



## Understanding Leadership Core Skills for Education in an Era of Digital Disruption and Transformational Change

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### ABSTRACT

This study presents a bibliometric analysis of research on leadership core skills in educational settings, with a specific focus on the context of digital disruption and transformational change. Using Scopus as the primary database, a total of 389 documents published between 2010 and 2025 were analyzed. The results indicate a steady growth in scholarly output, with strong contributions from Southeast Asian authors, particularly from Malaysia and Indonesia. Highly cited works emphasize digital leadership and crisis-responsive competencies. Keyword co-occurrence and network visualization reveal thematic clusters centered on higher education, professional development, systems thinking, and digital transformation. The findings show that digital and transformational leadership concepts are increasingly integrated into the educational leadership discourse. This study identifies research gaps and recommends future studies to focus on contextual leadership competency models, cross-institutional comparisons, and the role of soft skills such as emotional intelligence and communication. The analysis contributes to a deeper understanding of the evolving demands on educational leaders in a rapidly changing global landscape.

**Keywords:** Bibliometric, Digitalization, Education, Leadership, Skill

### ARTICLE INFO

**Article History:**

*Received 2 January 2025*

*Revised 5 February 2025*

*Accepted 10 March 2025*

*Available online 1 April 2025*



## 1. INTRODUCTION

In the twenty-first century, educational systems around the world are undergoing fundamental transformations driven by rapid technological advancement, global uncertainty, and the growing complexity of societal needs (Corbett & Spinello, 2020; Serageldin, 2022; Tinning, 2023). The emergence of digital technologies, artificial intelligence, and new learning ecosystems has catalyzed a wave of disruption across the educational sector. These changes demand not only structural and operational adjustments but also new models of leadership capable of navigating complexity and fostering innovation. At the core of this shift lies the concept of leadership core skills, which represent the foundational competencies essential for educational leaders to guide institutions through periods of disruption and transformational change (Bock & von der Oelsnitz, 2025; Corbett & Spinello, 2020; Tinning, 2023).

The concept of digital disruption in education refers to the profound and accelerating changes brought about by the integration of digital technologies into teaching, learning, and institutional governance (García-Morales et al., 2021; Zahra & Maryanti, 2022). These include the adoption of online learning platforms, digital assessment tools, data-driven decision making, and virtual collaboration among stakeholders. While such innovations offer new opportunities for access and personalization, they also introduce challenges related to digital equity, infrastructure, and pedagogical relevance. Consequently, educational leaders must possess a set of core competencies that are both adaptive and anticipatory, enabling them to lead systemic change while preserving educational values (Bock & von der Oelsnitz, 2025; Karousiou, 2025).

Transformational change, distinct from incremental reform, entails a deep rethinking of institutional structures, roles, and purposes. It requires leaders to foster vision-driven cultures, engage in continuous innovation, and manage resistance to change. The intersection of digital disruption and transformational change in education thus places unprecedented demands on leadership. Leaders are expected to integrate technology meaningfully, build resilience among staff and students, and cultivate partnerships that extend beyond the school or university.

Despite the growing interest in educational leadership competencies, existing research remains fragmented. Numerous studies have explored individual leadership models, regional policy frameworks, and training programs, yet few have synthesized the broader landscape of scholarship on leadership core skills in the educational sector. In particular, there is a need to map the evolution of concepts, identify influential works and scholars, and uncover thematic clusters that define the field.

Bibliometric analysis offers a powerful methodological tool to address this gap. By systematically analyzing large volumes of academic literature, bibliometrics enables researchers to visualize patterns, trends, and intellectual structures within a given domain (Cecilia-Martín et al., 2020; Hurtado-Reina et al., 2024). Tools such as VOSviewer, Biblioshiny, and CiteSpace allow for the examination of co-authorship networks, keyword co-occurrence, and citation dynamics. In this study, a bibliometric approach is adopted to

investigate the scientific production related to leadership core skills in education from 2000 to 2025. Through this analysis, the study aims to answer several key questions: What are the most influential publications and authors in this field? How have the themes of digital disruption and transformational leadership been integrated into the discourse on educational leadership skills? What is future research recommendation can be identified?

By framing leadership core skills within the dual context of digital disruption and transformational change, this study seeks to provide a comprehensive and evidence-based overview of the evolving demands placed upon educational leaders. The findings will be valuable for policymakers, researchers, and institutional leaders who aim to design leadership development programs, reform educational governance, and respond proactively to ongoing systemic shifts. Ultimately, the study contributes to the strategic management of human capital in education by clarifying which leadership skills are most crucial for fostering innovation, resilience, and inclusive learning environments in an era of profound change

## 2. METHOD

This study employs a bibliometric approach to systematically explore the intellectual landscape of leadership core skills within educational contexts, particularly in the era of digital disruption and transformational change. Bibliometric analysis enables researchers to examine large volumes of academic literature quantitatively, providing insights into publication trends, influential authors, thematic clusters, and the evolution of key concepts over time (Arjaya et al., 2024; Cecilia-Martín et al., 2020; Heck et al., 2023).

The primary data source for this study is the Scopus database, recognized as one of the most comprehensive and reliable bibliographic repositories for peer-reviewed literature across various disciplines (Cecilia-Martín et al., 2020; Pham-Duc et al., 2022). To retrieve relevant publications, a search query was constructed based on combinations of keywords that reflect the conceptual focus of this research. The search string used was:

*TITLE ( leader AND skill OR competen\* OR ability ) AND KEY ( education OR school OR teacher OR lectur\* )*

This query was designed to capture documents that explicitly mention leadership in the title and contain terms related to education within the keywords. The use of wildcard operators (\*) allowed for the inclusion of word variations such as *leadership*, *skills*, *competency*, *competence*, *ability*, *lecture*, and *lecturer*. The initial search was conducted in June 2025, yielding a total of 930 documents.

To ensure the relevance, quality, and consistency of the data, several inclusion criteria were applied to refine the dataset:

1. Publication Years: Only documents published between 2010 and 2025 were included. This 15-year range captures the most recent and relevant developments in leadership scholarship during the era of digital and systemic change.
2. Subject Area: Publications were filtered by subject area to include only those categorized under Education in the Scopus database. This ensures that the analysis focuses solely on leadership within educational contexts.
3. Language: Only articles written in English were included to maintain consistency and enable broader accessibility for international academic audiences.

4. Document Type: The analysis was limited to journal articles and conference proceedings, excluding books, reviews, editorials, and other non-peer-reviewed content to ensure the scholarly integrity of the dataset.

After applying these inclusion criteria, the final dataset comprised 389 documents, which served as the basis for subsequent bibliometric analysis.

The bibliometric analysis in this study was conducted using two primary software tools: VOSviewer and Biblioshiny. VOSviewer was utilized to perform network visualizations, including co-authorship analysis, keyword co-occurrence mapping, and citation network structures (Hamidah et al., 2020; van Eck & Waltman, 2010). This software is particularly effective in generating science maps that reveal the intellectual and conceptual structure of a research field through clustered node relationships. Complementing this, Biblioshiny, the web-based interface of the Bibliometrix R-package in R, was employed to generate descriptive statistics and graphical outputs related to annual publication trends, source impact, authorship productivity, and thematic evolution. Biblioshiny provides an interactive environment that facilitates the exploration of metadata through quantitative indicators and trend analyses (Heiges et al., 2022). The combined use of these two tools enabled a comprehensive and multi-dimensional examination of the literature on leadership core skills in education, enhancing both the analytical rigor and interpretability of the findings.

### 3. HASIL DAN PEMBAHASAN

#### Search Result

The descriptive results of the bibliometric search can be seen in Figure 1, which provides an overview of the dataset's key characteristics following the application of inclusion criteria. The bibliometric overview of 389 Scopus-indexed documents published between 2010 and 2025 reveals a growing scholarly interest in leadership core skills within educational contexts, particularly in response to global shifts driven by digital transformation and systemic change. With an annual growth rate of 7.36%, the research trend reflects consistent academic engagement over the past 15 years. The collaboration pattern is notable, with an average of 3.27 co-authors per document and 14.65% of the works involving international co-authorship, indicating a strong orientation toward interdisciplinary and cross-border research. The involvement of 1,190 authors across 257 sources highlights the diversity and breadth of contributors, while the presence of 1,188 unique author keywords suggests a wide thematic spread within the field. Although the average citation count per document is moderate at 6.738, it signals growing recognition of the field's relevance. Collectively, these indicators underscore that educational leadership research, particularly in relation to core competencies, is an active and globally interconnected domain shaped by contemporary demands for adaptability, innovation, and collaborative leadership.

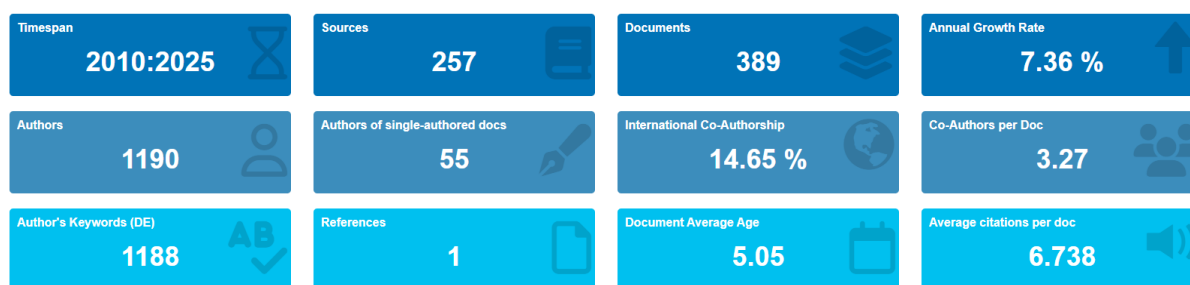


Figure 1. Search Result

### The Most Influential Publications and Authors

The bibliometric analysis identified several highly influential publications and prolific authors that have significantly shaped the discourse on leadership core skills in educational contexts. Table 1 presents the top five most cited documents based on citation frequency. Leading the list is the study by Blau and Shamir-Inbal (2017), published by *Springer Nature*, which received 127 citations. Their work emphasizes the integration of digital competences and long-term ICT strategies within school leadership, underscoring the importance of digital literacy among elementary school leaders in shaping school culture. This high citation count reflects the relevance of digital leadership in the broader context of educational transformation.

**Table 1.** Top 5 Most influential publications

Author	Title	Publisher	N. Cite
Blau & Shamir-Inbal (2017)	Digital competences and long-term ICT integration in school culture: The perspective of elementary school leaders	Springer Nature	127
Antonopoulou et al. (2021)	Transformational leadership and digital skills in higher education institutes: During the covid-19 pandemic	Ital Publication	104
Reed et al. (2019)	A systematic review of leadership definitions, competencies, and assessment methods in pharmacy education	Elsevier	58
Sousa (2018)	Entrepreneurship skills development in higher education courses for teams leaders	MDPI	46
Ismail et al. (2018)	Instructional leadership and teachers' functional competency across the 21st century learning	Gate Association for Teaching and Education	42

Following closely is the study by Antonopoulou et al. (2021) with 104 citations, which examines transformational leadership and digital skills in higher education institutions during the COVID-19 pandemic. This publication, released by *Ital Publication*, reflects the urgency of leadership adaptability during times of crisis. Other key contributions include the systematic review by Reed et al. (2019) on leadership competencies in pharmacy education (58 citations), and Sousa (2018) on entrepreneurship skills in higher education leadership (46 citations), both of which broaden the thematic lens of educational leadership by

incorporating cross-disciplinary perspectives. Additionally, Ismail et al. (2018) contributed to the discourse on instructional leadership and functional competency for 21st-century learning, with 42 citations, indicating ongoing interest in pedagogical leadership and curriculum transformation.

In terms of author productivity, Table 2 highlights the most prolific contributors in the dataset. Authors from Malaysia dominate the list, particularly from Universiti Kebangsaan Malaysia and Universiti Teknologi MARA. Alias, B.S. and Ghani, Erlane K. each contributed five documents, signaling strong research engagement from Malaysian institutions in the domain of educational leadership. Mansor, A.N. also made notable contributions with four publications, further reinforcing Malaysia's centrality in this research landscape. Beyond Southeast Asia, Gedvilienė, G. from *Vytautas Magnus University* in Lithuania and Wiyono, Bambang Budi from *Universitas Negeri Malang* in Indonesia each contributed three documents, demonstrating broader international engagement in this field.

**Table 2.** Top 5 Most influential publications

Author	Affiliation	Country	N. Doc
Alias, B.S.	Universiti Kebangsaan Malaysia	Malaysia	5
Ghani, Erlane K.	Universiti Teknologi MARA	Malaysia	5
Mansor, A.N.	Universiti Kebangsaan Malaysia	Malaysia	4
Gedvilienė, G.	Vytautas Magnus University	Lithuania	3
Wiyono, Bambang Budi	Universitas Negeri Malang	Indonesia	3

These findings underscore two key observations. First, the most cited works are those that directly engage with urgent educational challenges such as digital transformation and crisis leadership, indicating that relevance to contemporary issues significantly influences academic impact. Second, the concentration of productive authors in Malaysia and Indonesia highlights the growing regional leadership in educational research within the Global South, suggesting an important shift in the geographic distribution of scholarly influence.

### Keyword Analysis

The keyword analysis, as presented in Table 3, reveals that the term “leadership” is the most dominant, appearing in 83 documents with a total link strength of 111, signifying its central role in the research domain of educational leadership. “Higher education” follows with 45 occurrences and a link strength of 62, reflecting a strong focus on leadership development at the university level, particularly in response to digital and systemic change. Broader terms such as “education” (22 occurrences) and “skills” (12 occurrences) indicate the general framing of the discourse, while more specific concepts like “competencies” (15), “leadership skills” (12), and “leadership competencies” (11) emphasize the increasing interest in identifying and developing core leadership attributes. The inclusion of terms such as

“professional development” and “leadership development” underscores the ongoing relevance of capacity building among educators and institutional leaders. Interestingly, “engineering education” also emerges among the top keywords, suggesting that the discussion of leadership competencies extends into discipline-specific contexts. Overall, the high frequency and link strength of these keywords illustrate a research landscape that is both conceptually focused and practically oriented, reflecting the field’s response to evolving educational challenges in an era of disruption and transformation.

Table 3. Most Occurance Keyword

No	keyword	occurrences	total link strength
1	leadership	83	111
2	higher education	45	62
3	education	22	23
4	competencies	15	30
5	leadership skills	12	8
6	skills	12	26
7	leadership competencies	11	14
8	leadership development	11	12
9	engineering education	9	10
10	professional development	9	15

### Network Visualization

The keyword co-occurrence network visualization, as illustrated in Figure 2, maps the intellectual structure of research on leadership core skills in education by highlighting frequently co-occurring terms and their conceptual relationships. At the center of the network, the terms “leadership” and “higher education” appear as the most prominent nodes, indicating their pivotal role in connecting diverse research themes. The spatial proximity and line thickness among nodes reflect the strength of their co-occurrence, while color coding represents distinct thematic clusters.



5. Cluster 5 (Purple-Orange) brings together keywords related to skills application and educational context, such as *engineering education*, *leadership skills*, *skills*, *teamwork*, *entrepreneurship*, and *development*. This cluster reflects practical dimensions of leadership within specialized educational settings and multidisciplinary learning environments.

Overall, the network visualization demonstrates that the research field is both conceptually rich and thematically interconnected. The proximity of terms like *digital leadership*, *transformational leadership*, and *professional development* to the core concepts of *leadership* and *higher education* suggests a growing convergence toward innovation-oriented leadership paradigms. Furthermore, the presence of context-specific nodes (e.g., *Malaysia*, *medical education*, *engineering education*) reflects the diversity of educational environments in which leadership competencies are being examined. This analysis underscores the multidimensional nature of leadership research in education, shaped by both global imperatives and local dynamics

### **Future Research Recommendations**

Based on the network visualization, future research should further explore the intersection of transformational leadership and digital transformation, which appears as a highly connected thematic cluster. Although concepts such as *digital leadership*, *systems thinking*, and *sustainability* have begun to emerge, their integration remains relatively underdeveloped across educational levels. Researchers are encouraged to investigate how these leadership models can be effectively contextualized and implemented in diverse educational systems, particularly in regions facing technological and structural disparities. Comparative studies across countries or institutional types could also offer insights into how digital-era leadership practices vary and evolve under different governance and cultural contexts.

Another promising area for further research lies in the development and assessment of leadership competencies in specific educational environments, such as vocational, medical, or engineering education. The presence of keywords like *engineering education*, *entrepreneurship*, *medical education*, and *curriculum* within the network suggests that leadership studies are extending into discipline-specific pedagogical domains. However, empirical studies that operationalize leadership frameworks in these specialized contexts remain limited. Future research should aim to construct and validate competency models tailored to these educational sectors, while also evaluating their impact on student outcomes, innovation capacity, and institutional resilience.

Finally, the cluster focusing on teacher leadership, school principals, and professional development signals the continuing importance of capacity building at the institutional level. While professional development and instructional leadership are widely recognized, there is a need for longitudinal and evidence-based research that tracks how leadership training programs affect leadership behavior and educational performance over time. Future studies should also consider the role of emotional intelligence, communication skills, and self-leadership emerging yet under-connected nodes in the network as critical soft skills that

influence leadership effectiveness in disruptive educational environments. Incorporating mixed-methods approaches, digital learning analytics, and participatory design with educators could enrich this line of inquiry.

#### 4. CONCLUSION

This bibliometric study provides a comprehensive overview of the research landscape on leadership core skills in education within the context of digital disruption and transformational change. The overall search results revealed 389 relevant documents published between 2010 and 2025, reflecting a growing and collaborative body of literature on leadership core skills in educational contexts. The analysis identified highly cited publications such as Blau and Shamir-Inbal (2017) and Antonopoulou et al. (2021) as the most influential, particularly for their focus on digital integration and crisis-responsive leadership. Leading authors were primarily affiliated with institutions in Malaysia and Indonesia, indicating strong regional contributions. Thematic analysis revealed that digital disruption and transformational leadership have been increasingly integrated into the discourse through concepts like digital leadership, systems thinking, sustainability, and professional development. These themes form interconnected clusters alongside more specific contexts such as engineering and medical education. Based on these findings, future research is recommended to focus on developing contextualized leadership competency frameworks, examining the long-term impact of professional development, and exploring the role of soft skills such as communication, emotional intelligence, and self-leadership in navigating complex educational environments.

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