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Review

Charting the evolving landscape of digital leadership in education: A systematic literature review

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Abstract: The increasing domains of digital technology in educational settings urgently require digital leadership (DL) to ensure the sustainability of school improvement initiatives in the digital era and to facilitate the digital transformation of educational institutions. DL emerges as an urgent and evolving topic of significant public interest. However, there is a notable lack of consensus persists regarding its definition and constructs within educational settings, hindering the advancement of DL theory. To address this gap, a systematic literature review was conceived, employing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology. The primary aim was to enhance comprehension of the geographical and temporal distribution of relevant publications, as well as to elucidate prevalent definitions and constructs of digital leadership in educational contexts. This article endeavors to synthesize the extant scientific literature on DL, focusing on studies published between 2019 and 2024. Inclusion criteria encompassed scientific research publications sourced from Scopus and the Web of Science (WoS) databases, available in English, and centered on educational settings. Initial database queries yielded 578 papers, subsequently refined to 35 studies through meticulous screening for duplicity and adherence to inclusion criteria. Notably, the reviewed publications predominantly characterize DL as a multifaceted process, amalgamation, or integration, with a predominant emphasis on functional aspects of leadership. Noteworthy constructs frequently encountered include digital age learning culture, visionary leadership, excellence in professional practice, systemic improvement, and digital citizenship. This review contributes to the enrichment of theoretical conceptualizations surrounding DL. It underscores the imperative for future research to explore into the measurement of DL, thereby presenting promising avenues for evaluating principal DL within educational institutions.

Keywords: digital leadership; definition of digital leadership; construct of digital leadership; education field; systematic literature review

1. Introduction

The emerging digital technologies, such as 5G, AI, big data, blockchain, and VR/AR/MR have significantly changed and reshaped various aspects of society, including education, politics, economics, science, technology, culture, and security (Zhuang et al., 2023), posing serious threats, concerns, and challenges for organizations and leaders. In the educational settings, digital technologies are significantly transforming educational practices and models, communication and information access, problem-solving, and the way of teaching and learning (Mohd Izham, 2021). Educational institutions must consistently anticipate and adapt to changes and challenges in order to remain competitive in the digital age. This entails

equipping students with the essential knowledge and skills required to succeed and navigate the digital era (Mohd Izham, 2021). The increasing domains of digital technologies in teaching and learning process urgently necessitate digital leadership (DL) to strengthen pedagogy and communication with teachers and students.

Digital leadership, in this review, refers to the ability to set direction, influence others, initiate sustainable change and build relationships to anticipate future changes that are crucial for achieving school future success through the effective use and integration of digital technologies (Agustina et al., 2020; Karakose et al., 2021). Principals' DL plays a significant role in addressing the challenges emerged in the digital era (Lagemann, 2022), facilitating the promotion of a shared vision for extensive technology integration, and cultivating a favorable atmosphere to achieve the objectives (Benitez et al., 2022). Furthermore, principals' DL plays a pivotal role in cultivating teachers' willingness to embrace and integrate technology in teaching practices (Ismail et al., 2021), leading to positive outcomes for students regarding the academic performance and advancement (AlAjmi, 2022). Prior research has provided empirical evidence for the positive influence of principals' DL on teachers' integration of digital technology in educational practices. In their study, Hafiza et al. (2021) examined the positive effects of Principals' DL on teachers' digital teaching practices in Malaysia during the Covid-19 pandemic. AlAjmi (2022) conducted a cross-sectional survey to further investigate the correlation between principals' DL and teachers' usage of digital technology in their instructional practices. The results of the study indicate that PDL has a significant impact on the extent of technology integration among teachers in Kuwait during the COVID-19 pandemic. Sunu (2022) provided additional evidence to support the notion that teachers' utilization and acceptance of digital technology are greatly impacted by PDL. This is further supported by Tanti and Sethupathy (2022), the findings of their study revealed that PDL serves as a reliable predictor of teachers' proficiency in digital teaching and their subsequent adoption of digital teaching practices. Additionally, prior research has demonstrated the beneficial effects of principals' DL on the digital competence of teachers. According to the findings of Saputra and Saputra (2020), DL has a substantial positive effect on digital competence. The research conducted by Jorge-Vázquez et al. (2021) presented empirical support for the notion that the development of TDC is positively impacted by strategic leadership. This perspective is substantiated by the research conducted by Zhang (2022), who demonstrated that TDC was impacted by PDL.

Nevertheless, most organizations lack awareness of the significance of DL due to a lack of understanding regarding the nature and the specific DL capabilities required to effectively address the challenges posed by digitization in educational institutions (Lagemann, 2022; Turyadi et al., 2023). In recent years, although digital leadership has received great academic attention, studies on DL in the educational field are still limited. There is no consensus among scholars regarding its nature definition and constructs, the existing definition mainly focused on functional aspects of leadership neglecting to consider the interconnections among stakeholders or potential conflicts between various levels within the organization (Jameson et al., 2022). Regarding the constructs of digital leadership, the most used strategy is the adoption of local policy standards. ISTE Standards for Administrators (2014) and ISTE Standards for Education Leaders (2018) have emerged as the predominant conceptual

frameworks employed to assess the DL of principals. previous research (AlAjmi, 2022; Hafiza Hamzah et al., 2021; Karakose et al., 2021; Zhou and Tse, 2023) the ISTE (2014) as the framework to assess the level of principals' DL. In their study, Tanucan et al. (2022) and Tanti and Sethupathy (2022) assessed the DL proficiency demonstrated by principals based on ISTE (2018). These two standards provided a framework for directing digital, focusing on the knowledge and behaviors required for leaders to empower teachers and facilitate student learning. In addition, they focus on the hotly debated issues in the field of education, such as digital citizenship, visioneering, innovation and collaboration, continuous improvement and professional growth, lifelong learning, privacy, and security. Therefore, it can serve as a valuable guidance for school administrators and education leaders in the process of digital transformation (Luo et al., 2023).

The second strategy is developing the constructs and dimensions of DL from empirical studies (Luo et al., 2023). Yusof et al. (2019) developed a DL model for Malaysian principals, which encompasses communication and school climate. The DL model proposed by Hensellek (2020) encompasses three dimensions, namely digital vision, digital mind-set, and digital skillset. The ACC model of DL of preschool principals, developed by Luo et al. (2023), comprises three dimensions: attitude, cognition, and capacity. This evidence-based approach is more scientific and robust, and the findings are more reliable and validated (Luo et al., 2023). In our literature review, developing the constructs and dimensions of DL from prior research is rather common. Using a systematic literature review, Nurhafizah et al. (2022) identified the five most frequently used constructs in measuring DL in educational field are professional practice excellence, digital age learning culture, digital citizenship, systemic improvement, and visionary leadership. while the constructs of DL identified by Tigre et al. (2023) through bibliometric analysis are: people focus, personal aspects, long-term orientation, and task achievement. Despite the emergence of a few models in recent years (Zulu and Khosrowshahi, 2021), the constructs of DL in the educational settings remain ambiguous, without a precise explanation of the elements or instruments that can be employed for investigation, which has hindered the advancement of DL theory. Additionally, due to a deficiency in DL knowledge and skills, principals have limited ability to support proper and intentional integration of technology in teaching practice (Luo et al., 2023).

Regarding the research scopes, existing studies in the literature on DL can be categorized in 3 groups: (i) Conceptual theoretical studies in the educational settings, these studies attempt to define DL, digital capabilities, issues or to develop conceptual frameworks for it (Abdul Musid et al., 2022; Karakose et al., 2023; Karakose and Tülübaş, 2023; Mohd Izham, 2021; Neyisci and Sari, 2022; Prabhakar, 2022). (ii) Empirical studies on DL: Some of those focus on DL skills or capabilities (Ellis et al., 2021; Ghamrawi and M. Tamim, 2023; Imhof and Grivas, 2022; Luecha et al., 2022; Suryadi et al., 2023); some focus on model development (Luo et al., 2023; Yusof et al., 2019); most of them highlighted relationships between DL and teachers' integration of digital technology (AlAjmi, 2022; Hafiza et al., 2021; Karakose et al., 2021; Masrur, 2021; Sunu, 2022; Tanti and Sethupathy, 2022; Zhou and Tse, 2023), few focus on the relationship between job satisfaction (Abdul Musid et al., 2022; Tanucan et al., 2022); several of them identified the effects measurement of DL on

teachers' reflection practice (Agustina et al., 2020), or effects on communication and teacher professional development (Rusnati and Fakry Gaffar, 2021); Tanucan et al. (2023) investigated the socio-demographic determinants of the leadership of Filipino school leaders; and (iii) Literature surveys on DL (Büyükbeşe Tuba et al., 2022), Most of the literature surveys aim to determine DL features or trends (Karakose et al., 2022; Nurhafizah et al., 2022).

There is a lack of systematic literature review (SLR) on DL in the education field, especially the up-to-date SLR systematically investigating the definitions and dimensions of DL in educational settings. Conducting a SLR on DL would provide comprehensive information of DL in the educational field. It is necessary to understand the diversity in its definition as well as identify the most used constructs and lines of research for future studies on DL in the education field, focusing on the most cited papers globally (Espina-Romero et al., 2023). It is also necessary to explore how publications on this topic are distributed geographically and the trend regarding educational settings during the six years. Although Nurhafizah et al. (2022) have investigated the constructs of DL in the education field ranging from 2014 to 2022, there is a lack of investigation of the definition of DL. Therefore, this review aims to identify the country and year distribution of publications in DL in education from 2019 to 2024, to identify the definition and the constructs of DL in the educational context. More specifically, this review was conducted to addresses the following research questions:

- RQ1: What was the geographic distribution of the publications of DL in educational settings from 2019 to 2024?
- RQ1: What was the time distribution of the publications of DL in educational settings from 2019 to 2024?
- RQ3: How was DL defined in educational settings from 2019 to 2024?
- RQ4: What were the underlying constructs of the DL from 2019 to 2024?

This study is unique in its comprehensive synthesis of the most recent literature, providing a consolidated view of DL definitions and constructs in educational contexts. It contributes to the enrichment of theoretical conceptualizations surrounding DL, underscores the imperative for future research to explore into the measurement of DL, thereby presenting promising avenues for evaluating principal DL within educational institutions. Earlier studies have identified essential competencies required for effective digital leadership, such as technological proficiency, digital communication skills, and the ability to drive digital transformation within organizations (Ismail et al., 2021; Schiuma et al., 2024).

2. Materials and methods

To address the research questions, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology was used. This review aims to conduct a more focused and updated systematic review on DL in education, building upon previous reviews that explored the field of digital leadership. The review followed the guidelines for systematic literature reviews provided by Kitchenham and Charters (2007) and followed Nurhafizah et al.'s (2022) format, which consisted of four main steps: i) identification; ii) screening; iii) eligibility; iv) data analysis.

2.1. Resources

This article conducts a systematic review of studies on DL from 2019 to 2024 to cover the appearance of the scientific articles dealing with the subject, up until the present day. The Scopus and Web of Science (WoS) databases were employed as the major databases to select for the data. Scopus and Web of Science were selected as the primary databases for international multidisciplinary academic literature (Aghaei Chadegani et al., 2013). Apart from the database search, professional social networks, including Academia.edu and ResearchGate, were conducted to find relevant supplementary papers.

2.2. Identification

This review followed the three-step approach of Nurhafizah et al. (2022) in selecting articles for this study. The first step is to identify the keywords related to the research questions (Nurhafizah et al., 2022). After identifying the key words "digital leadership", the selected terms were searched in the title, keywords and abstract of the paper. **Table 1** summarizes the search strings applied for the searching process through Scopus, Web of Science (WoS) databases.

Table 1. Search strings used in databases.

Database	Search string	N
SCOPUS	TITLE-ABS-KEY ("digital leadership")	373
WOS	TS = ("digital leadership")	199

Initial database searches retrieved 578 papers in the identification step, among which, 373 are from Scopus database, 199 are from WoS database, and 6 articles from manual searching.

2.3. Screening

The second step in the selection process is article screening, which was used to remove the duplicate articles (Nurhafizah et al., 2022). After removing 129 papers, a total of 452 publications remained for further screening. To narrow the number of publications, further selection criteria was established. **Table 2** summarizes the inclusion and exclusion criteria applied for selecting the articles.

Table 2. Inclusion and exclusion criteria.

Inclusion	Exclusion
Article, conference paper, review, proceedings paper, book	Conference review, note, editorial materials
Published between 2019 and 2024	Published before 2019
Written in English	Written not in English
Focused on educational settings	Focused other than educational settings
Full text available	Full text unavailable

Publications were included if they were, conference paper, review, proceedings paper or book, published between the periods of 2019 to 2024, written in English, focused on educational settings, and allowed free and complete access. A total of 382

publications were excluded from the study. This included 69 publications that were conference reviews, notes, editorials, and other similar materials, 49 publications which were not published between 2019 and 2024, 8 publications that were not written in English, and 256 papers focused on non-educational contexts. In addition, 35 articles that did not have free and complete access were eliminated, leaving only 70 full-text papers that were evaluated for eligibility.

2.4. Eligibility

The third step is eligibility, **Figure 1** demonstrated the selection procedures based on PRISMA outlines and the final corpus publications that were eventually selected for the review. Initially, 42 publications met the inclusion criteria, which were then read and reviewed again using quality criteria to make sure that the selected publications satisfied the inclusion and exclusion criteria to address the research questions. However, in our manual screening of the publications, 8 articles were excluded because they were not related to DL in educational settings at school level, leaving 35 articles as review material, among which, 26 articles chosen from Scopus database, 6 articles from WoS, and 3 from manual searching. Finally, the data were transformed into a suitable format for analysis, enabling a comprehensive synthesis of the literature on digital leadership in educational contexts.

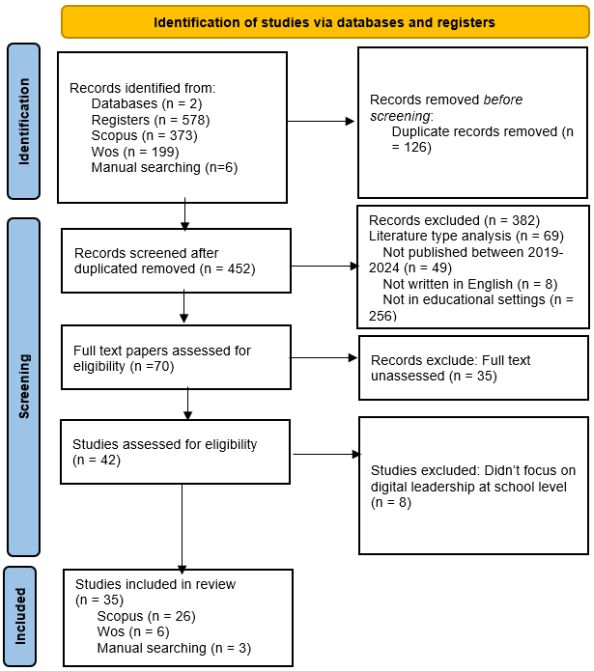

Figure 1. Research flow diagram adapted from Haddaway et al. (2022).

3. Results

In this section, four types of results were presented. First, descriptive statistics regarding the geographic and time distribution of the selected 35 publications gathered from Scopus and WoS databases between 2019 and 2024 to offer a comprehensive view of the trends in DL. Second, further details regarding the definitions of DL to better comprehend their conceptual implications. Finally, the constructs and frequency of DL in educational settings to provide a reference for the future advancement of the

DL model.

3.1. Analysis of the geographic distribution of the publication of DL in educational contexts

In this section, information on the geographic distribution of the publication regarding DL in education is demonstrated. As depicted in **Figure 2**, a total of 35 publications on this topic have been actively published across 14 different countries during 2019 and 2024. The data reveals that Malaysia and Indonesia occupy the highest positions on the list, with seven studies each, indicating a strong interest in DL within these two countries. Turkey ranks third, with 5 papers, which demonstrates a notable presence in DL in educational settings. Two studies were conducted on DL in China, India, Philippines, Thailand, and the United States of America. Additionally, one study examined DL in Czech, Greece, Kuwait, Qatar, South Africa, and Switzerland, respectively.

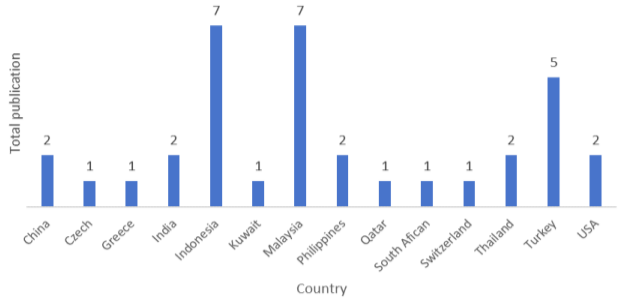

Figure 2. Geographical distribution of publications on DL in educational settings in 2019–2024.

Among the 35 studies, 23 of them were conducted within the Asia and Pacific region, including China, Czech Republic, India, Malaysia, Indonesia, Thailand, and the Philippines. Two research investigations were conducted inside the North American region, specifically in the United States of America. Two investigations were carried out in the Middle East, specifically in Qatar and Kuwait, while the remaining seven studies were conducted in Europe, specifically in Greece, Switzerland, and Turkey. It is noteworthy that countries in the Asia and Pacific region are the leading countries in addressing this issue.

3.2. Analysis of the time distribution of the publication of DL in educational contexts

As illustrated in **Figure 3**, thirty-five studies were published in 2019–2024, among which, two were published in 2019, four studies were published in 2020, seven studies in 2021, fourteen studies in 2022, and eight were published in the year of 2023. There has been a significant increase in the number of publications from 2019 to 2022, with the year 2022 exhibiting the largest number of publications.

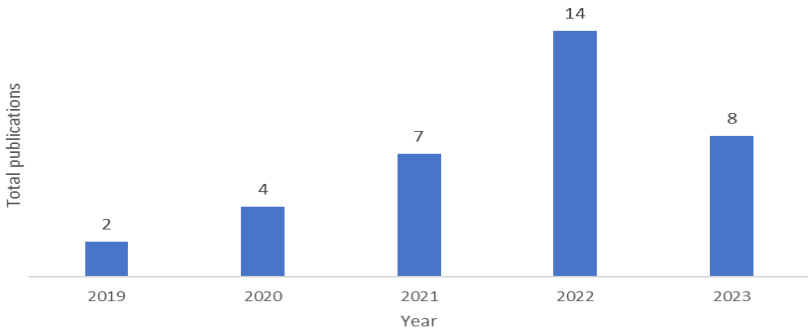

Figure 3. Number of publications on DL regarding educational settings in 2019–2024.

3.3. Analysis of the definition of DL in educational contexts

As an urgent and emerging topic, digital leadership has attracted public attention (Luo et al., 2023), **Table 3** presents the nineteen definitions identified in the prior research in educational contexts between 2019 and 2024. Throughout the literature on the definition of DL, it was prominently defined as a process (Karakose et al., 2022; Luo et al., 2023), a capability (Agustina et al., 2020; Antonopoulou et al., 2021; Rusnati and Fakry Gaffar, 2021; Sunu, 2022; Tanucan et al., 2022, 2023) and a combination or integration (Antonopoulou et al., 2020; Ellis et al., 2021; Hafiza et al., 2021; Karakose and Tülübaş, 2023; Mohd Izham, 2021; Prabhakar, 2022; Saraih et al., 2021; Sheninger, 2019; Tanti and Sethupathy, 2022; Yusof et al., 2019), the existing definitions was primarily concerned with the functional aspects of leaderships.

Karakose et al. (2022) defined DL as a social influence process facilitated by advanced information technologies with the aim of promoting organizational performance and behavior enhancement among all stakeholder groups. According to Karakose et al. (2022), DL is an umbrella term which encompasses several leadership styles, including e-leadership, leadership 4.0, technology leadership and virtual leadership, often interchangeably used. Luo et al. (2023) defined DL as a progressive process in which the director, using their digital attitude, cognition, and capability, guides faculty members in enhancing their digital attitude, digital cognition, and digital capability to establish an efficient digital team, which then gradually and effectively implements diverse digital management in preschools and technology-enabled preschools. Both viewpoints can be seen as an expansion of the concept of "e-leadership" as redefined by Avolio et al. (2014), a process of social influence that is facilitated by advanced information technology present in both immediate and distant contexts to generate changes in attitudes, feelings, mindset, behavior, and performance.

Another group of researchers considered DL as a capability and described it as a vital competency that educational leaders must possess to successfully implement digital transformation. Agustina et al. (2020), AlAjmi (2022), Antonopoulou et al. (2021), Luo et al. (2023), Rusnati and Fakry (2021), Sheninger (2019), Sunu (2022), Suryadi et al. (2023), Tanucan et al. (2022, 2023) enhance the student experience (Brown, 2014). DL has been defined in several studies as the ability to set direction, influence people, build relationships, and initiate sustainable change which are crucial for future school success through access to information (Agustina et al., 2020; Antonopoulou et al., 2021; Rusnati and Fakry, 2021; Sheninger, 2019; Sunu, 2022;

Suryadi et al., 2023). DL, as defined by AlAjmi (2022), is the capacity to employ and implement leadership approaches that are consistent with the digital age by using modern technological platforms. According to Tanucan et al. (2022), DL is the ability of leaders to formulate an insightful vision regarding the implementation, promotion, and adoption of technology in the workplace to lead educational institutions and the stakeholders towards digital transformation, which allows them to be adaptable and competitive in a rapidly evolving digital environment. While Tanucan et al. (2023) defined DL as the ability to use digital technologies to establish a well-organized system that sets direction, influences people, initiates sustainable change and establishes relationships that foster radical changes in digital teaching and learning.

Nevertheless, the above-mentioned process-capability dichotomy failed to comprehensively define the enriched content of DL (Luo et al., 2023). Thus, a third group of prior research proposed that DL can be defined as a combination or integration of diverse constructs, including leadership, digital technology resources, instruments or digital skills, mindsets, and behaviors. DL was defined in several studies as a dynamic combination of mindsets, digital skills, and behaviors (Hafiza et al., 2021; Prabhakar, 2022; Sheninger, 2019) that are used to change and enhance school culture through the effective use of digital technologies (Sheninger, 2019), or to facilitate the establishment of direction, influence others, and initiate sustainable changes that enhance school culture through digital technology (Prabhakar, 2022) or bring about change through the use of digital technologies (Hafiza et al., 2021), or achieve goals through the use of digital data (Antonopoulou et al., 2021; Karakose et al., 2021). DL was defined as the integration of digital technologies, including mobile devices, web applications, and communication applications into leadership practices with the aim of achieving sustainable changes in educational institutions (Antonopoulou et al., 2020; Mohd Izham, 2021; Tanti and Sethupathy, 2022; Yusof et al., 2019). These scholars argue that DL is a combination of leaders, resources, hardware, and technology. Ellis et al. (2021) and Saraih et al. (2021) have described DL as the integration of leadership and digital technology. On the other hand, Sunu (2022) argues that the structure of DL is formed by combining technology, motivation, and leadership style. While Karakose and Tülübaş (2023) defined DL as a leadership construct at the school level that integrates leadership skills with digital competences. The objective is to establish schools that are equipped with digital capabilities and capable of adapting to the fast-changing, digital environment. **Table 3** shows the results of definitions of digital leadership in educational settings starting 2019.

Table 3. Definitions of digital leadership in educational settings in 2019–2024.

Author/year	Definition	Define as
Sheninger (2019)	DL is defined as "establishing direction, influencing others, initiating sustainable change though access to information, and establishing relationships in order to anticipate changes pivotal to school success in the future". "Digital leadership consists of a dynamic combination of mindset, behaviors, and skills that are employed to change and enhance school culture through the strategic use of technology".	A capability/ combination
Yusof et al. (2019)	DL refers to integration of digital technologies such as mobile devices, communication applications, and web applications in leadership practices of school leaders towards a sustainable change in the use of technology at schools. It is a combination of leaders, resources, hardware, and technology.	A combination
Agustina et al. (2020)	DL is defined as the ability to set direction, influence people, build relationships, and initiate sustainable change which are crucial for future school success through access to information.	A capability

Table 3. (*Continued*).

Author/year	Definition	Define as
Antonopoulou et al. (2020)	DL is defined as the integration of a portfolio of technologies, tools, and instruments like: Internet of Things (IoT), e-platforms (webinars) social media, Artificial Intelligence, Big Data, Machine Learning in leadership.	A combination
Antonopoulou et al. (2021)	DL refers to the systematic use of an organizations' digital data to accomplish organization objective.	Data use
	DL refers to connecting leadership with digital technology to improve the lives, well-being, and circumstances of others.	A combination
Hafiza et al. (2021)	DL is a dynamic combination of mindsets, behaviors, and skills that are used to bring about change in the field of educational management through digital technologies.	A combination
Mohd Izham (2021)	DL is the integration of digital technologies such as mobile devices, communication applications, and web applications in leadership practices of school leaders towards a sustainable change in the use of technology at schools. It is a combination of leaders, resources, hardware, and technology.	A combination
Rusnati and Fakry Gaffar (2021)	DL is defined as the ability to set direction, influence people, build relationships, and initiate sustainable change which are crucial for future school success through access to information.	A capability
Saraih et al. (2021)	DL is a relatively new leadership practice that connects leaders with technology.	A combination
AlAjmi (2022)	DL refers to the implementation and use of leadership approaches that are consistent with the digital age, including reliance on modern technology platforms.	A capability
Karakose et al. (2022)	DL is described as a social influence process mediated by modern information technologies to support change and the improvement of behaviors and organizational performance across all stakeholder groups. Digital leadership is used as an umbrella term that encompasses several leadership styles, such as technology leadership, virtual leadership, e-leadership, and leadership 4.0, all of which are used interchangeably in literature.	A process
Neyisci and Sari (2022)	Creating an innovative vision by using technology effectively in managerial processes to create a sustainable culture of change in the organization.	A process
Prabhakar (2022)	DL is the ability to lead individuals or organizations to give full play to digital thinking by leveraging digital insight, digital decision-making, digital implementation, and digital guidance to ensure that their goals are achieved in the era of the digital world. It consists of a dynamic combination of digital skills, mindsets, and behaviors that lead to establish direction, influence others, and initiate sustainable changes that enhance school culture through the strategic and advanced use of the latest technology. digital leadership is concerned with providing direction in terms of digital education through improving access, capacitating peers, making informed decisions, and cultivating creativity	A combination
Sunu (2022)	DL is the art of directing, influencing others, initiating sustainable change through access to information, and building relationships to anticipate changes critical to future school success. DL structure is designed based on a combination of technology, motivation, and leadership style.	A capability
Tanti and Sethupathy (2022)	DL is defined as the incorporation of digital technologies—such as mobile devices, communication apps, and online applications—into the leadership practices of school administrators to bring about a long-lasting improvement in the use of technology at schools. It is a combination of hardware, software, resources, and leaders.	A combination
Tanucan et al. (2022)	DL is the ability of leaders to develop an insightful vision for the application, adoption, and promotion of technology at work to guide schools and their stakeholders toward digital transformation to be adaptable and remain competitive in a rapidly changing digital and social media landscape.	A capability
Karakose and Tülübaş (2023)	DL is defined as a school-level leadership construct that combines leadership skills with digital competences to establish schools that are digitally enabled and responsive to their fast-changing, digital environment. As an innovative, change-oriented, and team-based leadership model, DL is not only about using ICT or digital technologies in performing leadership functions at school but comprises several significant elements such as possessing leadership skills and qualities, providing professional development and support, establishing a digital-friendly culture, developing positive relationships, enabling systemic and structural improvement.	A combination
Luo et al. (2023)	DL is a progressive process in which facing the rapidly changing digital social environment, through the director's digital attitude, digital cognition, and digital capability, he or she will lead the teachers and staff to enhance their digital attitude, cognition, and capability to establish an efficient digital team to realize the process of diversified digital management of preschools and digital practice of technology-enabled preschools gradually and efficiently.	A process

Table 3. (*Continued*).

Author/year	Definition	Define as
Tanucan et al. (2023)	DL is the ability to use technology to create a well-organized system that establishes direction, influences social action, initiates sustainable change, and establishes relationships. It is a more innovative style of management that promotes radical change in education and is known to improve and encourage digital teaching and learning.	A capability

3.4. Analysis of the constructs of DL in educational contexts

Figure 4 the constructs and frequency of digital leadership in educational settings in 2019–2024. It provides a comprehensive overview of the 35 constructs employed in each literature during the same time. The findings of this review indicates that there are 35 constructs related to DL in educational settings as shown in **Table 4**, including visionary leadership/digital vision, digital age learning culture, excellence in professional practice/professional development, systemic improvement, digital citizenship/virtual citizenship, student engagement, learning, and outcomes, innovative learning spaces and environments, professional learning, communication, public relations, branding, opportunity, student engagement and learning, learning environment and space, digital competence/digital skills, equity and citizenship advocate/digital advocacy, visionary planner, empowering leader, systems designer, connected learner, school climate, digital technology usage, support for the digital transformation, revolutionary leadership, continual development, leadership power, digital-based innovative managerial functions, digital figure literacy, digital access, collaboration, digital differentiation, digital governance, technology and infrastructure support, evaluation and research, digital attitude, digital cognition, digital capability, deeply understanding people, ability to influence others, digital organization, drive and integrate technology trends. The findings offer sufficient information regarding the constructs of DL within the educational contexts.

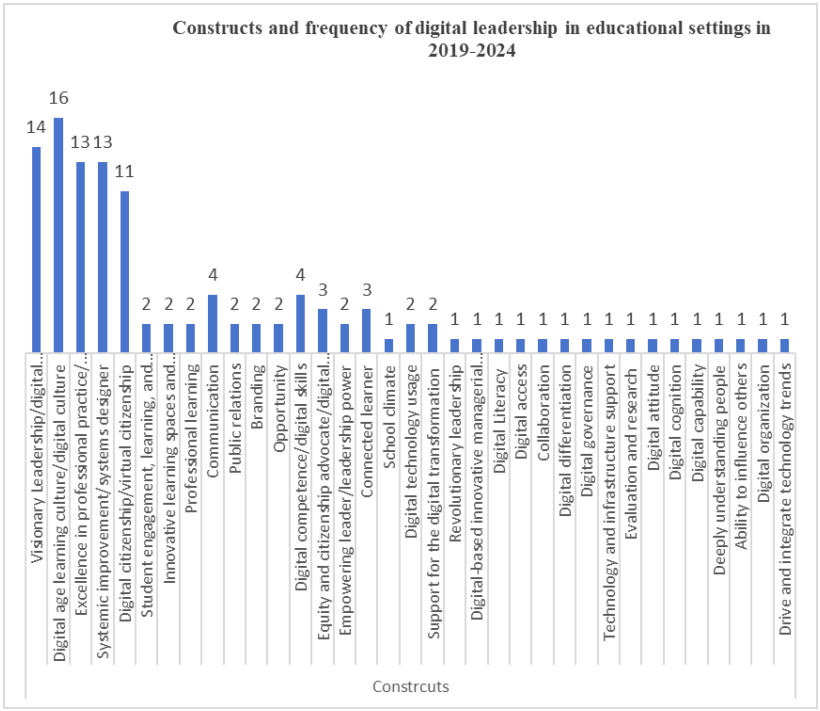

Figure 4. Constructs and frequency of DL in educational settings in 2019–2024.

Table 4. Constructs related to DL educational setting.

Author and Year	Visionary Leadership/digital vision	Digital Age Learning Culture	Excellence in Professional Practice/ professional development	Systemic Improvement	Digital Citizenship/Virtual citizenship	Student engagement, learning, and outcomes	Innovative learning spaces and environments	Professional learning	Communication	Public relations	Branding	Opportunity	Student engagement and learning	Learning environment and space	Digital competence/digital skills	Equity and Citizenship Advocate/Digital advocacy	Visionary Planner	Empowering Leader	Systems Designer	Connected Learner	School climate	Digital technology usage	Support for the digital transformation	Revolutionary leadership	Continual development	Leadership power	Digital-based innovative managerial functions	Digital Literacy	Digital Access	Collaboration	Digital Differentiation	Digital governance	Technology and infrastructure support	Evaluation and research	Digital attitude	Digital cognition	Digital Capability	Deeply understanding people	Ability to influence others	Digital organization	Drive and integrate technology trends
Sheninger (2019)	-	-	-	-	-	√	√	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yusof et al. (2019)	-	-	-	-	-	-	-	-	√				-	-	-	-	-	-	-	-	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agustina et al. (2020a)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agustina et al. (2020b)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ellis et al. (2021)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hafiza Hamzah et al. (2021)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Karakose et al. (2021)	-	√	√	-	-	-	-	-	-	-	-	-	-	-	√	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Author and Year	Constrcuts																																							
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Masrur (2021)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-	-	-	√	-	-
Mohd Izham (2021)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saraih et al. (2021)	-	-	-	-	-	√	√	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AlAjmi (2022)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Karakose et al. (2022)	-	√	√	-	-	-	-	-	-	-	-	-	-	-	√	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Luecha et al.(2022)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	-	-	-	-	-	-	-	-	-	-	-	-	-
Nurhafizah Abdul et al. (2022)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4. (*Continued*).

Author and Year	Constrcuts																																				
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Msila(2022)	√	√	-	-	-	-	-	-	-	-	-	-	-	-	√	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-
Neyisci and Sari (2022)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sunu (2022)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tanti and Sethupathy (2022)	-	√	√	-	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-	-	-	-
Tanucan et al. (2022)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asante and Novak (2023)	-	√	-	-	-	-	-	-	√	-	-	-	-	-	-	-	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	-	-	-	-	-
Luo et al. (2023)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	√	-	-	-	-

Table 4. (*Continued*).

Author and Year	**Constrcuts**																																								
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Suryadi et al. (2023)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√		√	√
Zhou and Tse (2023)	√	√	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ghamrawi and M. Tamim(2022)	-	√	-	-	-	-	-	-	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-

4. Discussion

The study introduces the geographic and time distribution of the publication of DL in educational contexts, it also identifies how DL is defined and the constructs of DL used in educational settings, which offers an overview of current research concerning DL in education field. This review outlines the progress and trends of DL in education over the previous six years. A total of 35 papers published in 14 different countries were examined in this review. The data reveals that countries in the Asia and Pacific region are the leading countries in addressing this issue during these 6 years, Malaysia and Indonesia showed strong interests in DL in educational settings. There has been a significant increase in the number of publications from 2019 to 2022, with the year 2022 exhibiting the largest number of publications.

The findings indicate that although there is no consensus on its nature and definition (Gfrerer et al., 2021; Zulu and Khosrowshahi, 2021), several key characteristics are commonly identified, including the leaders themselves, their behaviors, their influence, the dynamics of interaction between leaders and stakeholders, and the significance of context. In the educational settings, the existing definition was predominantly concerned with using digital technologies in the functional performing leadership functions at school (Karakose and Tülübaş, 2023), several significant elements are commonly identified, including (i) setting the direction, including teaching for future, school development and more than just technologies; (ii) developing people, including professional development for leaders, professional development for teachers, digital competence for students as well as and development of learning cultures; (iii) developing the organization, including digital technologies accessibility, and new forms and structures for sharing; (iv) developing teaching and learning, including creating conditions for new forms of teaching and learning and collegial learning (Håkansson Lindqvist and Pettersson, 2019). In this sense, DL is not only about using digital technologies in performing leadership functions at school but comprises several significant elements such as possessing leadership skills, providing professional development, cultivating a digital culture, developing relationships and enabling systemic and structural improvement (Karakose and Tülübaş, 2023). This review defined DL as a dynamic combination of digital thinking, mindset, behaviors, and skills that are employed to establish direction, provide professional development and support, influence others, initiate sustainable change through the effectively use of digital technologies, and establish relationships in order to anticipate changes that are crucial for school success in the future (Agustina et al., 2020; Antonopoulou et al., 2021; Rusnati and Fakry Gaffar, 2021; Sheninger, 2019; Sunu, 2022; Suryadi et al., 2023).

Based on the findings, it was observed that the five dominant constructs of DL in educational setting are: (i) digital age learning culture (also referred to as digital culture); (ii) visionary leadership (also referred to as digital vision); (iii) excellence in professional practice (sometimes referred to as professional practice excellence or professional development); (iv) system improvement (or system planner) and (v) digital citizenship. The findings of this review are consistent with those of Nurhafizah et al. (2022)'s, who demonstrated that five highest frequency constructs in measuring DL are: (i) professional practice excellence; (ii) digital age learning culture; (iii) digital

citizenship; (iv) systemic improvement, and (v) visionary leadership. However, there is a lack of inconsistency regarding the rank of the frequency of these five dominant constructs. More specifically, the finding of this review reveals that the construct with the highest frequency was digital age learning culture (also referred to as digital culture). The second most frequently used construct was visionary leadership, which is also known as digital vision. Following closely behind were excellence in professional practice (also known as professional development or professional practice excellence) and system improvement (or system planner). Digital citizenship (also known as virtual citizenship) ranked as the fifth highest construct. While in the review conducted by Nurhafizah et al. (2022), excellence in professional practice was the highest frequency construct, visionary leadership ranked the second, digital age learning culture ranked as the third most frequently used construct, systemic improvement ranked the third, while digital citizenship ranked the fifth.

Regarding the five dominant constructs of DL identified in this review, digital age learning culture suggests that educational leaders should foster a culture of innovation and collaboration, allowing both educators and learners to explore and experiment with digital technologies to enhance teaching and learning in innovative ways (ISTE, 2018). According to AlAjmi (2022), educational leaders with a clear vision can set direction for the organizations and enhance the efficiency of decision-making processes, which can effectively engage educational stakeholders in the pursuit of goals (Karakose and Tülübaş, 2023). Additionally, visionary leaders ought to actively seek and facilitate communication and collaboration among stakeholders inside or outside the organizations (Ellis et al., 2021). Therefore, it is crucial for educational leaders to actively engage education stakeholders in the development of a common vision, strategic plan, and continuous evaluation process to promote the incorporation of digital technology into the educational process (ISTE, 2018). The excellence in professional practice construct plays a crucial role in facilitating the successful integration of digital technologies into the teaching process. This is because ongoing professional development can equip educational leaders and teachers with the essential skills and confidence required to effectively implement new digital technologies (Ellis et al., 2021). Educational leaders must model and advocate continuous professional development for themselves and educators. The systemic improvement construct implies that school leaders should establish robust infrastructure and systems to ensure that resources for supporting the effective use of digital technology for teaching and learning are sufficient and scalable (ISTE, 2018). Digital citizenship (also known as virtual citizenship) construct implies that educational leaders should model digital citizenship by critically evaluating online resources, engaging in civil discourse online, as well as cultivating responsible online behavior, including the safe, ethical, and legal use of technology (ISTE, 2018).

In addition to this, although the effective use of digital technologies in teaching and learning holds significant importance in enhancing teaching and learning, issues like educational equity, such as digital divide and learning gaps, is still regarded a global issue, learners who are impacted by poverty, learners with disabilities, and children living in residential care, rural area and remote regions still can’t access to specialized and targeted equipment and support (Zhuang et al., 2023). Educational leaders must ensure that all students have skilled teachers who are actively using

digital technology in teaching and learning, all students and teachers can access digital learning devices and seamless internet connectivity as recommended by Schiuma et al. (2024). Apart from that, personal privacy protection and data security are major concerns by the international community, which has also become serious issues in education and challenges for the development of education in the future (Zhuang et al., 2023), educational leaders should cultivate the legal, safe, and ethical use of digital technologies. Therefore, digital leadership demands a set of certain dimensions—equity advocate, security and privacy—to ensure education equity as well as the privacy protection and data security (Zhuang et al., 2023). This was in line with the definition of equity and citizenship advocate construct defined by ISTE (2018) and Ellis et al. (2021), which was defined as school leaders' capability to use digital technologies to increase equity, inclusion, and digital citizenship practices. This includes ensuring all students have skilled teachers and technologies access, modeling digital citizenship by critical evaluating and cultivating responsible and legal use of digital technology. In this sense, equity and citizenship advocate construct should be highly concerned in future study. Findings of this study has resonated the previous findings underscore the importance of a holistic approach to digital leadership in education, combining technological adoption, cultural support, and strong leadership to drive success (Asif et al., 2024; Asif and Yang, 2021).

5. Conclusion

This review explored the geographical and time distribution of publications, the definition and the constructs of digital leadership commonly used in educational settings in 2019–2024. It's clear that DL in educational settings have received increasing attention in recent years, Malaysia and Indonesia showed a strong interest in addressing the issues related to DL in education. The reviewed publications primarily defined DL as a process, a combination, or integration, the existing definitions were primarily concerned with the functional aspects of leadership. After reviewing the constructs used in previous research, the top five frequency used constructs of DL are: Digital age learning culture, visionary leadership, excellence professional practice, systemic improvement, and digital citizenship. However, there are some global issues existing in smart education, including educational equity, security, and privacy (Zhuang et al., 2023), this review suggests that the equity and citizenship advocate constructs should be highly concerned. Therefore, this review suggests that the top five constructs of digital leadership should be equity and citizenship advocate, digital age learning culture, visionary leadership, excellence professional practice, systemic improvement, which should be included in the training for future school leaders.

The study also offers an overarching perspective on how educational leaders are adapting to the digital age, exploring the utilization of technology to enhance teaching and learning processes while addressing associated challenges. In parallel, the study resonates previous findings in providing specific insights within the Malaysian educational context (Alias et al., 2024; Ismail et al., 2022; Yusof et al., 2022). They respectively explore into ethical considerations for academic leaders, the transformation of music education through digital means for gifted students, and the

implementation of online distance learning initiatives for the gifted within the Malaysian system, illustrating how digital leadership manifests across diverse educational domains.

Considering that literature on DL in educational settings is rather young and quite limited (Karakose and Tülübaş, 2023), this systematic literature review could contribute to the deepening of the theoretical debate on DL, it offers valuable guidance for researchers interested in DL, pointing to areas for future research. Furthermore, the review highlights the functional aspects and the significance of DL in education, which offers valuable insights for educational leaders seeking to develop DL abilities within their organizations. In addition, building on identified constructs, this study advances the individual potential of school leaders in DL, which may improve the practice among the school leaders. Finally, these findings have the potential to enhance the understanding of how to tackle the difficulties posed by educational digitalization in the field of leadership.

6. Limitations

This systematic literature review has certain limitations. First, this review exclusively examined publications sourced from the Scopus and Web of Science (WoS) databases concerning digital leadership in educational settings, it is possible that certain previously published works were overlooked. Second, it is important to note that our search for articles has been limited to the time ranging from 2019 to 2024 to emphasize the findings from more recent years. Moreover, we mainly focused on the publications written in English, articles about digital leadership in educational settings published in other languages were excluded, there is a possibility of a geographical bias, as it relied on data that was more easily accessible from certain areas. In the future, it might be beneficial to enhance the review by adding supplementary databases and extending the duration. In future systematic literature reviews, it is advisable to have a minimum of two individuals utilize the evaluation criteria to review papers. Additionally, since this review doesn't identify the measurement for assessing DL, due to the increasing interest on this topic, future study should prioritize the investigation of the matter concerning the measurement and assessment of digital leadership.

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