

Assessing the Readiness of School Principals for Digital Leadership: An Exploratory Data Analysis Approach

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Abstract: The growing demand for quality education in the digital era requires schools to adopt strategic and visionary leadership, particularly in integrating digital technologies. This study investigates the readiness of school principals in implementing digital leadership by examining key dimensions, including visionary leadership, digital-age learning culture, professional development, systemic improvement, ethical technology use, and strategic resource planning. Employing a quantitative descriptive approach, the study uses Exploratory Data Analysis (EDA) to uncover patterns and relationships across multiple indicators of digital leadership. Data was collected through structured questionnaires distributed to 43 vocational school leaders in Karawang Regency, Indonesia, during a facilitated community engagement programme. The findings reveal that professional development is the most influential factor in supporting digital leadership readiness, followed closely by systemic improvement and the cultivation of a digital-age learning culture. Additionally, strategic partnerships, ethical use of technology, and the provision of infrastructure and equitable digital access are strongly interconnected, highlighting the need for a holistic approach to digital leadership. Visionary leadership, while important, shows relatively lower correlation, suggesting that vision alone is insufficient without operational and developmental support. This study concludes that digital leadership readiness is not the result of isolated efforts but the outcome of a comprehensive and coordinated strategy involving human resource capacity, institutional culture, infrastructure, and ethical guidance.

Keywords: Digital leadership readiness; School principals' competence; Vocational high schools; Technology integration in education; Educational quality improvement.

INTRODUCTION

The Fourth Industrial Revolution has significantly transformed various sectors, driven by advancements in mobile internet, cloud computing, and artificial intelligence (Xu et al., 2018; Ross & Maynard, 2021). The COVID-19 pandemic further accelerated this transformation, necessitating the rapid adoption of digital technologies across organisations (Peimani & Kamalipour, 2021; Shin et al., 2023).

In the educational sector, this digital shift has compelled schools to integrate technology into teaching and administrative processes. School principals play a pivotal role in leading this digital transformation, requiring them to possess not only technological proficiency but also visionary leadership

skills (Navaridas-Nalda et al., 2020; Di Sia, 2023). Effective digital leadership encompasses various dimensions, including fostering a digital culture, promoting professional development, and ensuring systemic improvement (Anderson & Dexter, 2020; Rajab et al., 2022). Recent studies have highlighted the challenges faced by school leaders in implementing digital initiatives, such as resistance to change, limited digital competencies, and infrastructural disparities (Young, 2022; Wang et al., 2020). Moreover, the success of digital transformation in schools is highly influenced by principals' perceptions of technological usefulness and their ability to align digital initiatives with school contexts (Navaridas-Nalda et al., 2020).

Despite growing awareness of the importance of digital leadership, there remains a limited empirical understanding—particularly in developing regions—of how prepared school principals are to implement technology-driven change. Most existing studies focus either on infrastructure readiness or general attitudes toward technology, without systematically exploring the multidimensional competencies required for effective digital leadership. This presents a critical gap, especially in the context of vocational high schools that face unique digital integration challenges due to their skill-based curricula and operational complexities.

To navigate these challenges, principals must adopt a collaborative approach, engaging teachers, students, and the broader educational community in the digitization process (Frolova et al., 2020; Nababan et al., 2022). This leadership style not only enhances the effectiveness of digital initiatives but also fosters a sense of ownership and shared responsibility among stakeholders.

Furthermore, the development of digital competencies among school leaders is crucial. Training programs and continuous professional development opportunities can equip principals with the necessary skills to lead digital transformation effectively (Ritzhaupt et al., 2021; Trust et al., 2020). In addition, several scholars emphasize the importance of visionary leadership that transcends basic technology use and fosters a long-term digital culture in schools (Salazar-Márquez, 2022; Zhu, 2023). Karakose et al. (2023) also suggest that strong digital leadership contributes to sustainable school management, particularly during times of crisis such as the COVID-19 pandemic. These competencies are essential for school leaders to adapt and thrive in evolving educational environments (Sheninger, 2019).

The literature consistently identifies five interrelated dimensions of digital leadership: visionary leadership, digital-age learning culture, professional development, systemic improvement, and digital citizenship (Anderson & Dexter, 2020; Rajab et al., 2022; Gustave & Alarfaj, 2021). Understanding and

enhancing these competencies is essential for successful digital transformation in educational institutions.

Therefore, the aim of this study is to explore the readiness of school principals in implementing digital leadership by using Exploratory Data Analysis (EDA) to identify the interrelationships between key digital leadership dimensions. This study is grounded in the theoretical framework of Digital Leadership Theory, which views leadership not only as an administrative function but as a transformative driver that integrates vision, learning culture, infrastructure, professional growth, and ethical digital engagement. By addressing the gap in readiness-focused empirical research and applying a data-centric approach, this study seeks to provide insights for policymakers and educational leaders to strengthen institutional capacity in the digital era.

Literature Review

Digital Leadership in Education

Digital leadership in education has become increasingly pivotal in navigating the complexities of the 21st-century learning environment. As educational institutions integrate technology into their pedagogical and administrative processes, the role of school leaders has evolved to encompass not only managerial competencies but also digital acumen and visionary thinking.

Defining Digital Leadership in Educational Contexts

Digital leadership in education refers to the strategic use of digital tools and platforms by school leaders to enhance teaching, learning, and organizational efficiency. This concept extends beyond mere technological proficiency; it involves fostering a culture that embraces innovation, collaboration, and continuous improvement (Sheninger, 2019). Key components include setting a clear vision for digital integration, promoting professional development, and ensuring equitable access to technology (Anderson & Dexter, 2020).

Core Dimensions of Digital Leadership

Research has identified several core dimensions essential for effective digital leadership:

1. **Visionary Leadership:** Establishing and communicating a clear, strategic vision for technology integration in schools (Salazar-Márquez, 2022).

2. **Digital-Age Learning Culture:** Creating an environment that encourages innovation and the effective use of digital tools in teaching and learning (Zhu, 2023).
3. **Professional Development:** Providing ongoing training and support for teachers to enhance their digital competencies (Ritzhaupt et al., 2021).
4. **Systemic Improvement:** Implementing policies and practices that support sustainable digital transformation within the educational system (Rajab et al., 2022).
5. **Digital Citizenship:** Promoting responsible and ethical use of technology among students and staff (Trust et al., 2020).

Impact of Digital Leadership on Educational Outcomes

Effective digital leadership has been linked to improved educational outcomes, including enhanced student engagement, better academic performance, and increased teacher satisfaction (Frolova et al., 2020). During the COVID-19 pandemic, schools led by digitally competent principals were more adept at transitioning to remote learning, highlighting the importance of digital leadership in crisis management (Shin et al., 2023).

Challenges in Implementing Digital Leadership

1. Despite its benefits, implementing digital leadership in education faces several challenges:
2. **Resistance to Change:** Teachers and staff may be hesitant to adopt new technologies due to a lack of familiarity or fear of increased workload (Wang et al., 2020).
3. **Resource Constraints:** Limited funding and infrastructure can hinder the effective integration of digital tools (Young, 2022).
4. **Digital Divide:** Inequities in access to technology among students can exacerbate existing educational disparities (Karakose et al., 2023).

Strategies for Enhancing Digital Leadership

To overcome these challenges, several strategies have been proposed:

1. **Collaborative Leadership:** Engaging all stakeholders, including teachers, students, and parents, in the digital transformation process (Nababan et al., 2022).
2. **Continuous Professional Development:** Offering regular training sessions to keep staff updated on emerging technologies and pedagogical approaches (Ritzhaupt et al., 2021).

3. Policy Development: Establishing clear guidelines and policies to support the ethical and effective use of technology in schools (Salazar-Márquez, 2022).

Future Research Directions

While the existing literature provides valuable insights into digital leadership in education, further research is needed to explore its long-term impact on student outcomes and to identify best practices for implementation across diverse educational contexts (Zhu, 2023).

RESEARCH METHODOLOGY

This study employed a quantitative descriptive approach using Exploratory Data Analysis (EDA) to explore the readiness of vocational school principals in implementing digital leadership. The research design focused on identifying patterns and insights from empirical data without initial hypotheses, thus allowing for a more flexible and data-driven exploration.

Instrument Development

The questionnaire instrument was developed by synthesizing key dimensions of digital leadership found in relevant international literature (Anderson & Dexter, 2020; Rajab et al., 2022; Gustave & Alarfaj, 2021). These dimensions include visionary leadership, digital-age learning culture, professional development, systemic improvement, and digital citizenship. The item development process involved adapting indicators from previous validated instruments and expert consultation to ensure contextual relevance for vocational school settings.

Table 1. The following are the variables and indicators used:

Variable	Indicator
Visionary Leadership	1. Inspire the Use of Digital Resources
	2. Support the use of digital resources
	3. Maximize its performance through the use of digital resources
	4. Continuously engage in integrating technology with vision
	5. Create funding program policies for the implementation of technology-infused visions
Digital Age Learning Culture	1. Ensure Digital Age Learning instructional innovation
	2. Model the use of technology for learning
	3. Promote the use of technology for learning
	4. Provide an environment with technology
	5. Ensure technology practices in the curriculum

	6. Promote and participate in digital communities
Professional Development	<ol style="list-style-type: none"> 1. Ensure professional growth of technology integration 2. Facilitate learning communities using technology 3. Promote communication and collaboration using digital age tools 4. Model communication and collaboration using digital age tools 5. Follow research, education and technology usage trends 6. Encourage evaluation of potential new technologies 7. Leading change through the use of technology
Systemic Improvement	<ol style="list-style-type: none"> 1. Collaborate to improve performance 2. Recruit and retain highly competent personnel in using technology 3. Build and leverage strategic partnerships 4. Build a robust infrastructure for technology 5. Ensure equitable access to appropriate digital tools and resources
Digital citizenship	<ol style="list-style-type: none"> 1. Promote, model and establish policies for the safe, legal and ethical use of digital information and technology 2. Promote and model responsible social interactions related to the use of technology and information 3. Create models and facilities for information technology

Source: (Zhong, 2017)

Population and Sampling

The population of this study consisted of school leaders from vocational high schools (SMKs) in Karawang Regency, Indonesia. A purposive sampling technique was applied, targeting schools willing to participate and having internet access to complete the digital questionnaire. A total of 43 vocational schools were involved, each represented by a school administrator (principal or vice-principal) with strategic roles in school digital transformation.

Data Collection Procedure

Data were collected through a structured self-administered questionnaire distributed during a community engagement activity organized by the research team. Participants were briefed on the purpose of the study and guided through the questionnaire by researchers to ensure clarity and accuracy. This hybrid approach-community service integration and guided administration-served as a novel aspect in increasing respondent engagement and understanding of digital leadership concepts.

Data Analysis and Visualization

After initial cleaning and preprocessing, the responses were subjected to Exploratory Data Analysis (EDA) using Python-based tools (Pandas, Matplotlib, Seaborn) to examine variable distributions, identify patterns, and explore potential relationships between dimensions. EDA allowed the visualization of principal readiness across the five digital leadership dimensions. Bar charts, box plots, and correlation heatmaps were utilized to identify trends and outliers, providing deeper insight into institutional digital leadership readiness.

This study presents a novelty by applying EDA in the context of school leadership, a method that is more commonly associated with data science. By integrating data-driven analysis into the evaluation of leadership readiness, this research bridges the gap between educational leadership studies and modern analytical techniques.

Recommendation Formulation

Based on the patterns revealed through EDA, the study concluded with the formulation of practical recommendations for enhancing digital leadership readiness. These suggestions were grounded in best practices from prior studies and adapted to the local context, thus contributing to both theory and practice in educational digital transformation.

RESULTS AND DISCUSSION

Result

1. Visionary Leadership

Based on the results of data collection, the following are the data results from visionary leadership:

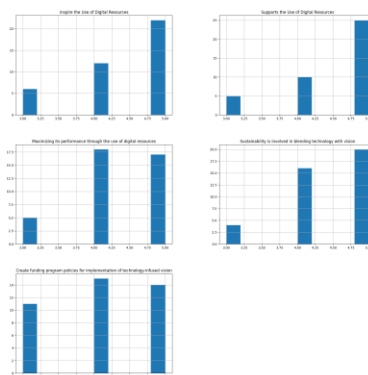


Figure 1. Visionary Leadership

Figure 1 shows that almost all principals have inspired the use of digital resources, supported the use of digital resources, maximized their performance through the use of digital resources, and continuously been involved in integrating technology with vision and creating funding programs to implement technology-infused visions. About five schools lack this visionary leadership, especially in the indicator of technology-infused funding policies. In addition, we can also see the relationship between indicators in this visionary leadership variable as follows:

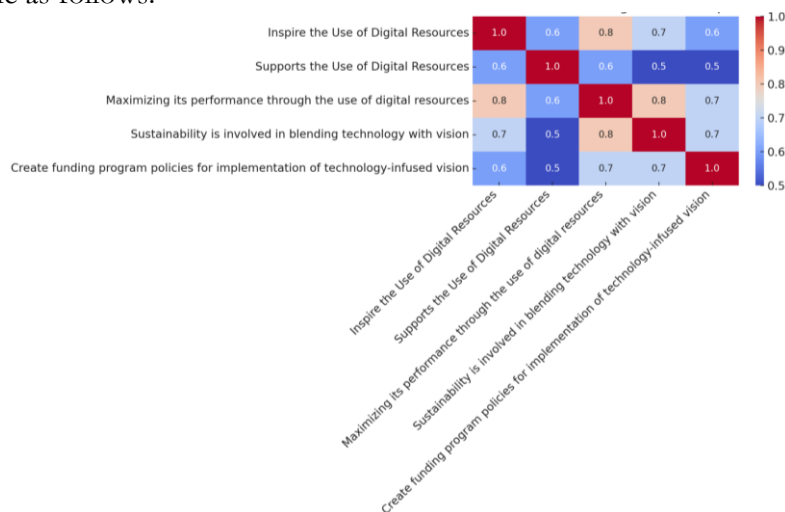


Figure 2 Relationship between indicators in the visionary leadership variable

Based on Figure 2, The correlation analysis between five key indicators of digital leadership reveals critical insights into how these elements interact to support the implementation of a technology-infused vision in schools. Among the variables, “*Maximizing its performance through the use of digital resources*” emerged with the highest average correlation (0.725) with other variables, indicating that effective utilization of digital tools plays a central role in reinforcing all other aspects of digital leadership. This suggests that when school leaders focus on performance optimization through digital means, it positively influences their ability to sustain, inspire, and support a technology-driven vision. Following closely, “*Sustainability is involved in blending technology with vision*” and “*Inspire the use of digital resources*” both demonstrate high average correlations (0.675), emphasizing the importance of long-term strategic thinking and inspirational leadership. These dimensions highlight that successful digital leadership is not merely about adopting technology, but about embedding it into a sustainable, forward-thinking vision that motivates and engages all stakeholders. Conversely, “*Create funding program policies for the implementation of technology-infused vision*” shows a slightly lower average correlation (0.625), implying that while funding policies

are important, they must be complemented by visionary and performance-focused strategies to be truly effective. The lowest average correlation was observed in “*Supports the use of digital resources*” (0.55), suggesting that passive or administrative support alone may not significantly drive digital transformation unless it is strategically aligned with broader leadership initiatives. In summary, the analysis demonstrates that digital leadership is most impactful when it balances inspiration, sustainability, and performance optimization, rather than relying solely on policy or basic support structures.

2. Digital Age Learning Culture

The following are the results of the distribution of digital age learning culture:

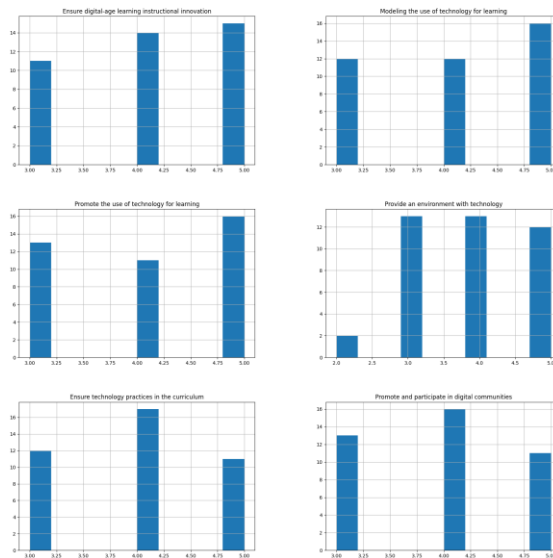


Figure 3. Digital Age learning Culture

In the indicator of ensuring digital age learning instructional innovation, it can be seen that almost 15 schools answered that the principal had ensured the innovation. This is also followed by the indicator of modelling the use of technology for learning. While in the indicator of promoting the use of technology for learning, providing an environment with technology, ensuring technology practices in the curriculum and participating in the digital community, almost 12 schools still appear lacking. In addition, it can be seen in the indicator of providing an environment with technology; it turns out that two schools have not done it. The following is the relationship between indicators in the digital age learning culture:

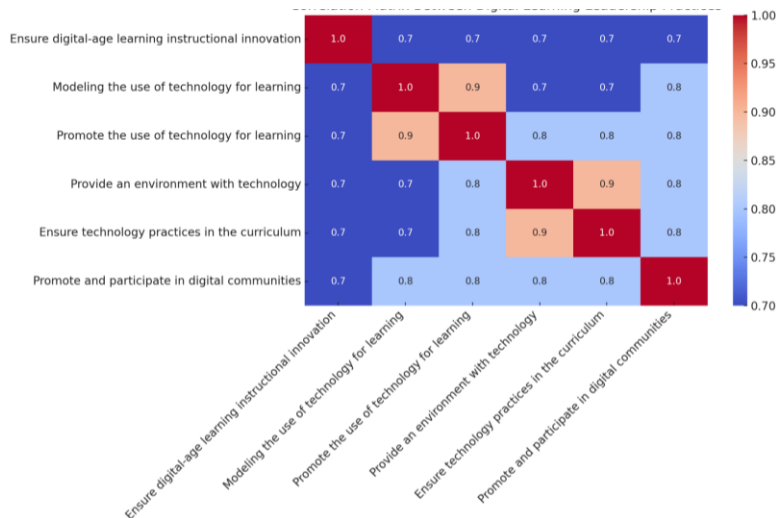


Figure 4. Relationship between indicators in digital age learning culture

The analysis of digital learning leadership variables reveals a strong and interconnected structure among the six examined dimensions. The variable “*Promote the use of technology for learning*” shows the highest average correlation (0.80) with all other indicators, indicating that advocacy and encouragement by school leaders are central to fostering a digital-age learning environment. When leaders actively promote technology usage, it tends to reinforce other critical dimensions such as innovation, modeling, curriculum integration, and community participation. Closely following are “*Provide an environment with technology*” and “*Ensure technology practices in the curriculum*”, each with an average correlation of 0.78. These findings suggest that physical and pedagogical integration of technology forms the backbone of effective digital learning. Creating a technology-rich environment and embedding tech practices in the curriculum not only enhance instructional effectiveness but also increase alignment among stakeholders within the educational system.

Interestingly, “*Promote and participate in digital communities*” also exhibits a high average correlation (0.78), indicating the growing importance of collaborative and networked leadership in digital transformation. Leaders who actively engage in digital communities set an example and create networks of continuous learning that positively influence their institutions. “*Modeling the use of technology for learning*” also demonstrates a strong association (0.76), reinforcing the idea that leaders who exemplify digital practices inspire adoption among teachers and staff. On the other hand, “*Ensure digital-age learning instructional innovation*”- while still significantly correlated-has the lowest average (0.70), suggesting that innovation efforts may require more strategic alignment with other dimensions to achieve systemic impact. In summary, the results highlight

that effective digital leadership in learning environments is multidimensional, where promotion, environment building, and community engagement play dominant roles. Instructional innovation, although important, benefits greatly from being supported by these foundational leadership practices.

3. Professional Development

The following are the results of the distribution of professional development:

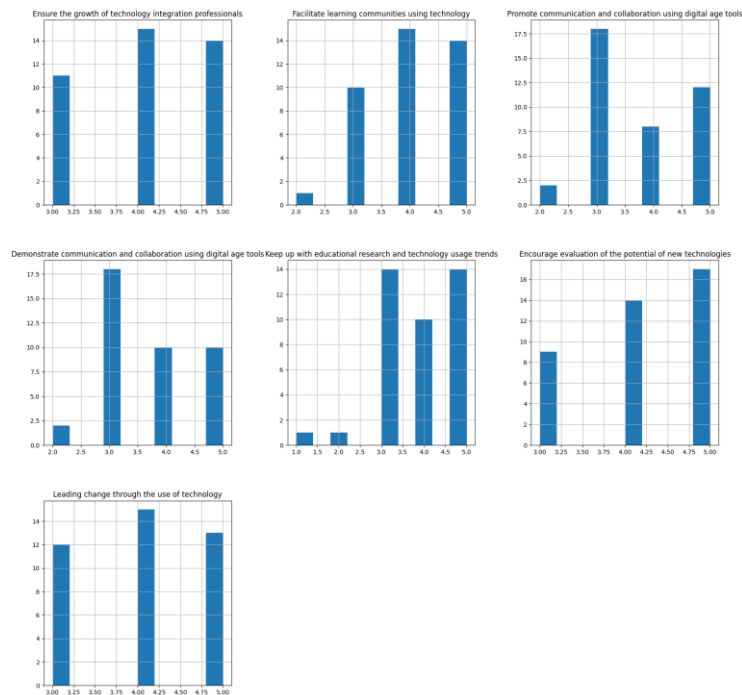


Figure 5. Professional development results

Based on Figure 5, it can be seen that the principals of almost 10 schools lack the ability to ensure professional growth integrated with technology. In addition, it was found that there were nearly 2 schools that did not promote or exemplify the Communication and collaboration of digital age tools. In the indicator of following research and education, one school did not do it. In the indicator of evaluating the potential of new technology, almost all schools did it. The indicators of the following research, education, and the use of technology were also carried out by nearly all schools, with a range of choices from 3 to 5. This was also followed by the indicator of facilitating learning communities using technology.

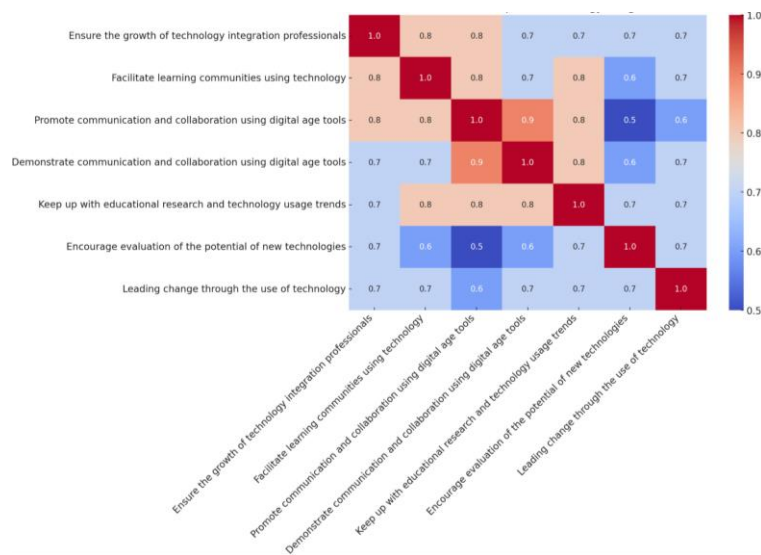


Figure 6. Relationship between indicators in the professional development variable

The analysis of leadership practices related to technology integration reveals a strong, interconnected framework among the seven variables. At the top of the correlation rankings is *“Keep up with educational research and technology usage trends”* with an average correlation of **0.75**, signifying that staying updated with emerging research and technology trends is a central pillar that reinforces other leadership behaviors. Leaders who actively monitor and engage with current educational innovations tend to also excel in fostering collaboration, promoting communication, and leading meaningful change through technology.

1. Closely following are four variables tied at an average correlation of **0.73**:
2. *“Ensure the growth of technology integration professionals”*,
3. *“Facilitate learning communities using technology”*,
4. *“Promote communication and collaboration using digital age tools”*, and
5. *“Demonstrate communication and collaboration using digital age tools”*.

These findings highlight the importance of distributed leadership in digital environments. Building capacity by supporting tech-integrated professionals, fostering collaborative learning networks, and leading by example in communication practices significantly enhance a school's digital transformation journey. This cohesive alignment suggests that instructional modeling and professional development are deeply intertwined with community engagement and communication fluency in the digital age.

Meanwhile, *“Leading change through the use of technology”* holds a slightly lower, but still substantial, average correlation of **0.68**. This shows that change

leadership—while important—requires a strong foundation in ongoing communication, research-based practice, and professional learning to be most effective. The lowest among the group is “*Encourage evaluation of the potential of new technologies*” with an average correlation of **0.63**. Although this task is essential, the relatively lower score suggests that this practice might often be performed in isolation, or lacks integration with broader leadership actions such as modeling and community participation. It may also indicate that many school leaders are still cautious or inconsistent when critically assessing new technological tools. Summary, effective leadership in digital transformation requires more than isolated actions—it demands a coherent set of practices. Leaders who balance awareness of technological trends, actively engage in communication and collaboration, and build internal professional capacity are better positioned to drive sustainable change. Encouraging critical evaluation of new tools remains necessary, but it must be anchored within a culture of continuous professional learning and system-wide collaboration.

4. Systemic Improvement

The following are the results of the Systemic Improvement:

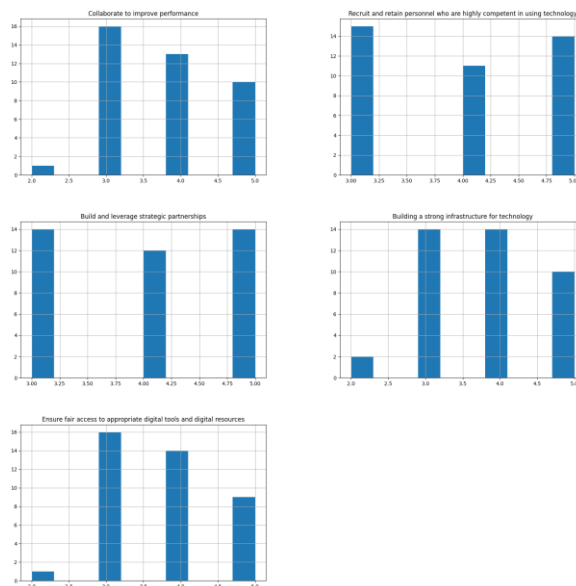


Figure 7. Systemic Improvement Results

In the systemic improvement variable, the principals have collaborated to improve performance, recruited and retained competent personnel in the use of technology, built and utilized strategic partnerships, built a strong infrastructure for technology and ensured fair access to digital tools and digital

resources. Only two schools still lack collaboration to improve performance and build infrastructure for technology.

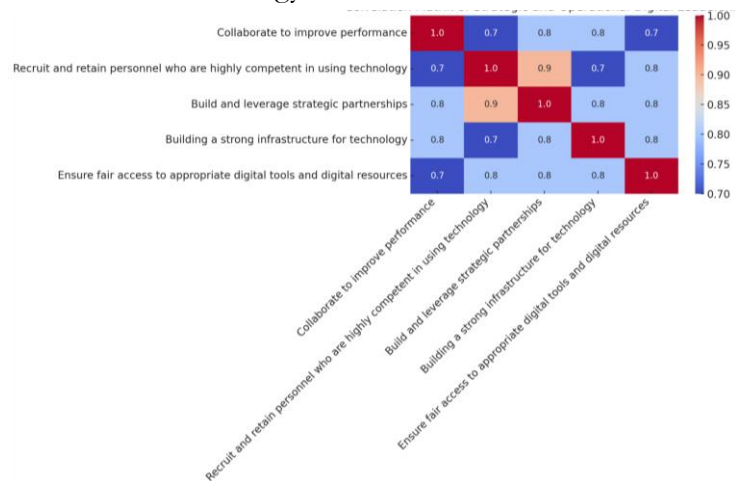


Figure 8. Relationship between indicators in the systemic improvement variable

The analysis of the correlation matrix between five strategic leadership indicators highlights the interconnected nature of effective digital leadership practices. Among them, “*Build and leverage strategic partnerships*” has the highest average correlation (0.825) with the other indicators. The evidence suggests that strategic partnerships are not only valuable in themselves but also reinforce other aspects of leadership—such as talent acquisition, infrastructure development, and equitable access to digital resources. Effective school leaders appear to rely heavily on external collaborations to enhance institutional performance and extend their digital capacities. Closely following are “*Recruit and retain personnel who are highly competent in using technology*”, “*Build a strong infrastructure for technology*”, and “*Ensure fair access to appropriate digital tools and digital resources*”, each with a high average correlation of **0.775**. These three variables form the backbone of operational readiness in digital leadership. Investing in skilled personnel ensures that digital tools are used effectively, while a robust infrastructure and fair access to digital resources create an environment in which technological integration can flourish equitably. Interestingly, “*Collaborate to improve performance*”, while still highly correlated (**0.75**), ranks slightly lower. The result indicates that internal collaboration, although vital, might be more dependent on foundational aspects such as talent, tools, and strategic alliances. Collaboration likely thrives best when the necessary human and technological infrastructure is already in place. This analysis illustrates that building strategic partnerships is a central leadership practice that amplifies the impact of other operational domains. Meanwhile, talent, infrastructure, and digital equity form an interdependent triad essential for digital transformation. Collaboration to

enhance performance, although critical, appears to be most effective when underpinned by a solid strategic and operational base. These insights underscore the importance of holistic planning and system-wide alignment in educational digital leadership.

5. Digital Citizenship

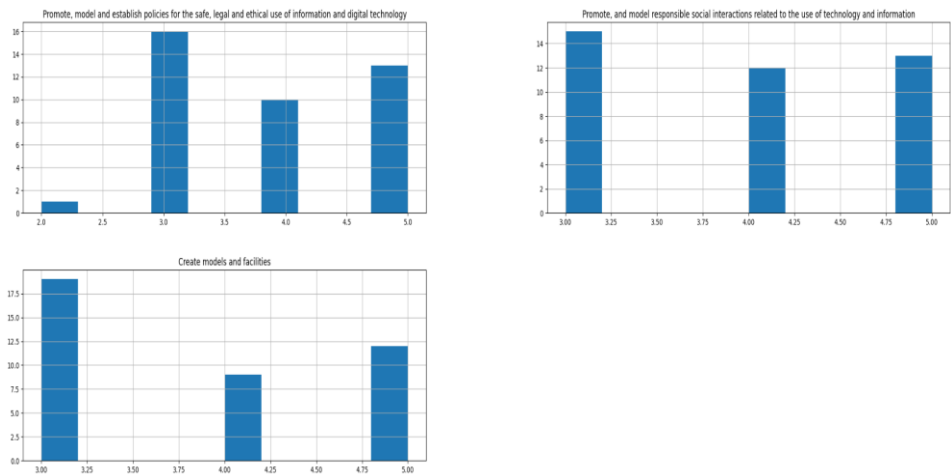


Figure 9. Relationship between indicators in the Digital Citizenship

Based on Figure 9, it can be seen that almost all schools have promoted, modeled, and established policies for the safe, legal, and ethical use of digital information and technology and have promoted and exemplified responsible social interactions related to the use of technology and information. It can be seen that there is one school that is lacking in promoting, modeling, and establishing policies for the safe, legal, and ethical use of digital information and technology.

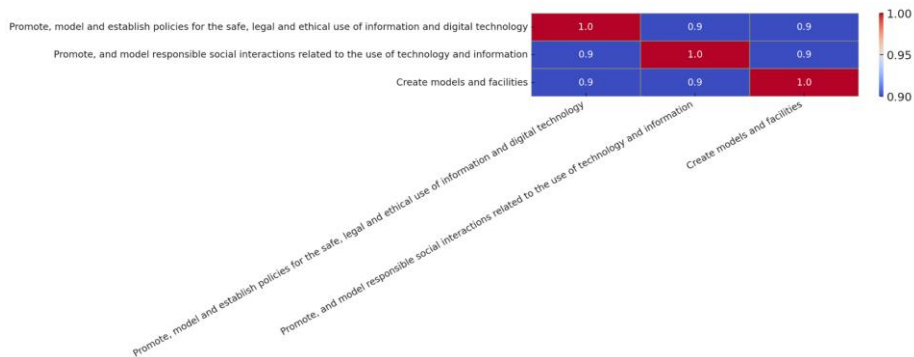


Figure 10. Relationship between indicators in the digital citizenship variable

The correlation analysis among the three indicators reveals a near-perfect alignment in the ethical, legal, and social dimensions of digital leadership. All three variables—*“Promote, model and establish policies for the safe, legal and ethical use of Information and digital technology”*, *“Promote and model responsible social interactions related to the use of technology and information”*, and *“Create models and facilities that demonstrate an equally high average correlation of 0.9 with one another.* This exceptionally strong interdependence indicates that these dimensions are not only conceptually related but are also consistently practiced together in real-world educational leadership settings. The result suggests that ethical policy development, digital citizenship, and infrastructure support operate in a tightly integrated manner. Promoting and modelling legal and ethical behaviour cannot be effectively executed without also modelling responsible social use of technology and creating an environment that supports these values. In other words, ethical leadership in the digital domain is not just about rules—it is about example-setting and systemic support. Moreover, the strong correlation between *“Create models and facilities”* and the other two variables emphasises the importance of tangible, physical, and digital infrastructure to support abstract ethical values. Without well-established facilities—such as controlled access systems, content filtering tools, and digital literacy programs—the implementation of ethical and responsible behaviour policies may remain superficial or difficult to enforce. This analysis highlights that ethical digital leadership is holistic, requiring coherence between policies, modelled behaviours, and the provision of enabling systems. When school leaders align these three dimensions, they not only build trust and integrity in technology use but also foster a culture of accountability and responsible digital citizenship across the institution. The equally strong relationships among all variables underscore the need for an integrated approach to ethics and safety in digital transformation.

Discussion

The results of the principal’s readiness to implement digital leadership can be seen based on data collection.

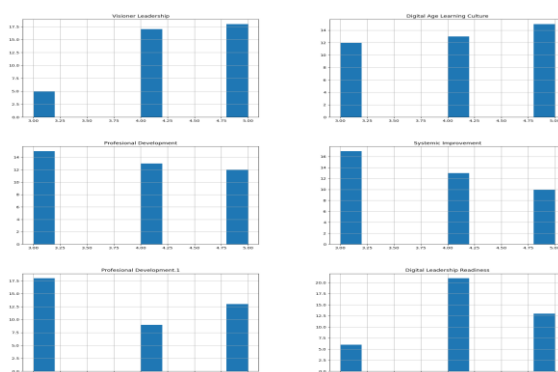


Figure 11. Average results of all principal readiness variables in implementing digital leadership.

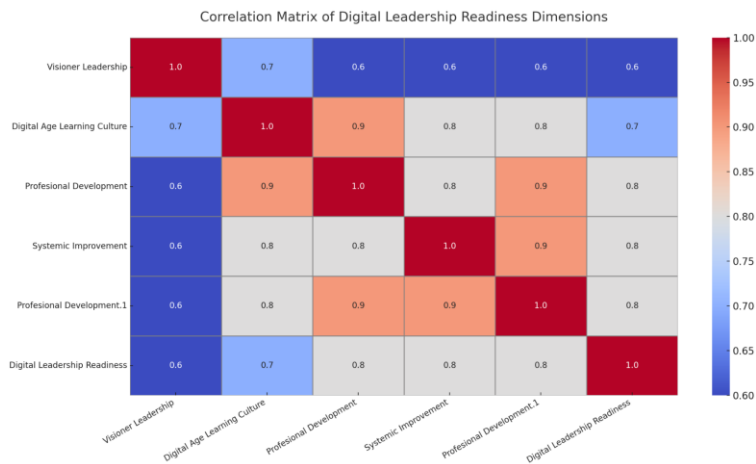


Figure 12. Correlation between variables of the principal's readiness to implement digital leadership

The analysis of the correlation matrix among six dimensions of digital leadership readiness provides valuable insights into the relative influence and interdependence of each component. Among all variables, *professional development* (including the duplicated label “professional development.1”) ranks highest with an average correlation of **0.80**, underscoring its central role in supporting other elements of digital leadership. This implies that initiatives aimed at improving the skills and competencies of school leaders and staff are fundamental to developing readiness for digital transformation. *Digital Age Learning Culture* and *Systemic Improvement* both show strong average correlations of **0.78**, reinforcing their importance in the ecosystem of digital leadership. A culture that promotes digital-age learning—marked by innovation, collaborative practices, and learner-centered environments—directly enhance the effectiveness of both professional development and strategic systemic reform. Likewise, improving systems at the institutional level ensures sustainability and scalability of digital practices, thus reinforcing readiness. *Digital leadership readiness* itself exhibits a strong average correlation (**0.74**) with the contributing dimensions, especially with professional development and systemic improvement. This evidence suggests that readiness is not a standalone construct but rather a cumulative outcome of several strategic and developmental initiatives working in tandem. Interestingly, *visionary leadership*, while essential conceptually, ranks the lowest in average correlation (**0.62**). This study suggests that while having a clear vision is important, it must be actively supported by tangible actions—such as building capacity, transforming learning culture, and improving systems—to be impactful. Without implementation mechanisms, visionary thinking may not significantly impact readiness. This analysis emphasises that professional development is the

cornerstone of digital leadership readiness, closely followed by cultivating a digital-age learning culture and making systemic improvements. Readiness is best developed through a holistic approach where vision is translated into action through training, structural reform, and cultural change. Schools aiming to improve their digital leadership capabilities must prioritise professional learning and institutional transformation alongside strategic planning.

CONCLUSION

This study aimed to explore the readiness of school principals in implementing digital leadership through an in-depth analysis of several core dimensions, using exploratory data techniques to reveal interrelationships among leadership practices. The findings offer significant insights into how digital leadership readiness is shaped by visionary planning, strategic implementation, professional development, and ethical digital citizenship. Across all clusters of variables, professional development consistently emerged as the strongest contributor to digital leadership readiness. Both in terms of building internal capacity and enabling systemic improvements, investing in the continuous learning of educators and leaders is fundamental. It is not only highly correlated with leadership performance but also with strategic alignment, ethical practice, and cultural change within schools. Equally important are systemic improvement and digital-age learning culture, which demonstrate strong relational impact across multiple leadership practices. These dimensions highlight the importance of transforming not just individual skills, but the entire learning environment—creating ecosystems that support innovation, collaboration, and sustainability in digital education. On a strategic level, building partnerships, infrastructure, and ensuring fair access to digital tools are shown to be foundational for enabling collaboration and performance. The ability to leverage external networks and resources amplifies internal efforts, supporting long-term success in digital transformation. Meanwhile, ethical leadership practices—including modeling responsible technology use and creating safe digital environments—demonstrate a tightly coupled structure. These must be treated as integral elements of digital leadership, not separate compliance efforts. Ethics, responsibility, and security are inseparable from modern digital learning environments. Interestingly, while visionary leadership is acknowledged as essential, its lower average correlation suggests that vision alone is insufficient. Effective vision must be embedded within actionable systems, supported by training, infrastructure, and policies to translate aspirations into measurable readiness. Digital leadership readiness is not a product of isolated competencies but rather a symphony of aligned efforts—where vision, development, infrastructure, ethics, collaboration, and innovation all play critical roles. For educational institutions to thrive in the digital era, their

leaders must cultivate a balanced approach that combines strategic foresight with operational excellence, community engagement, and a culture of continuous learning.■

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