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Digital Transformation Leadership in Elementary School Management: Evidence from a Digital School Transformation Program

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ABSTRACT

This study aims to examine the role of digital transformation leadership in strengthening elementary school management and improving educational quality. The research employed a qualitative approach using a systematic literature review combined with a case study to explore leadership practices, challenges, and strategies for implementing digital transformation in primary education. The findings reveal that effective digital transformation leadership depends on the integration of a clear strategic vision, digital competencies, and an adaptive organizational culture. School leaders play a pivotal role in promoting technology adoption, enhancing teachers' digital capacity, fostering collaboration, and establishing a sustainable digital learning ecosystem. Furthermore, continuous professional development and stakeholder engagement are essential for ensuring the successful implementation of digital initiatives. The study implies that educational institutions should develop a contextual digital leadership model that prioritizes human resource development as the foundation for sustainable digital transformation and improved educational management. Such a model can support schools in responding effectively to technological change while enhancing organizational performance and learning quality.

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INTRODUCTION

Digital transformation has become one of the most significant drivers of change in contemporary society, reshaping the way organizations create value, manage resources, and deliver services (Omol, 2024; Van Veldhoven & Vanthienen, 2022). The education sector is no exception, as schools are increasingly expected to integrate digital technologies into administrative processes, teaching practices, and decision-making systems. This transformation

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is essential because students must be prepared with competencies that meet the demands of the Fourth Industrial Revolution and Society 5.0, where digital literacy, collaboration, creativity, and problem-solving are fundamental skills. Moreover, technological advancement has expanded opportunities for more personalized, efficient, and data-driven educational management (Kustitskaya et al., 2023; Lin et al., 2024). However, technology alone cannot transform educational institutions without effective leadership capable of guiding organizational change (Altassan, 2025; Tsekouropoulos et al., 2025). Therefore, digital transformation leadership has become a strategic requirement for school development, as it enables educational institutions to adapt to technological change while maintaining the quality, equity, and sustainability of learning systems.

The importance of digital transformation leadership extends beyond improving school administration because it directly influences teacher development (Ruloff & Petko, 2025; Sliwka et al., 2024), organizational innovation, and students' learning experiences. Effective leaders not only adopt digital technologies but also establish a shared vision, encourage collaboration, and cultivate an organizational culture that supports continuous innovation. Previous studies demonstrate that successful digital transformation depends on visionary leadership, strategic planning, and continuous professional development rather than merely technological investment (Kalogeratos, 2026). Likewise, Akhmad (2025) emphasized that effective digital leadership is characterized by technology adoption, data-driven decision-making, digital literacy enhancement, collaborative leadership, and the integration of emerging technologies such as artificial intelligence (Akhmad, 2025). These findings indicate that digital leadership represents a multidimensional capability combining managerial competence with technological understanding. Consequently, strengthening digital transformation leadership has become a critical strategy for improving educational quality and institutional resilience in rapidly changing educational environments (Ntavlourou et al., 2026).

Despite its recognized importance, implementing digital transformation in elementary education continues to face substantial challenges worldwide (Oyeniran et al., 2024). Many schools encounter difficulties in integrating technology into daily management because of limited digital competencies, inadequate infrastructure, organizational resistance, and insufficient strategic planning. Research conducted in the Philippines found considerable disparities across leadership domains, where technology-based instructional leadership achieved a very high average score of 3.50, whereas school operational management recorded the lowest average score of 2.49 due to limited utilization of cloud-based applications and weak online stakeholder engagement (Asis,

2025). Similar challenges have been identified in Indonesia, where school principals demonstrated nearly adequate digital readiness with a score of 3.92 out of five, yet a considerable gap remains between digital leadership practices and expected management competencies (Arifin et al., 2024; Padolina-Alcantara, 2023). Additional barriers include organizational resistance, limited educator digital literacy, privacy concerns, and data security issues (Jarkawi et al., 2025).

These challenges are reflected in practical educational settings where school leaders often demonstrate strong commitment toward digital transformation but continue to experience significant implementation barriers. Previous research reported that elementary school principals perceived themselves as highly competent in digital vision (3.99), technology utilization (4.05), and digital communication (4.04), yet they still struggled with insufficient technological knowledge, limited digital skills, resistance to organizational change, and inadequate internet infrastructure (C Bonto, 2026; Areces-Berazain & Ackerman, 2020). These findings suggest that positive leadership perceptions alone are insufficient to ensure successful digital transformation. Instead, school leaders must continuously strengthen their technological competencies while fostering collaborative organizational cultures that support innovation. Furthermore, the acceleration of digital technology adoption following the COVID-19 pandemic has exposed the varying capacities of schools to respond effectively to technological change, highlighting the urgent need for leadership models that integrate strategic vision, digital competence, and sustainable organizational development (Firmansyah et al., 2025).

Transformational leadership has long been recognized as a theoretical foundation for understanding leadership effectiveness in educational change, particularly in technology-driven environments. Bass and Avolio's transformational leadership framework emphasizes four essential dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, all of which are relevant to digital transformation initiatives (Rasdiana et al., 2024). Recent studies demonstrate that school principals who exhibit transformational leadership are more capable of encouraging innovation, supporting teacher development, and facilitating organizational adaptation to technological change. Asis (2025) reported that inspirational motivation was the strongest dimension of transformational leadership among elementary school principals, whereas individualized consideration remained relatively weak, suggesting that leaders were more successful in communicating a shared vision than in addressing individual teachers' professional needs (Asis, 2025). Similarly, Eberl and Drews (2021) argued that visionary principals with strong managerial competencies could integrate digital administration into school management and improve teacher

performance through technology-based monitoring systems (Rasdiana et al., 2024). These studies collectively indicate that transformational leadership provides an important conceptual basis for digital transformation but requires complementary digital competencies to respond effectively to rapidly evolving technological environments.

Building upon transformational leadership theory, recent scholarship has introduced digital leadership as a more comprehensive framework that integrates leadership capability with technological competence, innovation management, and organizational learning. Živković (2022) proposed a digital leadership competency framework consisting of strategic vision and innovation, technological understanding and empowerment, and continuous learning supported by multiple intelligences (Živković, 2022). Likewise, the Digital Leadership Scale identifies seven human-centered dimensions, including positive attitude, ethical artificial intelligence utilization, growth mindset, transparent governance, participatory leadership, continuous skill acquisition, and demonstrated leadership performance (Abbu et al., 2025). Although previous studies have substantially advanced understanding of digital leadership, several important gaps remain. Existing research predominantly focuses on higher education or corporate organizations, while empirical evidence from elementary education, particularly in developing countries, remains limited (Amin et al., 2025). Furthermore, longitudinal investigations examining the long-term impact of digital leadership on educational quality are still scarce (Jarkawi et al., 2025), and limited attention has been devoted to understanding how leadership behavior interacts with school digital culture to influence technology implementation and teacher digital competencies (Arifin et al., 2024; Amin et al., 2025). These limitations indicate the need for a contextual investigation of digital transformation leadership within elementary school management.

Digital transformation leadership in elementary education requires a contextual perspective that extends beyond technology adoption toward sustainable organizational development. The novelty of this study lies in integrating transformational leadership principles, digital leadership competencies, and school digital culture into a comprehensive framework for elementary school management. Rather than emphasizing technology as the primary driver of educational change, this study positions human resource development, organizational learning, and collaborative leadership as the core elements that determine the success of digital transformation. The study also proposes that effective digital leadership should simultaneously strengthen strategic vision, teacher professional capacity, digital governance, stakeholder collaboration, and continuous innovation within schools. By combining theoretical perspectives with practical implementation, this research offers a

holistic understanding of how digital transformation leadership can support sustainable school improvement. Consequently, the proposed framework contributes to the development of a contextual model of digital leadership that is more responsive to the characteristics and needs of elementary education than existing approaches.

Based on these considerations, this study addresses the central question of how digital transformation leadership can effectively strengthen elementary school management while improving educational quality in an increasingly digital environment. It argues that successful digital transformation cannot be achieved solely through technological investment or infrastructure development but depends primarily on the capacity of school leaders to inspire organizational change, develop teachers' digital competencies, foster an adaptive school culture, and sustain collaborative innovation. Accordingly, this study examines the relationship between leadership practices, organizational readiness, and digital transformation processes to identify key elements that support sustainable educational management. The findings are expected to contribute both theoretically and practically by providing a contextual digital transformation leadership model that can guide policymakers, educational leaders, and schools in designing more effective strategies for digital transformation. Ultimately, strengthening digital leadership is expected to improve institutional resilience, educational quality, and students' readiness to meet future societal and technological challenges.

RESEARCH METHODS

This study employed a qualitative case study design to explore the implementation of digital transformation leadership in elementary school management (Cleland et al., 2021; Lavarda & Bellucci, 2022). A qualitative approach was selected because it enables researchers to gain a comprehensive understanding of complex social phenomena by examining participants' experiences, perceptions, and interactions within their natural settings (Sabono et al., 2024). The case study design was considered appropriate because digital transformation leadership is a multidimensional and context-dependent process involving leadership practices, technological integration, organizational culture, and human resource development. Furthermore, a case study allows for an in-depth investigation of a bounded system through multiple sources of evidence, providing rich and contextual insights into how digital transformation is implemented within a particular educational institution rather than merely describing observable outcomes. This design also facilitates the exploration of processes, challenges, and leadership strategies that cannot be adequately explained using quantitative methods (C Bonto, 2026).

The study was conducted at an elementary school implementing the Samsung Digital Lighthouse School program because the institution represents a practical example of digital transformation in primary education. The school was purposively selected based on its active participation in integrating digital technology into school management, learning processes, and leadership practices, making it an information-rich case for examining digital transformation leadership. Data were collected through classroom observations, semi-structured interviews, and document analysis. Observations were conducted to examine technology-supported teaching and learning activities, interactions among school stakeholders, and leadership practices associated with digital transformation. Semi-structured interviews involved the principal, teachers, and students to obtain comprehensive perspectives regarding leadership strategies, implementation challenges, and the perceived impact of digital transformation. In addition, institutional documents, including school policies, digital learning plans, and program reports, were analyzed to strengthen the credibility and completeness of the findings.

Data were analyzed using an interactive qualitative analysis model consisting of data condensation, data display, and conclusion drawing and verification (Agilan, 2026). Data condensation involved selecting, simplifying, coding, and organizing field data according to the research objectives. The condensed data were subsequently presented through narrative descriptions and thematic categorization to facilitate interpretation and identify relationships among emerging themes. Finally, conclusions were continuously verified through iterative comparisons between data sources and emerging interpretations to ensure the consistency and trustworthiness of the findings. To enhance research rigor, data validity was established through source and method triangulation, member checking with participants, maintaining an audit trail documenting the research process, and peer debriefing to minimize researcher bias and strengthen the credibility, dependability, and confirmability of the study.

RESULTS AND DISCUSSION

Results

Profile of the Samsung Digital Lighthouse School Program

The Samsung Digital Lighthouse School (SDLS) program was implemented as a comprehensive digital transformation initiative designed to develop an integrated digital learning ecosystem in elementary education. The program was carried out through three sequential phases consisting of preparation, implementation, and evaluation.

During the preparation phase, the school conducted a digital needs assessment through psychological assessments administered to all teachers to identify their digital competencies and professional development needs. Based on the assessment results, four teachers were selected as the first batch of teacher champions and received intensive digital training. A second batch of teachers subsequently participated in advanced training activities. At the same time, Samsung devices were provided to support digital learning. The Savvy team installed the devices and conducted orientation sessions on the use of digital learning applications, including Samsung Notes, Screen Recording, Google Workspace, Gamification, and Asembrl Edu.

During the implementation phase, teachers integrated Samsung devices into classroom instruction. Teachers used digital devices to present learning materials, annotate content, and facilitate classroom interaction. Students utilized Samsung Notes for both individual and collaborative learning activities, including digital note-taking and classroom assignments. Smart View technology was employed to support student presentations and communication activities. Learning assessments were delivered through educational games to increase student engagement. Teachers developed lesson plans integrating digital technology into classroom activities. Students' digital works were presented during the Amfest digital exhibition, while teachers continued participating in online professional development through the Samsung Learning Hub with continuous assistance from the Savvy team.

During the evaluation phase, the implementation of digital learning was monitored through classroom supervision conducted by school leaders. Program implementation was also reviewed collaboratively with the Savvy team to evaluate the effectiveness of digital learning practices and identify areas requiring further improvement.

Leadership in Digital Transformation

The findings indicate that school leadership played a central role throughout the implementation of the digital transformation program. School leaders established a clear digital transformation vision by providing policy direction, allocating technological resources, establishing a digital transformation team, and supporting continuous teacher development. Leadership commitment was demonstrated through the provision of Samsung devices and the implementation of structured digital learning policies.

Teacher capacity development was implemented through tiered professional development consisting of Batch 1 and Batch 2 training programs, mentoring provided by the Savvy team, and continuous learning opportunities through the Samsung Learning Hub. Teacher champions served as facilitators who assisted other teachers during the implementation process.

The school leadership also promoted an organizational culture that encouraged experimentation and innovation in classroom learning. Teachers were provided with opportunities to implement new digital learning approaches and share successful practices with colleagues.

Collaboration was established among multiple stakeholders, including Samsung, the Savvy team, the school foundation, teachers, parents, and the broader school community. These partnerships supported the implementation and sustainability of digital transformation activities throughout the program.

Improvement of Digital Transformation Leadership Competencies

The implementation of the Samsung Digital Lighthouse School program resulted in improvements across all dimensions of digital transformation leadership competencies. The largest improvements occurred in collaboration and partnership, strategic digital vision, professional development, and technology competence, while data management remained the lowest-performing dimension despite substantial progress.

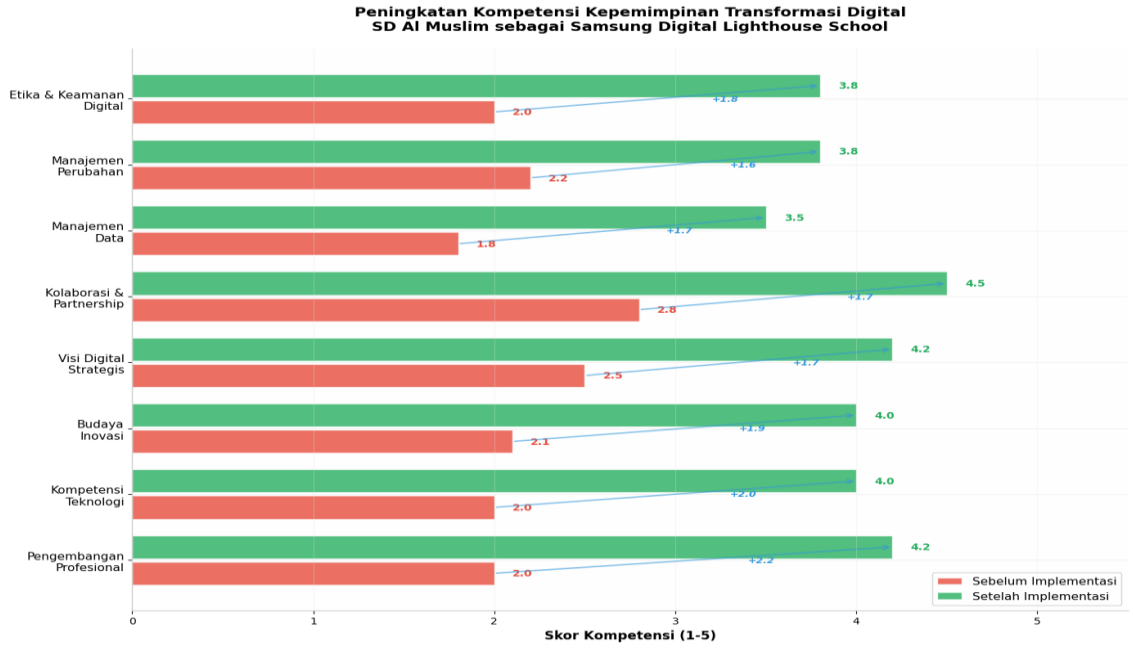

Figure 1. Improvement of Digital Transformation Leadership Competencies after the Samsung Digital Lighthouse School Program

Figure 1 illustrates the comparison of digital leadership competency scores before and after the implementation of the Samsung Digital Lighthouse School program. Improvements were observed across all eight competency dimensions. Collaboration and Partnership achieved the highest post-implementation score (4.5), followed by Strategic Digital Vision and Professional

Development (4.2). Data Management showed the greatest relative improvement, increasing from 1.8 to 3.5, although it remained the lowest competency area after implementation. Overall, the results indicate consistent enhancement of digital leadership competencies following program implementation.

Following program implementation, the school demonstrated substantial improvement in developing a strategic digital vision. Before implementation, the principal's digital vision was reactive and lacked a structured roadmap. Technology utilization was limited to basic instructional support using computers and LCD projectors, with no alignment between technology planning and the school's educational goals. During implementation, the principal, management team, and the Savvy team collaboratively developed a digital transformation roadmap focusing on three priorities: human resource development, digital curriculum development, and optimization of technological infrastructure. The roadmap was integrated into the school's flagship programs, including Student Projects, Teacher Digital Literacy, and the Eco Digital Learning Environment. After implementation, the digital vision became part of the school's medium-term strategic plan and was consistently communicated through meetings, digital bulletins, and reflection sessions. The digital vision also guided operational decision-making related to budgeting, curriculum development, and teacher recruitment.

Technology competence also increased considerably throughout the program. Prior to implementation, the principal and management team possessed only basic digital skills, primarily limited to office applications and email communication. During implementation, intensive training, practical workshops, mentoring by the Savvy team, and self-directed learning through the Samsung Learning Hub enabled school leaders to strengthen their digital competencies. The principal actively practiced using Samsung Galaxy Tablets, Smart TVs, Samsung Notes, Google Workspace, and various digital learning applications. At the conclusion of the program, technology competence had reached a high level. School leaders were able to utilize digital applications for instructional supervision, school administration, communication, and monitoring while also providing technical guidance to teachers and supporting technology integration into classroom learning.

The implementation process also strengthened the school's change management capacity. Initially, organizational change occurred through conventional top-down approaches, resulting in resistance from several teachers, particularly senior staff members. During implementation, change was managed through a phased strategy emphasizing teacher champions, leadership modeling, recognition of incremental achievements, and continuous mentoring

provided by the foundation and the Savvy team. As implementation progressed, teacher participation increased substantially, resistance declined, and technology adoption expanded across classrooms. School leaders became capable of identifying potential barriers, anticipating organizational challenges, and providing differentiated support according to teachers' readiness for change.

Significant development was also observed in collaboration and partnership. Prior to the program, external collaboration was primarily limited to schools within the same educational foundation and local educational authorities. The Samsung Digital Lighthouse School program expanded collaboration by establishing partnerships involving Samsung Indonesia, the Savvy team, the school foundation, parents, and national professional learning communities. Throughout implementation, the school actively participated in collaborative activities, exchanged experiences with other participating schools, and utilized external expertise to strengthen digital transformation initiatives. By the end of the program, collaboration and partnership became the highest-performing competency dimension, demonstrating the school's ability to coordinate multi-stakeholder partnerships that supported continuous institutional development.

Professional development became one of the most significant outcomes of the program. Before implementation, teacher development mainly consisted of periodic workshops that were not systematically aligned with teachers' professional needs. Academic supervision primarily emphasized administrative compliance. The initial digital competency assessment enabled school leaders to classify teachers according to their development needs and design differentiated professional development pathways. Teacher champions received advanced training, while other teachers participated in structured digital literacy programs and individualized mentoring. Peer coaching activities and self-directed learning through the Samsung Learning Hub further strengthened teachers' professional growth. At the completion of the program, professional development had evolved into a continuous, data-informed process integrated with clinical supervision and classroom improvement activities.

The greatest relative improvement occurred in data management. Before implementation, school data were managed manually using paper records and basic spreadsheets, with limited use of data to support decision-making. During implementation, digital tools such as Google Forms, Google Sheets, and Google Drive were introduced for data collection, analysis, and documentation. School leaders gradually adopted digital reporting practices and began utilizing data to monitor teacher competencies, student learning progress, and school program implementation. Although advanced analytical systems had not yet been implemented, data management became substantially more systematic and supported evidence-based planning and reporting.

The implementation of the program also transformed the school's culture of innovation. Before implementation, innovation was largely dependent on individual initiatives, and experimentation with new instructional approaches was limited. Throughout the program, school leaders encouraged experimentation with digital learning, supported teachers in testing new instructional strategies, and created opportunities to showcase innovative practices through digital exhibitions and school events. Teachers increasingly shared successful practices during professional learning activities, while students actively developed digital projects. By the end of the implementation period, innovation had become an integral part of the school's organizational culture, with failure viewed as an opportunity for collective learning and continuous improvement.

Improvement was likewise observed in digital ethics and safety. Prior to implementation, formal policies regarding responsible technology use, digital communication, student privacy, and cybersecurity had not yet been established. During implementation, the school developed written guidelines governing the use of digital devices, protection of personal data, appropriate online behavior, and classroom technology practices. Coordination with the foundation's information technology team strengthened network security and device management. By the end of the program, digital ethics had become integrated into school policies and daily learning practices, enabling school leaders to guide teachers and students in using digital technology responsibly, safely, and ethically while supporting the development of students' digital citizenship competencies.

Discussion

Digital transformation leadership at Al Muslim Elementary School emerged as the primary driver of educational change by establishing a shared vision, strengthening teachers' digital capacity, and integrating innovation into school programs (Areces-Berazain & Ackerman, 2020). The implementation of SDLS through Student Project, Teacher Digital Literacy, and Eco Digital Learning Environment demonstrates that digital transformation is supported by clear vision, teacher empowerment, collaboration, and continuous learning (Živković, 2022). These findings also reinforce that educational transformation depends on visionary leadership, teacher capacity, collaboration, and meaningful technology integration (Al-Maroof et al., 2024). Unlike previous studies that mainly emphasize leadership concepts, this study highlights that structured implementation through phased adoption, teacher champions, and continuous evaluation is equally essential for achieving sustainable change. Theoretically, these findings extend existing digital leadership frameworks by linking strategic

vision with systematic implementation. Practically, they provide evidence that effective leadership supports sustainable digital transformation in primary education.

The findings further indicate that technology integration at Al Muslim Elementary School has progressed beyond simple technology adoption toward collaborative, student-centered learning. Students regularly use Samsung Notes, Google Docs, and Google Drive to communicate, collaborate, and construct knowledge, showing that digital tools have become an integral part of classroom learning (Asis, 2025; Jarkawi et al., 2025). However, this study also reveals differences in students' digital competencies, particularly in using more advanced technological features (Arifin et al., 2024). These findings suggest that successful technology integration should be assessed not only through technology access but also through users' competencies. Therefore, schools should complement infrastructure development with differentiated digital literacy programs to minimize competency gaps and strengthen sustainable technology integration in learning.

Another important finding is that digital culture mediates the relationship between digital leadership and successful digital transformation (Arifin et al., 2024). At Al Muslim Elementary School, digital culture is intentionally strengthened through routine technology use, digital exhibitions, peer mentoring, and continuous integration of digital competencies into lesson planning (Akhmad, 2025). These practices demonstrate that digital culture is actively developed through leadership strategies rather than emerging solely as an organizational outcome (Eberl & Drews, 2021). Theoretically, this finding positions digital culture as a dynamic mechanism connecting leadership with sustainable educational transformation. Practically, schools should cultivate sustainable digital habits alongside continued technological investment to strengthen teachers' and students' digital competencies and ensure long-term educational transformation.

The findings also indicate that digital transformation leadership extends beyond technology adoption by strengthening organizational capabilities through systematic professional development, collaborative partnerships, and evidence-based decision-making. These findings support the view that sustainable educational transformation depends on visionary leadership, teacher capacity building, collaborative cultures, and meaningful technology integration to improve learning (Al-Maroof et al., 2024). Likewise, the implementation of structured teacher development, clinical supervision, and continuous mentoring reinforces the importance of ongoing professional learning for successful digital transformation (Kalogeratos, 2026). However, this study demonstrates that professional development is more effective when integrated with organizational

change management rather than implemented as isolated training. Theoretically, this finding expands digital leadership by emphasizing the simultaneous development of technological competence, organizational commitment, and innovation capacity. Practically, schools should establish sustainable professional development systems supported by mentoring, collaborative learning communities, and continuous performance evaluation.

The principal novelty of this study lies in proposing a contextual understanding of digital transformation leadership for elementary school management. Previous studies have primarily examined digital leadership in higher education, corporate organizations, or broader educational settings, with limited attention to the interaction among leadership behavior, digital culture, and human resource development in primary education (Amin et al., 2025). In contrast, this study shows that successful digital transformation results from integrating strategic digital vision, technology competence, change management, collaborative partnerships, professional development, data management, innovation culture, and digital ethics within a unified leadership framework. Rather than functioning as separate competencies, these dimensions operate as interconnected organizational capabilities that collectively support sustainable school improvement. This integrated perspective broadens the conceptual understanding of digital transformation leadership by emphasizing the relationship between leadership practices, organizational culture, and continuous capacity development.

Overall, this study contributes to both theory and practice by enriching the literature on digital transformation leadership in elementary education. Theoretically, the findings extend transformational and digital leadership frameworks by explaining how leadership competencies are translated into organizational practices that support sustainable digital transformation. The study also highlights the mediating role of school digital culture in linking leadership behavior with technology integration and teacher professional development. Practically, the findings provide guidance for school leaders, policymakers, and educational institutions to implement digital transformation through integrated leadership strategies that prioritize human resource development alongside technological investment. The proposed framework emphasizes continuous collaboration among school leaders, teachers, external partners, and the wider school community. Consequently, this study offers a contextual reference for developing digital leadership models that strengthen educational quality, institutional resilience, and organizational adaptability in rapidly evolving technological environments.

CONCLUSION

This study demonstrates that digital transformation leadership is the key determinant of successful digital transformation in elementary school management, emphasizing that sustainable change depends not only on the availability of digital technologies but also on the integration of strategic vision, leadership competencies, teacher capacity development, and an adaptive school culture. The findings highlight that effective leadership fosters technology integration, strengthens professional learning, promotes collaborative partnerships, and cultivates a digital culture that supports continuous innovation and organizational improvement. These insights provide an important contribution to the literature by extending existing digital leadership frameworks through a contextual model that integrates transformational leadership, digital leadership competencies, and school digital culture within elementary education management. The study also offers practical guidance for school leaders and policymakers in designing sustainable digital transformation strategies centered on human resource development rather than technology alone. Nevertheless, this research is limited by its single-case study design, which may restrict the generalizability of the findings to other educational contexts. Future research should employ multiple-case or longitudinal designs to examine the long-term impact of digital transformation leadership across diverse educational settings and to validate the proposed leadership model using mixed-method or quantitative approaches.

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