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INNOVATIVE LEADERSHIP OF SCHOOL PRINCIPALS IN PROMOTING DIGITAL TRANSFORMATION IN THE LEARNING PROCESS

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Abstract

This study aims to analyze the role of innovative school leadership in encouraging digital transformation in the learning process. The study was conducted through a qualitative method based on Systematic Literature Review (SLR) by searching scientific articles from three main databases: SINTA, Scopus, and Google Scholar. The initial identification process produced 122 articles, then a screening process was carried out based on inclusion criteria for theme suitability, the 2018–2024 range, and the connection with innovative leadership concepts and digital learning transformation. At the final stage, 25 articles were selected that met the criteria for further analysis. Data collection techniques in SLR are carried out through four stages: (1) identification of keywords such as innovative leadership, digital transformation in education, and school leadership; (2) search for articles in selected databases; (3) selection through PRISMA Flow, including elimination of duplication, head-abstract analysis, and content feasibility review; and (4) data extraction based on innovative leadership indicators, digital transformation strategies, and learning technology implementation results. Data analysis was carried out using thematic synthesis techniques, which map patterns, core concepts, and consistent findings between articles to produce a comprehensive understanding of innovative leadership relationships and learning digitization processes. The results of the study show that school principals with innovative leadership characteristics, especially those oriented towards adaptation, collaboration, and teacher capacity development, play a significant role in accelerating the integration of digital technology in schools. Innovative leadership encourages the strategic use of technology, improves the quality of learning planning, and strengthens a collaborative work culture among educators. These findings confirm that innovative school leadership is a key factor in accelerating digital transformation while building an adaptive learning culture oriented towards improving the quality of education.

Keywords Innovative Leadership, Digital Transformation, Learning Process.

INTRODUCTION

Digital technology is increasingly changing the way people learn around the world. UNESCO GEM Report (2023). It notes that the proportion of global internet users increased from 16% in 2005 to 66% in 2022, and about 50% of junior high schools worldwide are connected to the internet for learning purposes. Schools are starting to integrate e-learning, big data, artificial intelligence, and mobile learning applications to support more flexible and interactive learning (LP2STM Aceh Research 2025). Milati (2025) further explains that artificial intelligence and automation are increasingly being used in learning, in line with the vision of integrating technology into the curriculum of the 21st century. In addition, UNESCO (2025) emphasizes that school leadership is a decisive factor in the success of digital transformation because visionary policies and systematic support are needed for technology to truly improve the quality of learning.

In addition to these developments, various recent studies confirm that the success of educational technology integration is determined not only by the availability of devices but also by the quality of transformational leadership at the school level. Studies conducted by (Anderson and Dexter 2024) show that schools that have leaders with high digital capacity, including the ability to make data-based decisions, encourage innovation, and build a collaborative culture, experience an acceleration in improving the quality of learning up to 35% faster than schools that only focus on providing technological devices. This is reinforced by the analysis (Fullan and Quinn 2023), which found that effective digital transformation depends on "learning leadership" that is able to connect educational goals, teacher professional development, and sustainable use of technology. They emphasized that technology does not automatically improve the quality of education if it is not integrated through a framework of systematic change. In the context of developing countries, studies (Kurniawan and Hartati 2024) prove that school principals who actively build a digital ecosystem through intensive training, technology mentoring, and collaboration based on digital platforms have succeeded in creating a more adaptive and equitable learning environment, especially for students with low levels of digital literacy. The findings make it clear that the existence of technology is just a starting point; Its ultimate success is largely determined by the school's leadership being able to navigate change, manage resistance, and ensure the use of technology is aligned with learning needs.

Digital transformation in learning refers to the integration of technology into all teaching and learning activities, including planning, implementation, and evaluation. This process requires a

paradigm shift from conventional approaches to data-driven learning, digital collaboration, and the systematic use of technology devices and platforms (Arifin and Efendi 2025). Therefore, school principals are expected to have the innovative ability to design visionary digital strategies that foster a learning environment that is responsive to technological developments (Adnyana et al. 2025).

At a basic level of education, elementary schools play an important role in growing students' digital literacy skills. However, the implementation of digital transformation is often constrained by challenges such as limited infrastructure, varied teacher competencies, and a lack of a culture of technology use. In this context, the innovative leadership of the principal becomes an important foundation for driving change. School principals must be able to utilize technology not only as a learning tool but also as a managerial instrument to improve the overall quality of the learning process (Estede et al. 2025).

Digital transformation in learning also requires innovation in school management. Principals are responsible for creating a technology-oriented learning culture, providing ongoing training, and formulating internal policies that encourage teachers to collaborate and experiment with digital learning strategies. Innovative leadership is key to ensuring that the use of technology truly improves the quality of learning rather than just administrative or symbolic (Judijanto et al. 2025). Innovative principals must be able to formulate, implement, and evaluate digital strategies that support learning. This includes strengthening teachers' digital competencies, optimizing learning platforms, and leveraging technology to enrich pedagogical interactions and improve assessment effectiveness. Thus, innovative leadership enables the realization of more personalized, flexible, and efficient learning according to the demands of the digital age (Adnyana et al. 2025).

Previous studies have shown that the innovative leadership of school principals plays an important role in accelerating the digital transformation of learning. The results of the first study show that school principals who have a digital vision are able to increase teachers' readiness to integrate technology sustainably (Bandura 2024b). The second study found that leadership support through digital training was proven to strengthen teachers' ability to adapt online learning platforms (Ainin 2024a). The third study revealed that the principal's collaborative strategy encourages the creation of a culture of innovation and a more adaptive digital ecosystem in schools (Rahmawati 2023). The fourth research shows that leadership that is responsive to technological developments accelerates the adoption of digital tools in learning planning and evaluation (Sutrisno 2024). Meanwhile, the fifth study found that principals who encourage ICT-based pedagogical

experimentation can improve the quality of learning interactions and expand learning personalization (Najib 2024a).

However, each of these studies still leaves a number of important gaps. Bandura has not explained how innovative leadership strategies are practiced specifically at the elementary school level. Ainin did not delve in depth into the mechanism of support for school principals for teachers in the context of sustainable digital transformation. Rahmawati has not studied the inhibiting factors that affect the success of the innovation culture at the elementary school level. Sutrisno (2024) does not highlight the relationship between innovative leadership and digital infrastructure challenges that elementary schools often face. Najib has not discussed the role of school principals in integrating digital strategies into school managerial policies.

Departing from this gap, this research offers novelty by focusing on the analysis of how innovative leadership of elementary school principals concretely encourages digital transformation in all stages of learning, planning, implementation, to evaluation, and how school principals build strategic support for teachers in the midst of infrastructure limitations and uneven digital competencies. Thus, the purpose of this study is to analyze the innovative leadership strategies of school principals in encouraging digital transformation of learning, identify the supporting and inhibiting factors of digital learning implementation, and evaluate the contribution of innovative leadership to improving the quality of ICT-based learning in elementary schools.

METHOD

This study uses a qualitative approach using library research methods, with a focus on exploring and analyzing literature related to the innovative leadership of school principals in encouraging digital transformation in the learning process (Sahir 2021). Data collection is carried out through a systematic review of relevant scientific publications, including journal articles, conference proceedings, and research reports. The literature selection process begins with identifying key themes, followed by a structured classification of sources to gain a comprehensive conceptual understanding of the contributions and dynamics of innovative leadership in the context of digitalization of learning (Ismayani 2019).

The literature sources in this study were selectively determined with a focus on relevant, credible, and up-to-date academic publications regarding the innovative leadership of principals and digital transformation in learning. The research data is in the form of scientific articles that

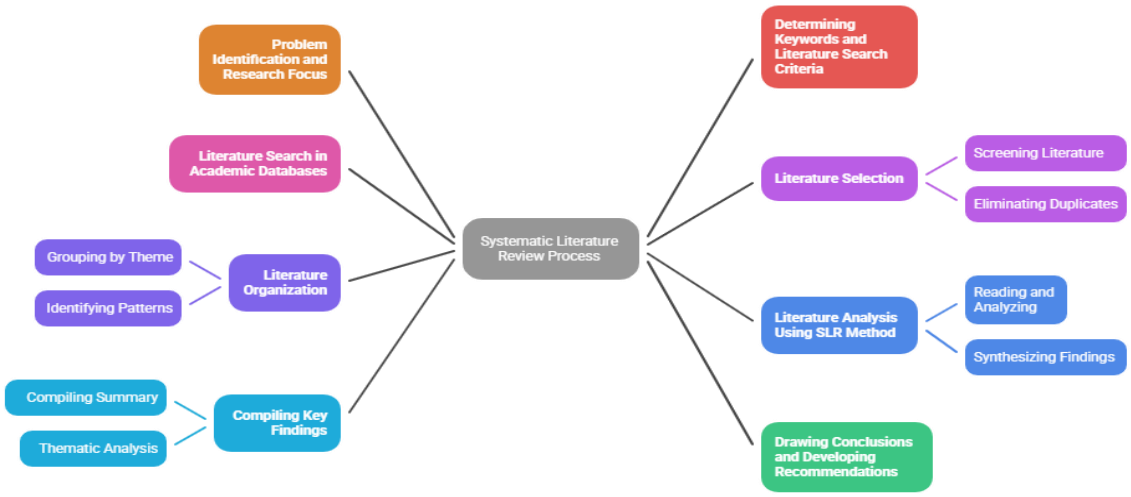
directly discuss innovative leadership, school digital transformation, teachers' digital competence, and ICT-based management. To obtain this data, the author searched articles from several major databases, namely SINTA (Science and Technology Index), Scopus, and Google Scholar, which were chosen because they provide indexed, quality-tested publications and represent the development of global research in the field of digital education.

The search was conducted with keywords such as innovative school leadership, digital transformation in education, school digital leadership, and ICT-based learning management. From the initial search results, more than 120 publications were found, then filtered based on inclusion-exclusion criteria until 25 main articles were obtained that met thematic relevance and scientific quality standards. In addition to journal articles, academic books from reputable publishers, indexed conference proceedings, and official documents from UNESCO, OECD, and the World Bank are also included as supporting materials to strengthen the theoretical and analytical foundations of this research.

This data source selection strategy aims to ensure that all the literature analyzed has high academic validity, is representative empirically and theoretically, and is relevant to the focus of the study. Thus, the analysis process can be carried out systematically and produce a comprehensive understanding of the contribution of innovative leadership of school principals in accelerating the digital transformation of learning (Sahir 2021).

The literature analysis process is carried out using the Systematic Literature Review (SLR) approach, which is designed to examine, classify, and interpret research findings critically and systematically (Wada et al. 2024). Each article is analyzed to identify theoretical constructs, innovative leadership models, digital transformation strategies implemented in schools, and existing research gaps. Through the SLR approach, this research is expected to produce an in-depth scientific synthesis and contribute conceptually to strengthening the innovative leadership of school principals in accelerating digital transformation in the learning process.

Figure 1. Systematic Literature Review Process



FINDINGS AND DISCUSSION

Findings

The transformation of innovative leadership in elementary schools is a strategic step in responding to the rapid development of digital technology that continues to shape the field of education. Through innovative leadership, principals are able to direct the use of digital tools and platforms not only to improve administrative efficiency but also to strengthen the quality of the learning process. Visionary, technology-driven integration leads to significant changes in various aspects, including increased learning effectiveness, more interactive communication patterns, greater transparency of academic information, and improved digital competence among teachers and students. In addition, the use of technology allows principals to optimize available resources and support data-driven decision-making in instructional management.

Overall, the innovative leadership of principals plays a major role in creating a learning environment that is adaptive, creative, and responsive to the challenges of the digital age. This transformation ensures that schools are able to compete and grow amidst an increasingly complex and digitally connected modern educational landscape. The following table presents the differences in learning leadership characteristics in elementary schools before and after the implementation of digital transformation through innovative leadership.

Table 1. Comparison of Traditional Leadership and Innovative School Leadership In Driving Digital Transformation in Learning

Aspects	Traditional Leadership	Innovative Leadership in Digital Transformation
Communication	Communication relies on face-to-face interaction or written notes.	Principals use a variety of digital platforms such as email, messaging apps, LMSs, and video conferencing to ensure fast, interactive, and transparent communication (Rahmawati 2023).
Decision	Decisions are centralized and determined solely by school leaders.	Decisions are more collaborative, supported by digital data, learning analysis, and input from teachers through online forums (Huang et al. 2024).
Collaboration	Collaboration is limited to physical meetings and formal discussions.	Collaboration is expanded through digital platforms that enable remote teamwork, real-time document sharing, and technology-powered brainstorming (Sukardi 2017; Lestari et al. 2023).
Performance Monitoring	Performance is monitored through direct observation and manual reports.	Principals use digital tools such as performance monitoring apps, learning dashboards, and real-time data analytics (Pradana et al. 2022).
Professional Development	Training is conducted through workshops and face-to-face seminars.	Principals promote teachers' digital competencies through e-learning, webinars, microlearning, and online professional learning communities (Attas 2001).
School Administration	Paper-based administration requires extensive time and storage.	Administration goes digital through e-archives, school information systems, and cloud-based document management (Murphy and Klein 2024a).
Access to Information	Access to information is slow and often centralized at the leadership level.	Information becomes quickly accessible and available to all school stakeholders through the school's digital portal and app (Annas and Putri 2023).
Troubleshooting	Problem-solving occurs through face-to-face discussions that are limited by space and time.	Principals leverage technology for data analysis, virtual discussion forums, and faster collaborative problem-solving (Lim and Tan 2024).
Curriculum Management	Curriculum management is manual, and updates are often delayed.	Curriculum management becomes dynamic through a digital platform that enables rapid updates, multimedia integration, and data-driven instructional customization (Salim 2025).
Parental Relationships	Communication with parents occurs through face-to-face meetings and written notifications.	Principals reinforce communication through school apps, email, and parent portals, making interactions faster and more efficient (Widodo 2023).
Student Assessment	The assessment relies heavily on written tests and hands-on observation.	Assessments use digital platforms that support varied and automated evaluation formats, digital portfolios, and learning analytics (Kimura and Seto 2024).
School Culture	School culture is built through physical interaction and manually established routines.	Principals foster digital school culture through technology-based work habits, online collaboration, and digital literacy throughout the school community (Nugraha and Sari 2022).

Source: OECD Education Working Paper (2025)

The findings in the table show that the principal's innovative leadership in promoting digital transformation brought about fundamental changes in various aspects of the school's learning and management processes. Technology integration makes leadership practices more adaptive, collaborative, and data-driven. Through the use of digital platforms, communication between principals, teachers, and stakeholders becomes faster, more flexible, and more efficient. Decision-Creation is no longer just leader-centric but involves digital collaboration and more accurate analysis of learning data. This is in line with Sembiring's (2025) research, which shows that innovative digital leadership is critical in driving the transformation of technology-based education.

Innovatively led digital transformation also enables real-time monitoring of teacher performance and student learning progress through a variety of apps and learning dashboards. In addition, digitalization enriches teachers' professional development through a more dynamic and sustainable online learning platform. Curriculum management has also become more responsive because it can be updated and adjusted to the needs of digital-based learning. This is in line with the opinion of Kasim and Surya (Kasim and Surya 2025), which states that the digital leadership of school principals has proven to have a positive effect on the use of teacher technology in the aspects of administration and communication.

In addition to improving administrative efficiency, innovative leadership in digital transformation strengthens school culture by creating a more participatory, open, and technology-oriented learning ecosystem. Engagement with parents becomes more effective through school communication apps that allow for quick and transparent tracking of student progress. Overall, digital transformation guided by the innovative leadership of school principals encourages the realization of a learning process that is more adaptive, integrated, and in line with the demands of education in the digital era. These changes make schools more responsive to the evolving learning needs of students and better prepared to face an increasingly complex and technology-driven educational landscape.

Discussion

The results of this study show that innovative principals' leadership substantially contributes to the acceleration and quality of digital transformation in learning at the elementary school level. In summary, the main findings of the study include: (1) increasing the transparency of decision-making through the use of school management information systems (SIMS) and learning dashboards that allow access to data on attendance, teacher performance, and student achievement

for teachers, parents, and stakeholders; (2) increased efficiency of administrative and pedagogical processes thanks to the digitization of academic services, online assessments, and administrative automation; (3) implementation barriers in the form of resistance to change among staff, limited infrastructure and budget, and digital access gaps; and (4) the need for continuous and data-driven evaluations to ensure optimal learning outcomes. These findings are consistent with previous empirical findings that position school principals as transformation agents who need to combine technological vision, teacher capacity building, and infrastructure management (Sheninger, 2014; Maisaroh et al., 2025).

From a theoretical perspective, the findings can be analyzed through several complementary frameworks. First, transformational leadership provides a foundation for understanding how leaders' visions and inspirations drive organizational culture change; visionary principles to motivate teachers to experiment with digital practices and build a learning culture that is responsive to innovation (Bass & Avolio in the leadership literature; empirical relevance:(Rahman et al. 2025). Second, the evidence-based leadership approach emphasizes the use of real-time data for more objective decision-making practices seen in the use of SIMS and analytics dashboards in this study, which serves to reduce subjectivity and increase the legitimacy of school policies (Sergis and Sampson 2016; Wayman 2017). Third, the distributed leadership framework emphasizes that digital transformation is more sustainable if technical capacity and responsibilities are distributed to the teacher and team level, rather than centralized solely to the principal. Al: This has been proven to increase program ownership and sustainability of digital initiatives in schools (Harris and Spillane 2020; Gomez and Ortega 2023).

In dialogue with other literature, this study shows a number of common points as well as differences in nuances. In line with Sheninger and Maisaroh (Sheninger 2014; Maisaroh et al. 2025), the study confirms that technology-facilitated transparency strengthens accountability and builds public trust in schools. Findings related to administrative and pedagogical efficiency support the report (Murphy and Klein 2024b; Pradana 20,24), which records the acceleration of administrative processes and the ease of performance monitoring thanks to digitalization. In the realm of professional development, the evidence from this study corroborates Darling's claim (Darling-Hammond 2021) that the digital webinar, microlearning, and online PLC-based professional development model is effective in increasing teachers' pedagogical readiness (Gomez and Ortega 2023).

But this study also shows important differences when compared to some previous studies. (Bandura 2024) and (Ainin 2024) emphasizes that leadership support improves teacher readiness, but our findings confirm that one-time formal support is inadequate; Practical transformation in the classroom requires continuous mentoring, classroom observation-based coaching, and a continuous learning model that is integrated with performance evaluation of a claim that is also raised by (Najib 2024). In addition, while much of the literature highlights the benefits of technology, critical studies such as Selwyn (2016) warn of the reproduction risks of inequality—something we encounter in local contexts: without access interventions, digitalization can widen the learning gap between students who are connected and those who are not. (Saputra 2025).

The issue of data security and privacy emerged as an important correction to optimistic assumptions about digital transformation. (Rahayu and Iskandar 2023) has underlined the urgency of education data protection regulations; Our research confirms that school principals do not just implement internal policies but need to act as policy advocates to the Education Office and regional policy makers to strengthen the regulatory framework. Without adequate data protection, parental and stakeholder trust can be eroded, hindering wider adoption of technology.

One of the novel contributions of this research is the affirmation of a more detailed cause-and-effect relationship between specific leadership strategies and digital learning outcomes. This study maps how a combination of leadership actions—digital vision setting, budget allocation for infrastructure, sustainable professional development, data security policies, and analytics-based evaluation mechanisms produce three main outputs: improved quality of pedagogical interaction (in the form of personalization and quick feedback), improved administrative efficiency (reduced bureaucratic time), and increased parental participation in the learning process. These findings enrich previous literature that tended to separate managerial and pedagogical aspects (Murphy and Klein 2024) (Pradana 2024), by demonstrating that holistic integration between these dimensions is a prerequisite for impactful transformation.

A key affirmation of this discussion is that innovative leadership that is visionary, collaborative, and data-driven significantly increases the chances of a meaningful digital transformation. Principals who direct resources, facilitate teacher development, and build data-driven evaluation mechanisms are more likely to succeed in improving the quality of digital learning (Maisaroh et al. 2025) (R; an et al. 2025). But the antithesis, which is also confirmed by field evidence and critical literature, is that leadership alone is not enough without systemic support: funding,

infrastructure, access to tools, and data protection policies must be present as a supporting ecosystem so that principals' initiatives are not fragmentary or temporary (Rahayu and Iskandar 2023; 2025).

Based on this dialogue, the practical implications are clear: first, principals need to adopt a leadership model that combines transformational vision and evidence-based practice; second, professional development programs should be seen as long-term investments with mentoring and coaching schemes; third, regional policies must be directed to close access gaps and strengthen education data protection regulations; Fourth, implementation evaluation must be continuous and utilize analytics to assess the impact on learning outcomes, not just the use of technology. This research emphasizes the need for multi-stakeholder synergy—schools, teachers, parents, local governments, and donor partners—to ensure that digitalization improves the equity and quality of education, not just as a symbol of administrative modernity (Milati 2025). Overall, the results of the research and the literature dialogue present an optimistic but realistic picture: the innovative leadership of school principals is a necessary condition for digital transformation, but its sustainability and fairness depend on broader structural support. Technical and social challenges must be addressed simultaneously to ensure digitalization supports inclusive and quality pedagogical goals.

CONCLUSION

The innovative leadership transformation of principals in the digital context has proven to be an important factor in improving the quality of learning in schools. Innovation-based leadership encourages the use of technology to improve lesson planning, academic communication, and access to digital learning resources, while replacing traditional leadership patterns that are less responsive to change. Innovative principals are better able to make data-driven pedagogical decisions, facilitate teacher collaboration, and integrate digital platforms to monitor student learning performance directly. However, digital transformation faces challenges such as teacher competency readiness, limited infrastructure, and gaps in device access. For this reason, adaptive leadership is needed that can strengthen teacher training, provide technological support, and build a school culture that is open to innovation so that the digitalization of learning can run optimally and have an impact on improving the quality of education.

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