srivastava et al., 2023) argument that self-efficacy is a strong factor in shaping agility, transformational leadership strength digital adaptation through findings (Nendi & Askarno, 2023) that lecturers' self-efficacy has a significant effect on knowledge sharing and performance, while transformational leadership reinforces organizational culture, that research consistent with (Apriliansyah, 2023) which demonstrates that transformational leadership is the key to shaping agility and digital adaptation in higher education, in line with his findings that lecturers, as classroom leaders, must adopt transformational leadership styles to meet the challenges of the Fourth Industrial Revolution.

The research by (Dasruth et al., 2024) emphasize that digital leadership in schools remains limited to administrative aspects, with biases arising from socio-economic contexts and subjective perceptions. The evidence is strong enough to highlight the urgent need for training and supportive policies, although generalization remains limited, without strong digital leadership, educational transformation in the era of the Fourth Industrial Revolution will be hindered. Therefore, several mitigation policies are needed, such as supporting digital leadership training for principals, providing equitable digital infrastructure to reduce the digital divide, and integrating the *Batho Pele* (people first) principle into digital policies to ensure more inclusive and transparent educational services. The research by (Dasruth et al., 2024) which highlights that socio-economic bias and subjective perceptions act as barriers to the implementation of digital leadership, this is consistent with the findings of research by (Karakose et al., 2024) that demonstrate the evolution of the digital leadership concept, yet still reveal socio-economic contextual biases influencing perceptions of its effectiveness. Furthermore, another study supports (Dasruth et al., 2024) policy recommendations on digital leadership training and equitable infrastructure, align research by (Acebuche, 2024) conclusion that such training is necessary for principals to strategically integrate technology into school management.

The research by (Dang et al., 2024) find that lecturers' digital competence significantly influences students' learning value. Although potential biases exist (self-reporting, local context), methodological strength and consistency of results make these findings relevant as a basis for policies aimed at improving the quality of higher education in the digital era. The research by (Mardiana, 2024) was found that lecturers' digital literacy competence has a direct impact on the quality of teaching, research, and students' learning experiences. Therefore, this study supports Dang et al.'s research regarding the urgency of policies to enhance lecturers' digital capacity. In addition, research by (Fernández-Batanero et al., 2021) study provides consistent methodological evidence showing that lecturers' digital competence influences instructional design, interaction with students, and learning outcomes, thereby supporting policies aimed at improving the quality of higher education in the digital era.

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The research by (Li et al., 2024) state that the Digital Intelligence Quotient (DQ) scale is a methodologically strong tool, but its relevance to practice and policy depends on the cultural and educational context in which it is applied. The research by (Haryanto et al., 2024) supports (Li et al., 2024) view that the relevance of Digital Intelligence Quotient (DQ) depends on socio-cultural context and educational policy. This is based on his findings, which emphasize the importance of ethics, skills, and determination in the use of technology to enhance students' digital competence.

The research by (Zhao & Zhou, 2024) highlight that bibliometric evidence is strong in mapping global trends, but it must be critically examined to avoid neglecting local contexts. Its relevance is significant for educational practice and policy, especially in designing inclusive and sustainable digitalization strategies. The research by (Pusztai & Rosta, 2023) emphasize that global evidence must always be weighed against local contexts so that educational policies do not lose practical relevance, as demonstrated by their finding that religious upbringing within the family has a much stronger influence on religiosity than church schools.

The research by (Jameson et al., 2022) emphasize that digital leadership in higher education is still in its early stages, with diverse characteristics and significant methodological and conceptual biases. Current evidence is limited but sufficient to affirm that transformational leadership styles are more effective. Its relevance to practice and policy lies in the urgent need for a mature digital leadership framework, so that digital transformation is not only technology-oriented but also considers social, cultural, and well-being aspects of the academic community. The line with (Jameson et al., 2022) the research by (Peng et al., 2024) emphasizes the need for a mature and inclusive digital leadership framework. This is demonstrated through its examination of the diverse characteristics of digital leadership in education, with limited yet consistent evidence indicating that transformational leadership styles are more effective. This study has several limitations, such as the timeframe of analyzed publications being restricted to January 2020 – January 2025, and its focus only on research questions related to publication gaps, trends, and influential authors.

#### **4. Conclusion**

Based on the bibliometric review of eight articles, it can be concluded that digital leadership in education is still at an early stage, characterized by diverse features and methodological biases. However, consistent evidence indicates that transformational leadership styles and self-efficacy are the strongest factors in shaping agility and strengthening digital adaptation. Lecturers' digital competence has been proven to significantly influence the quality of teaching, research, and students' learning experiences, while instruments such as the Digital Intelligence Quotient (DQ) possess methodological strength but their relevance largely depends on socio-cultural contexts and educational policies. These findings highlight the need for a mature, inclusive, and human-centered digital leadership framework, supported by policies on digital leadership training, equitable infrastructure, and the

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integration of ethics and academic well-being. Future research is recommended to reduce bias through cross-cultural and longitudinal approaches, and to develop digital leadership policy frameworks that balance technological, social, and cultural aspects to ensure that higher education transformation is truly sustainable.

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