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Bibliometric Analysis in Scopus Data Base on Digital Leadership and School Performance

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Abstract. This study examines publication trends, leading contributors, and citation patterns on digital leadership and school performance through a quantitative bibliometric design using Scopus-indexed publications. Performance metrics and science mapping techniques were applied to systematically retrieved, cleaned, and standardized datasets. Findings revealed that research productivity in the field was limited during the 1990s but increased significantly in recent years, reflecting the growing relevance of digital transformation in education. The analysis showed that the field is dominated by selected journals, institutions, and countries, particularly the United States, which produced the highest number of publications and citations. Journal articles emerged as the most common publication type, while the social sciences remained the leading disciplinary area associated with the topic. Co-authorship analysis demonstrated tightly connected collaborative networks among scholars and institutions, highlighting the increasing importance of research partnerships in advancing knowledge production. Keyword and thematic analyses identified "technology leadership" as the central research theme, alongside related concepts such as innovation, e-leadership, digital transformation, and educational technology. These findings indicate the evolving and interdisciplinary nature of digital leadership research within educational contexts. In conclusion, the need for policies and institutional initiatives that strengthen international and interdisciplinary collaboration, in underrepresented regions. It highlights the importance of embedding digital leadership competencies into educational curricula by integrating ICT foundations with innovation, resilience, collaboration, adaptability, and strategic leadership practices. Such integration may better prepare future educational leaders to manage digitally mediated learning environments. Despite limitations, including reliance on a single database, exclusion of non-English publications, and limited qualitative interpretation, the study underscores the value of expanding scholarly participation and incorporating diverse disciplinary perspectives to support evidence-based educational digital transformation.

Introduction

The growing involvement of digital technologies in learning has made digital leadership one of the most important elements that affect the performance of schools. The current research will be centered around performing a bibliometric analysis of scientific literature published on Scopus on the topic of digital leadership and school performance (Fitriana & Zuraida, 2025). As is known, bibliometrics implies a scientific approach that helps analyze the existing literature on the selected topic with the use of such methods as counting (Marfilinda et al., 2025). It may be used for examining publication patterns, studying authors' contributions to the topic under consideration, identifying significant papers and other aspects of research. The current study will help examine the intellectual structure of research on digital leadership and its effect on school performance (Hungo et al., 2025).

The view of the scholars is that digital leadership has emerged to be a paradigm-shifting tool which allows the leaders of schools to use the technology in an effective manner and develop innovations in their educational institutions. Scholars

state that digital leadership encompasses much more than mere knowledge about the technologies but requires vision and change management along with building of the learning environment based on digital technology (Adeoye et al., 2024). On the other hand, school performance is considered in terms of several factors including student performance, teacher performance, and even organizational efficiency (Abiola et al., 2024; Hungo et al., 2025). Understanding Research Productivity and Trends in Mathematics Education using Bibliometric Analysis. Indonesian Journal of Educational Research and Review, 8(2), 443-454.). It is also seen from the perspective of bibliometric analysis that researchers employing the approach believe that it helps to synthesize large amounts of literature and identify the most influential publications along with the collaboration patterns of authors.

However, despite the increasing popularity of digital leadership and school performance, there are still many research gaps. Previous works have tended to focus primarily on empirical research conducted within localized environments while ignoring the wider research world and knowledge structure of digital leadership and school performance (Arham et al., 2024). The existing literature does not include systematic bibliometric analysis of Scopus-indexed articles on digital leadership in education to reveal patterns in terms of citations and topics. Moreover, prior work has failed to investigate the correlation between digital leadership and school performance using large datasets.

To fill these gaps, this study will contribute to the existing knowledge base through a comprehensive bibliometric review of the literature related to digital leadership and school performance in Scopus. This will provide insights on the development, structure, and dynamics of research in this field that can be used by future researches as well as in determining research topics and potential collaborators. The results of this study will help educators, policymakers, and academic institutions understand the development of research on digital leadership and its impact on school performance. This study geared to achieve several objectives, including analyzing the publication trends, identifying the key contributors to the research in terms of authors, institutions, and countries, and discussing citation patterns to highlight important studies.

Research Questions

To explore and analyze the publication trends, identifying the key contributors to the research in terms of authors, institutions, and countries, and discussing citation patterns to highlight important studies.

Methodology

Research Design

This study employed a quantitative bibliometric research design to systematically analyze scholarly publications on digital leadership and school performance indexed in the Scopus database. Bibliometric analysis was selected as it enables the objective evaluation of large volumes of academic literature through statistical and computational techniques, allowing the identification of research trends, patterns, and intellectual structures within a specific field. The approach integrates performance analysis (e.g., productivity and citation metrics) and science mapping (e.g., co-authorship, co-citation, and keyword co-occurrence networks) to provide a comprehensive understanding of the domain.

Data Source and Search Strategy

The primary data source for this study was the Scopus database, chosen due to its extensive coverage of peer-reviewed journals, conference proceedings, and high-quality academic publications across disciplines. A systematic search strategy was employed using a combination of keywords and Boolean operators. The search string included terms such as: “digital leadership”, “e-leadership”, “technology leadership”, “school performance”, “academic performance”, and “educational outcomes”. These keywords were searched within article titles, abstracts, and keywords to ensure relevance. The search was limited to publications written in English and categorized under education, social sciences, and related fields.

Inclusion and Exclusion Criteria

To ensure the quality and relevance of the dataset, specific inclusion and exclusion criteria were applied. Included in the analysis were peer-reviewed journal articles, conference papers, and review articles directly related to digital leadership and school performance. Publications outside the scope of education (e.g., corporate digital leadership without educational application), non-English documents, editorials, notes, and unpublished works were excluded. Additionally, duplicate records were identified and removed. A screening process involving title and abstract review was conducted to confirm the alignment of each document with the study’s focus.

Data Extraction and Preparation

The retrieved records were exported from Scopus in compatible formats (e.g., CSV and RIS) for further analysis. Extracted bibliographic information included authors, publication year, title, abstract, keywords, source title, affiliations, country of origin, citation counts, and references. Data cleaning procedures were conducted to standardize author names, merge synonymous keywords, and remove inconsistencies in institutional affiliations. This step ensured the accuracy and reliability of subsequent analyses.

Validity and Reliability Measures

To ensure methodological rigor, the study adopted transparent and replicable procedures in data collection and analysis. The use of a well-established database (Scopus), clearly defined search strings, and systematic screening enhanced the validity of the dataset. Data cleaning and normalization minimized errors and inconsistencies. Additionally, the triangulation of multiple bibliometric indicators (e.g., publication counts, citation metrics, and network analyses) strengthened the reliability of findings.

Ethical Considerations

This study relied solely on secondary data obtained from publicly accessible academic databases. No human participants were involved, and no personal or sensitive information was collected. Proper citation and acknowledgment of all sources were observed to maintain academic integrity and avoid plagiarism.

Limitations of the Methodology

Despite its strengths, the methodology has certain limitations. The reliance on Scopus as the sole data source may exclude relevant studies indexed in other databases such as Web of Science or Google Scholar. The restriction to English-language publications may also limit the inclusion of significant research from non-English-speaking regions. Furthermore, bibliometric analysis focuses on quantitative patterns and may not fully capture the contextual depth or quality of individual studies.

Results and Discussion

Results

Figure 1 displays the yearly number of scholarly works related to digital leadership and academic performance found in Scopus. From the early 1990s to the early 2000s, the number of scholarly papers is very small, mostly close to zero or just a handful per year. On the other hand, the data series has its maximum during recent years, where 2023 (15 papers), 2024 (30 papers), and 2025 (34 papers) have the highest volume of research outputs.

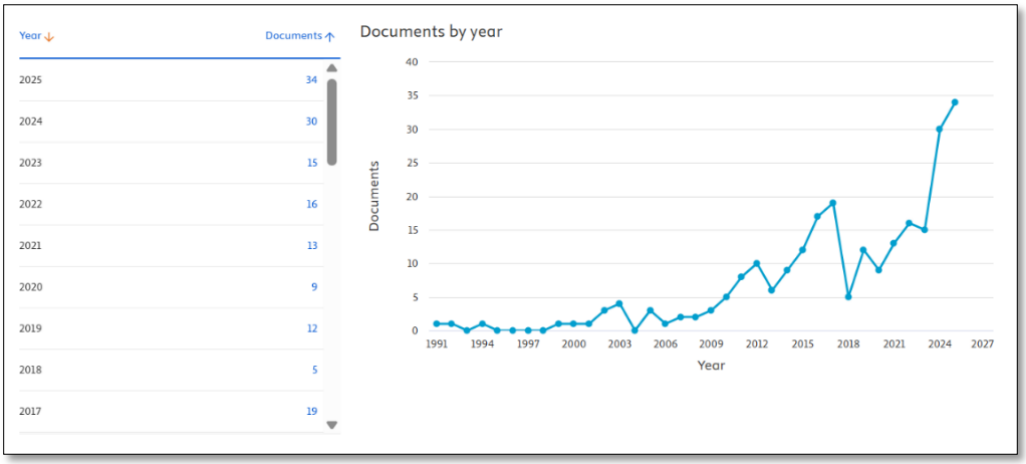

Figure 1: Digital Leadership and School Performance Documents by Annual Publication Trends

Figure 2 shows an analysis of the distribution of publications among journals reveals that whereas many journals contribute little but periodically, there are specific journals which have recorded significant increases in contributions. The Journal of Educational Administration presents a definite increase trend, thereby revealing increased scholarly interest in studies based on leadership perspectives in educational administration. In a similar pattern, the International Journal of Learning, Teaching and Educational Research maintains steady involvement, hence demonstrating its increasing importance as a forum for discussion about digital leadership. On the other hand, journals like the Journal of Research on Technology in Education and Turkish Online Journal of Educational Technology continue to provide steady contributions, hence maintaining their relevance as far as technology integration in education is concerned. Generally, it can be deduced from this information that whereas publication contributions by journals are still modest, there has been significant progress with respect to publication contribution, hence indicating an expanding field.

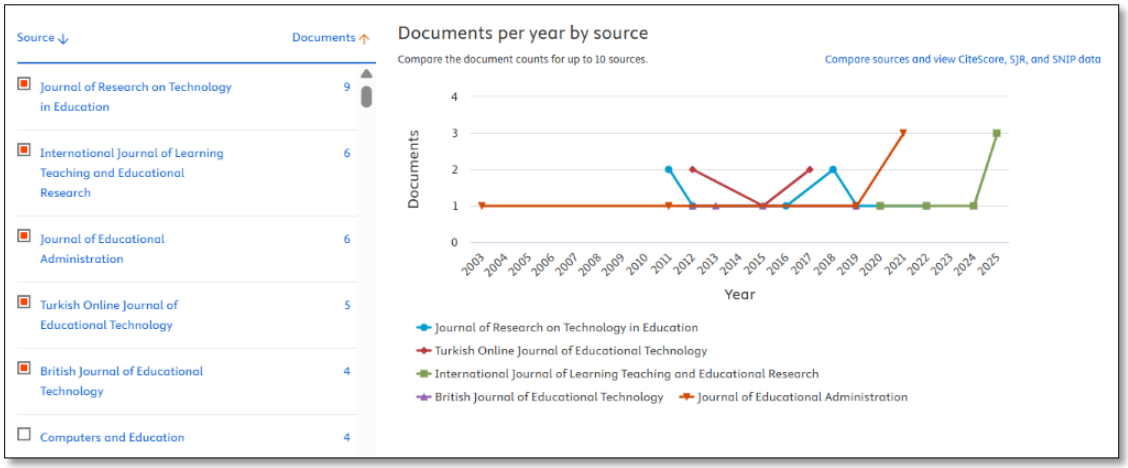

Figure 2: Digital Leadership and School Performance Documents by Journal Contributions

In figure 3, the examples of educational material capture are shown at the two extremes. The first example shows that the lack of clarity and distortions of the worksheet have made many portions of the text illegible, highlighting the inefficacy of technological mediation in maintaining instructional clarity. However, even at the latter example of low-quality digital capture, certain aspects such as the fill-in-the-blanks questions, numberings, and boxed parts can still be easily discerned, demonstrating that even in the process of technological capture, instructional conventions continue to exist.

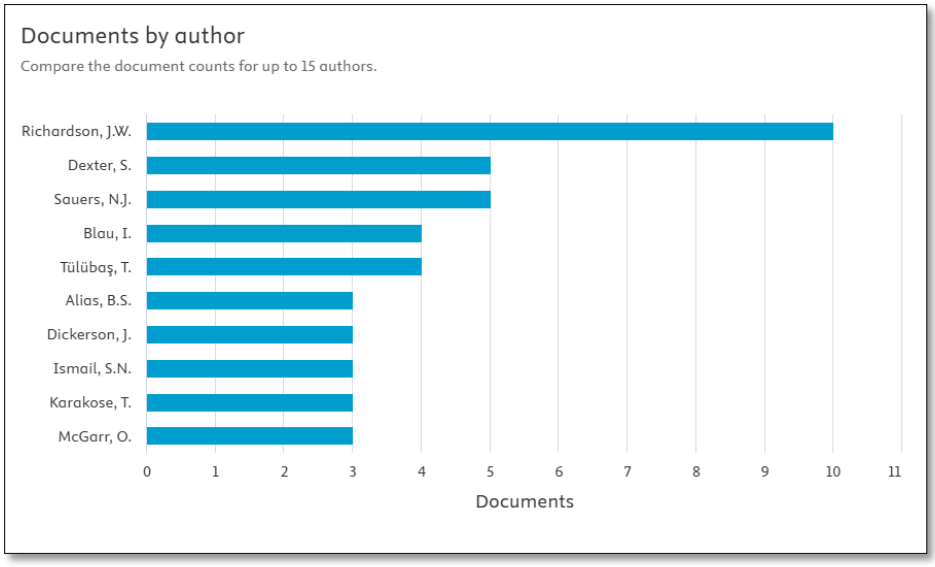

Figure 3: Digital Leadership and School Performance Documents by Educational Resource Capture

As indicated in Figure 4, it is evident that there are only a few institutions leading in research production on digital leadership and academic performance, with the University of Kentucky and Universiti Malaya being the two most active institutions contributing to research in this area. On the other hand, the majority of other universities exhibit low levels of productivity, with their levels of productivity falling somewhere in the middle range.

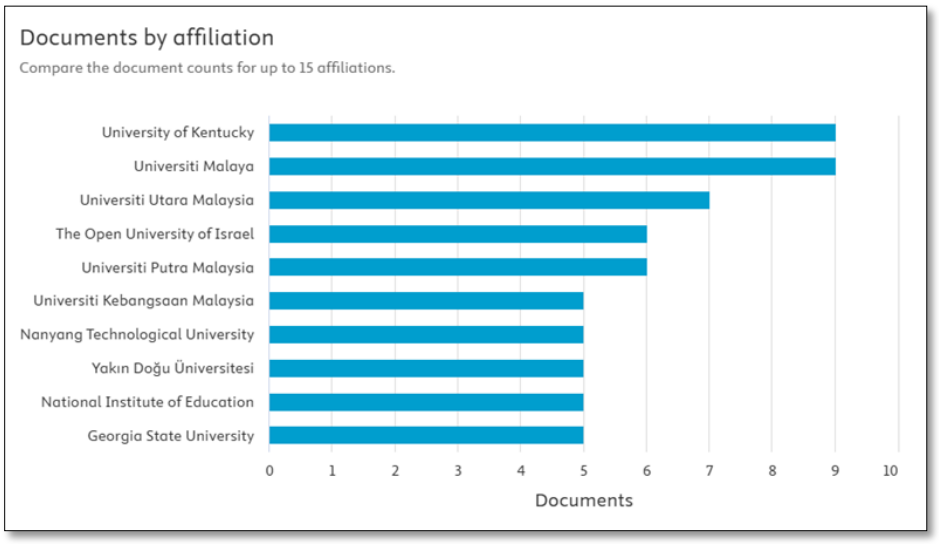

Figure 4: Digital Leadership and School Performance Documents by Institutional Productivity

As is evident from the figure 5, there is clearly the domination of the United States in terms of research contributions in the field of digital leadership and school performances. Other nations, such as Malaysia, Turkey, Indonesia, and China, exhibit low amounts of involvement, whereas the rest of the territories show very little contribution in comparison. The uneven distribution of research activities is obvious here.

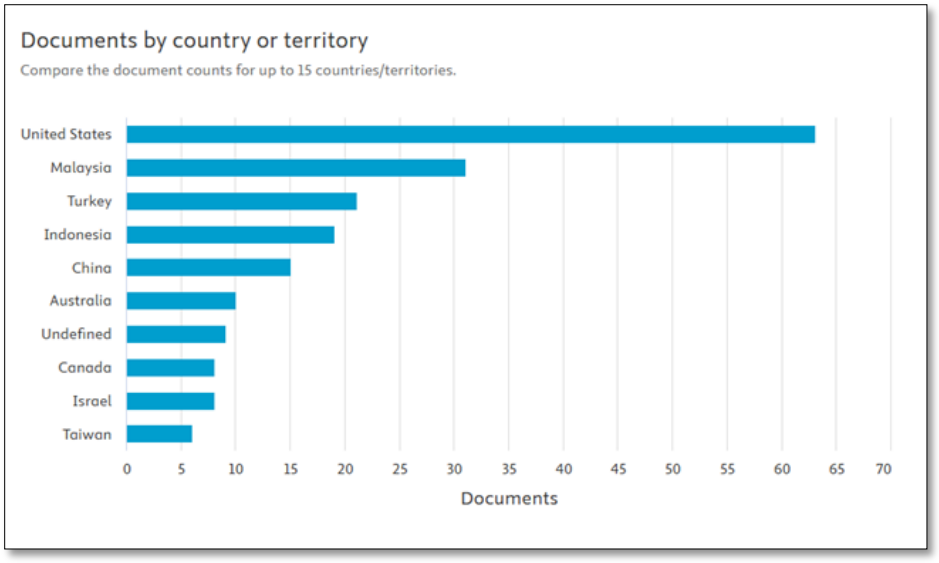

Figure 5: Digital Leadership and School Performance Documents by Country Contributions

Figure 6 is proof of the dominance of journals as the main form of scholarly dissemination within the digital leadership and school performance study area. On the contrary, other types of documents such as conferences, book chapters, reviews, books, editorials, and errata are only in secondary positions in terms of their contribution to knowledge production. The disproportionate representation highlights the preference of articles through a rigorous review process as the key tool of knowledge dissemination.

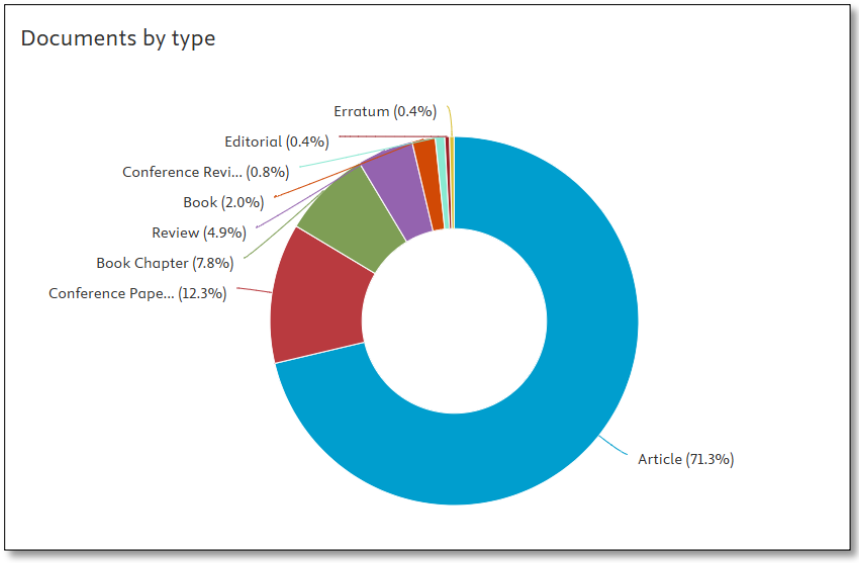

Figure 6: Digital Leadership and School Performance Documents by Document Types

As seen in Figure 7 below, there is a clear tendency for the social sciences to dominate scholarship regarding digital leadership and school effectiveness, thus situating the field firmly within an organizational, cultural, and pedagogical context. However, contributions from technology, math, and decision sciences, such as computer science and business, have been relatively few compared to contributions from the technical and quantitative fields. The field of environmental sciences has had the least contribution to this field.

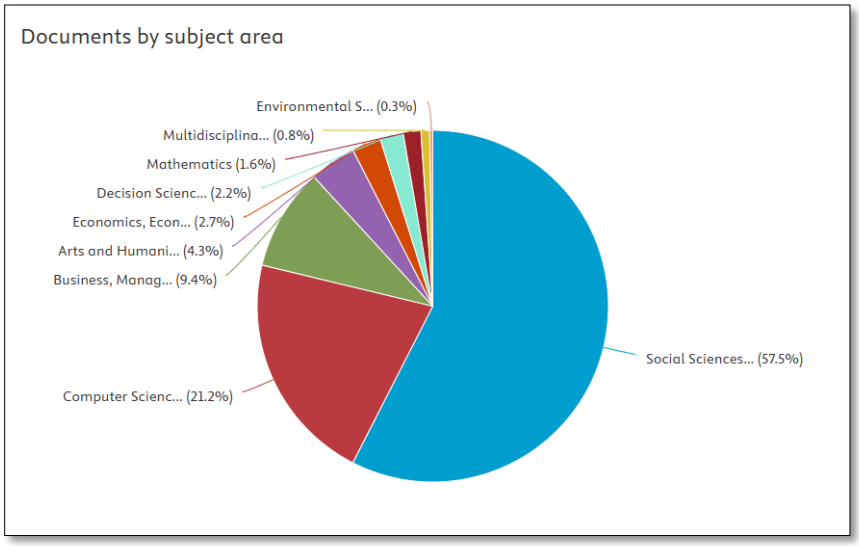

Figure 7: Digital Leadership and School Performance Documents by Subject Area Distribution

As can be seen in Figure 8, there is a small number of author clusters that are very strongly connected to one another and hence make up highly effective collaborative clusters, and these are the most prominent communities in this field. The

connections that span across these author clusters are few in number, which emphasizes the low levels of collaboration among different communities.

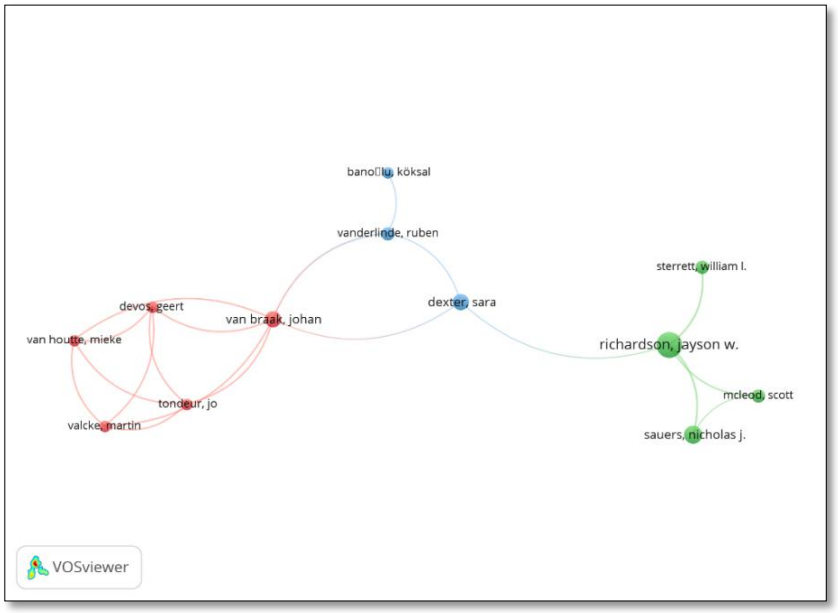

Figure 8: Digital Leadership and School Performance Documents by Co-authorship Networks

Figure 9 represents the visualization, which illustrates how "technology leadership" dominates the research field of educational technology leadership as the most central concept within the entire network. In contrast, the presence of two recent bright clusters – "innovation" and "e-leadership" – indicates the transition of the field into its future-focused and technology-oriented path. Such contrast clearly illustrates the poles of both continuity and change – where fundamental ideas related to ICT form the basis of the discipline, new ideas mark emerging trends in leadership within digitally-enhanced education.

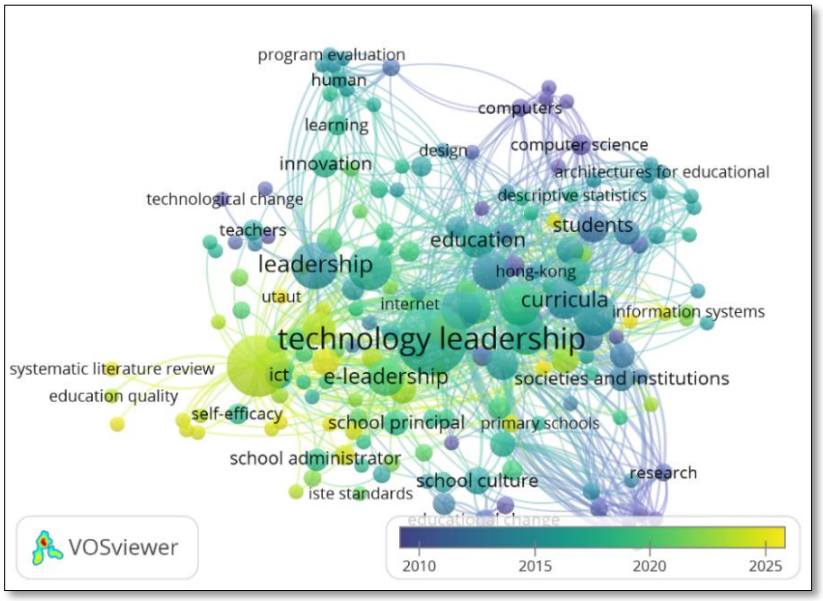

Figure 9: Digital Leadership and School Performance Documents by Keyword Co-occurrence

Discussion

Initially, the evolution of academic studies on digital leadership and the impact on performance in schools demonstrates an obvious move from neglect to attention in scholarly discourse. Initially, there were very few research works in this field, indicating the lack of understanding of the importance of leadership in digital integration into schools' activity. The above situation reflects early education technology literature that focused mostly on the technological component of digital transition in schools and neglected the aspects that are more related to human resource management and other organizational elements (Zhu et al., 2025). Currently, the development of scholarly literature on digital leadership is characterized by its increased significance for defining school culture, fostering innovation and achieving positive performance outcomes in education institutions. There are numerous publications devoted to digital leadership because of some changes caused by certain global events, such as the spread of the COVID-19 infection. Thus, future academic research is expected to address such questions as ways to implement leadership in different settings and the connection between the problem under consideration and teacher training.

Subsequently, the publication pattern of journal articles reveals both the scattered beginnings and the steadily expanding nature of research into the connection between digital leadership and school effectiveness. Early contributions to the field appeared sporadically, reflecting its emerging status and the fact that educational technology scholarship was initially more concerned with building the necessary technological infrastructure than with leadership frameworks. This early focus underscores the foundational role of access and infrastructure in enabling digital transformation, but it also highlights the limited attention given to leadership as a driver of organizational change during the formative years of the field. Over time, however, journals specializing in educational management and pedagogical principles have consistently engaged with the topic. Their sustained coverage suggests that digital leadership is increasingly recognized as a critical factor in shaping organizational culture, guiding systemic change, and ensuring that schools adapt effectively to technological advancements (Fakhfakh et al., 2025). This shift in focus marks a significant development: leadership is no longer viewed as a peripheral concern but as central to the success of digital integration in education. The inclusion of technology-focused journals alongside educational management publications further demonstrates the interdisciplinary character of this research. By bridging leadership theory with the practical implementation of digital technologies, scholars have created a framework that emphasizes innovation, teacher empowerment, and equity in learning environments. This interdisciplinary approach is significant because it ensures that digital leadership is studied not only as a managerial function but also as a catalyst for pedagogical transformation and social inclusion. The growing diversity of publication outlets also reflects the consolidation of digital leadership as a mainstream research domain. The interplay between technology journals and education-focused publications highlights the dual emphasis on technical proficiency and organizational vision. This balance is crucial for advancing strategies that enable schools to harness digital tools while fostering collaborative and resilient cultures. The evolving pattern of journal articles underscores the maturation of digital leadership research. What began as sporadic contributions has developed into a sustained, interdisciplinary discourse that positions leadership as central to educational innovation and equity. The significance of these findings lies in their ability to chart the intellectual trajectory of the field, pointing toward future research that integrates leadership, technology, and pedagogy to strengthen school performance in an era of rapid digital change. This suggests that scholars not only discuss the aspects of managerial leadership but also its transformative qualities and ability to help schools adapt to new conditions. It is possible that digital leadership will soon become one of the widely researched areas, allowing researchers to analyze various ways leadership theories can be applied to different settings.

Afterwards, the creation of educational resources in the digital age presents both difficulties and possibilities, particularly when learning materials are captured and transmitted through technological mediation. The blurred and fragmented character of the worksheet exemplifies the challenges of accessibility and authenticity in digital resource design. Such distortions raise critical questions about how effectively content can be conveyed when mediated by technology, echoing broader debates in digital education about the potential of technology to obscure rather than clarify understanding (Stadniichuk et al., 2025). The significance of this observation lies in its reminder that digitalization, while offering new opportunities, also risks undermining the fidelity of instructional materials if not carefully managed. At the same time, the persistence of structural elements—such as fill-in-the-blank exercises, enumerated items, and boxed information—points to the enduring influence of classical approaches to language and literacy education. Even when partially concealed, these features highlight the importance of readability and clarity in instructional design. Their presence suggests that traditional pedagogical strategies remain central, but they must be adapted to ensure effectiveness in digital formats. This tension between conventional forms and digital mediation underscores the need for instructional design that balances academic rigor with technological accessibility. Researchers further caution that inadequately designed or poorly digitized resources can hinder learner engagement, particularly for students who rely on mobile devices as their primary means of accessing educational content (Kulal et al., 2024). Such limitations not only reduce the effectiveness of learning but also exacerbate existing inequalities, as students with limited access to high-quality digital resources may fall behind. The significance here is profound: digital resource design is not merely a technical issue but a matter of educational equity, demanding attention from policymakers, educators, and designers alike. Despite these challenges, conventional grammar and comprehension

tests remain prevalent, reflecting the resilience of traditional instructional formats. Yet their coexistence with digital mediation highlights a conflict between old methods of delivery and new technological possibilities. This conflict suggests that future research should focus on how instructional design can be recalibrated to meet dual demands: maintaining academic rigor while ensuring accessibility across diverse technological platforms. Such inquiry would provide valuable insights into how schools can harness digitalization to enhance learning without sacrificing clarity, equity, or pedagogical integrity. The findings emphasize that educational resource creation in digital contexts is a complex endeavor. It requires careful design to preserve authenticity, promote inclusivity, and adapt traditional pedagogical structures to the realities of technological mediation.

Then, the geographic diversity in terms of publications' distribution across institutions illustrates the nature of collaboration involved in research regarding digital leadership and school performance. In contrast to other research topics, which tend to focus solely on a particular university, articles published as part of this research are affiliated with institutions located in various places in North America, Europe, the Middle East, and Asia. One of the possible reasons for the geographical spread of publications on digital leadership and school performance lies in the international nature of the discussed phenomenon as schools all around the globe attempt to adapt technology to their curricula. As per literature in comparative education, it is common knowledge that diversity in institutions often contributes positively to the academic discipline by providing researchers with various cultures, policies, and pedagogies (Lauring et al., 2025). Since the authors come from both technology-oriented and educational administration institutions, one can suggest that digital leadership research is interdisciplinary, covering both organizational and more practice-related aspects of the process. According to recent academic publications, inter-institutional collaboration may help enhance innovative potential through contextualization of leadership in socio-cultural settings.

Next, the geographical distribution of scholarly works on digital leadership and school performance reveals both concentration and diversity in the global research landscape. The dominance of publications from the United States reflects its strong research infrastructure and longstanding engagement with educational technology, aligning with prior literature on digital leadership and innovation in schools (Lauring et al., 2025). While this concentration underscores the influence of established academic systems, it also raises concerns about the risk of over-reliance on Western perspectives. The implication here is that future scholarship must deliberately expand beyond these contexts to ensure that digital leadership frameworks are globally representative. At the same time, the increasing contributions from Malaysia, Turkey, Indonesia, and China demonstrate the growing involvement of other regions in shaping the discourse. Researchers in developing countries often view digital leadership as a pathway to educational equality and modernization through technological integration (Mpofu & Nemashakwe, 2023). This diversification enriches the field by introducing perspectives shaped by different cultural, policy, and infrastructural realities. The implication is that comparative and cross-cultural studies are essential to capture the complexity of digital leadership and to generate insights that are adaptable across diverse educational systems. The participation of scholars from Asia and the Middle East further signals the internationalization of the discussion. These contributions highlight the adaptability of digital leadership frameworks and emphasize the importance of context-sensitive approaches. Future research should therefore prioritize comparative analyses of regional practices, examining how governance structures, resource availability, and cultural norms influence leadership strategies. Such work would not only deepen theoretical understanding but also provide practical guidance for policymakers and educators seeking to implement effective digital leadership models. Another implication arises from the observation that some publications lack clear information about their country of origin. This gap points to weaknesses in international documentation and database management, which hinder the ability to conduct meaningful comparative studies. Strengthening reporting standards and metadata accuracy is therefore critical for building a transparent and reliable global knowledge base. The current trends highlight both the concentration of research in established economies and the growing diversification of contributions worldwide. The global implications are clear: digital leadership must be studied as an international phenomenon, responsive to varied educational challenges and opportunities. Comparative, cross-regional analyses and improved documentation practices will be essential for advancing a more inclusive and comprehensive understanding of digital leadership in the years ahead.

Later, the distribution of document types in the field of digital leadership and school performance research demonstrates the predominance of scholarly journal articles as the primary vehicle for advancing scientific knowledge. Journal articles remain the most widely accepted format within academia, often regarded as the gold standard for reliability, peer review, and dissemination of findings (Hensellek, 2020). Their dominance reflects the academic community's preference for rigorous, evidence-based contributions that can be systematically evaluated and cited across disciplines. This trend also highlights the central role of journals in shaping the intellectual structure of the field, ensuring that research on digital leadership is accessible, credible, and subject to continuous scholarly dialogue. While other formats such as conference papers, book chapters, and reviews contribute valuable perspectives, the overwhelming reliance on journal publications underscores the importance of peer-reviewed scholarship in legitimizing and consolidating knowledge about digital leadership and its impact on school performance. The inclusion of conference papers and book chapters indicates the need for experimental approaches in exploring new territories of scientific inquiry, which is typical for emerging research fields.

While there are not many review articles and books, they contribute to providing theoretical context to the problem under study and consolidating the existing body of knowledge in the field. Editorials and errata have been rarely used in this literature, which shows that the scholarly discourse is rather empirical and based on scientific research. Overall, this distribution pattern points to the young age of the academic area of inquiry related to digital leadership. It seems that the community of researchers prioritizes empirical studies while slowly integrating theoretical and interdisciplinary contributions into their work. The development of future scientific knowledge might require exploring new publication formats, such as edited books and reviews.

Thereafter, this co-authorship network illustrates the cooperative framework underpinning the academic community engaged in digital leadership and school effectiveness research. The visualization highlights how scholars form clusters of collaboration, sharing expertise across institutions and regions. Such cooperative structures not only strengthen the intellectual foundation of the field but also accelerate the exchange of ideas, methodologies, and innovations. By linking diverse perspectives, the network demonstrates that digital leadership is being shaped collectively rather than in isolation. This interconnectedness underscores the importance of collaboration in advancing knowledge, fostering resilience, and ensuring that schools adapt effectively to technological change. The existence of separate clusters shows that the creation of knowledge in this sphere is characterized by local cooperation among scholars who share institutional and geographical proximity. Academic literature on networks points out that the clustering in research leads to greater specialization and development, since the members of each cluster create common theoretical and methodological base (Cherniavska et al., 2023). At the same time, it can be seen from the diagram that cross-cluster links exist and play an important role. In fact, despite the predominant intra-cluster cooperation, it is essential for scholars to interact with members of other clusters and share their ideas and findings. This idea corresponds to the results of studies devoted to research networks. Scholars claim that cross-cluster interaction is an essential part of innovative collaboration (Vestal & Danneels, 2022). In the context of educational technology and leadership research, it means that the field develops due to the work of well-known scientists as well as collaboration among different networks. Potential avenues for future research lie in examining how cooperative scholarly structures influence the global dissemination of digital leadership strategies. The growing interconnectedness of researchers across regions suggests that networked scholarship is not only expanding the reach of ideas but also shaping the adaptability of schools in the face of rapid technological change. By analyzing these collaborative networks, scholars can better understand how knowledge flows across borders and how diverse educational contexts contribute to the refinement of digital leadership practices. Equally important is the investigation of how such cooperation fosters institutional flexibility. Schools today must respond to constant advancements in technology, and leadership that is informed by international scholarship can provide models for resilience and innovation. Future studies should therefore explore the mechanisms through which collaborative research enhances organizational learning, supports teacher empowerment, and promotes equity in digital transformation. Comparative analyses across regions will be particularly valuable, as they can reveal how cultural, infrastructural, and policy differences shape the adoption of digital leadership strategies. Ultimately, the significance of this research lies in its potential to guide policymakers, educators, and administrators toward evidence-based practices that ensure schools remain agile, inclusive, and prepared for the challenges of a rapidly evolving digital environment.

Finally, the keyword network visualizations provide compelling evidence of the centrality of technology leadership within the broader discourse on educational technology and leadership research. By positioning “technology leadership” at the core of the network, the visualizations underscore its role as the organizing principle that connects diverse strands of inquiry. This centrality is not merely symbolic; it reflects the way technology leadership has become the anchor for discussions on how schools, educators, and administrators navigate digital transformation. The significance of this finding lies in its ability to highlight technology leadership as both a foundational and evolving construct—one that continues to shape the intellectual structure of the field. Equally important is the breadth of themes revealed through the clustering of related concepts such as leadership, curricula, innovation, ICT, and school principals. These clusters illustrate the multidimensional nature of digital leadership, which encompasses organizational management, pedagogical design, and technology integration. The visualization makes clear that digital leadership is not confined to technical expertise but extends into areas of curriculum development, instructional innovation, and school governance. This complexity signifies that future research must adopt interdisciplinary approaches, recognizing that effective digital leadership requires balancing technical proficiency with educational vision and organizational strategy. The presence of earlier topics associated with infrastructure and ICT adoption further reinforces the historical trajectory of the field. These themes correspond to research emphasizing that digitalization begins with access to necessary technologies and infrastructure (Lin, 2025). Their continued visibility in the network suggests that while the field has advanced, foundational concerns about equitable access and technological readiness remain relevant. The significance here is twofold: first, it acknowledges the enduring importance of infrastructure as a prerequisite for digital transformation; second, it highlights the need for ongoing policy attention to ensure that schools are not left behind in terms of technological capacity. In contrast, newer clusters around innovation and e-leadership reflect the field’s shift toward examining how leaders actively shape organizational culture and empower teachers (Xueying et al., 2025). These emerging themes signal a transition from viewing technology leadership as a matter of resource provision to understanding it as a catalyst for systemic change. The

significance of this finding lies in its implications for leadership preparation and professional development: leaders must now be trained not only to manage technology but also to foster innovation, resilience, and collaborative practices within their institutions.

The diversity of thematic clusters—from school culture to program evaluation—suggests that digital leadership transcends purely technical concerns. It is increasingly framed as a holistic practice that influences equity, accountability, and long-term institutional resilience. This broadening of scope is significant because it positions digital leadership as a lever for addressing pressing educational challenges, including inclusivity, sustainability, and adaptability in rapidly changing environments. Taken together, these insights suggest that future research will conceptualize digital leadership as a complex phenomenon that facilitates innovation and organizational change in technologically mediated contexts. The significance of the findings lies in their ability to chart the evolution of the field: from infrastructure and access, to innovation and culture-building, to equity and accountability. This trajectory underscores that digital leadership is not simply about managing technology—it is about reimagining education itself in the digital age

Conclusion and Implications

Based on the findings of the bibliometric study, it can be concluded that studies on digital leadership and academic performance have developed from virtual nonexistence during the 1990s to an area that is rapidly growing recently, with "technology leadership" being the foundation, and innovation and e-leadership becoming increasingly important as well. This means that in the area of educational policies, research funding must be extended, and international and cross-disciplinary cooperation must be encouraged to tackle the problem of the scholarly output being focused in just a few countries and institutions. In terms of curricula design, digital leadership skills must become a part of education programs for future leaders, combining the knowledge of ICT with innovation.

The growing increase in scholarly works on digital leadership and its impact on school performance underscores the need for comprehensive interventions across multiple domains of education and governance. At the policy level, governments and institutions must prioritize expanding research capabilities beyond leading economies such as the United States. Concentrated scholarship risks producing a narrow understanding of digital leadership, while underrepresented regions remain overlooked. Policy briefs should therefore recommend targeted investments in research infrastructure, funding opportunities, and international collaborations that bridge borders and diversify perspectives. Such measures will ensure that digital leadership strategies are globally relevant and adaptable to varied educational contexts. In education, the findings highlight the importance of embedding digital leadership principles into teacher preparation and leadership development programs. Schools must not only equip future leaders with ICT competencies but also cultivate innovative thinking, organizational resilience, and e-leadership skills. This requires curriculum reforms that integrate interdisciplinary approaches, combining insights from social sciences, computer science, business, and quantitative disciplines. By doing so, educational institutions can foster leaders who are capable of navigating technological change while promoting equity, accountability, and collaborative practices. Curriculum development plays a pivotal role in institutionalizing these competencies. Syllabi should be redesigned to balance technical skills with broader leadership attributes, ensuring that students are trained to manage digital tools while simultaneously driving organizational innovation. The significance of this recommendation lies in its potential to transform curricula into vehicles for preparing leaders who can sustain performance outcomes in digitally mediated environments. Educational management must also adapt to the evolving demands of digital leadership. Administrators should adopt evidence-based strategies that align organizational structures with technological innovation, creating cultures that value adaptability and resilience. This involves rethinking management practices to emphasize collaboration, distributed leadership, and accountability mechanisms that support digital transformation. Finally, seminars and training programs are essential for continuous professional development. Policymakers, educators, and school leaders should be encouraged to participate in workshops that disseminate the latest research findings and practical strategies for digital leadership. These platforms can serve as spaces for dialogue, capacity-building, and the exchange of best practices across contexts. The significance of these initiatives lies in their ability to translate scholarly insights into actionable skills, ensuring that leaders remain responsive to the challenges of rapidly evolving technological environments. In sum, the rise of digital leadership scholarship calls for coordinated action across policy, education, curriculum, management, and training. By implementing these recommendations, stakeholders can ensure that digital leadership becomes a transformative force for innovation, equity, and sustainable school performance.

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Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study; all data used were obtained from the Scopus Data-Based. Others are properly cited as observed in the reference list.

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Appendices

No appendices are attached to this study.