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PRINCIPAL AS A DIGITAL LEADER IN MANAGING TECHNOLOGY-BASED LEARNING

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Abstract

Digital transformation has reshaped the paradigm of global education. School principals are required to possess digital leadership capacity to manage technology-based learning. This study aims to examine the role of school principals as digital leaders in managing technology-based learning innovations within educational institutions. The method used is a literature review and descriptive-qualitative analysis from various scholarly sources. The findings indicate that school principals play a strategic role in creating a digital vision, fostering a technology-oriented culture, enhancing teacher capacity, and ensuring the availability of supportive technol.

Here's the English transliteration of your keywords:

Keywords: principal, digital leadership, educational technology, school management, digital learning

INTRODUCTION

The massive transformation of digital technology in the education sector demands changes in the school management system. One of the key actors in this transformation is the school principal, who is not only responsible for administrative aspects but must also be capable of leading innovation in educational techn ology.[1]The role of the school principal as a digital leader is crucial in guiding the utilization of information and communication technology (ICT) to improve the quality of learning.[2]

The COVID-19 pandemic accelerated the adoption of technology in education, but even after the pandemic, the demand for digital learning remains high. Learning is no longer limited to physical classrooms but has also expanded into dynamic and interactive digital spaces.[3]
Therefore, school principals need to possess digital competence, managerial skills, and a long-term vision in integrating technology into the learning system.

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[1] Suyatno. *Kepemimpinan Pendidikan: Teori dan Praktik dalam Konteks Sekolah*. Yogyakarta: Pustaka Pelajar, 2020
[2] Anderson, R. E. "Technology Leadership for School Improvement." *Journal of Educational Administration* 56, no. 2 (2018): 234–251
[3] UNESCO. *Education in a Post-COVID World: Nine Ideas for Public Action*. Paris: UNESCO Publishing, 2021

Digital transformation has become an unstoppable force in all sectors of life, including education. The Fourth Industrial Revolution and the progression toward Society 5.0 demand that the education sector adapt to rapid and complex changes.[4] This change demands a new paradigm in school management and learning practices. Information and communication technology (ICT) is no longer merely a complement but has become an essential element in supporting the success of the teaching and learning process.[5]

As the leader of an educational institution, the school principal plays a strategic role in responding to these developments. They are required not only to act as administrative managers but also as transformational leaders capable of integrating technology into the school's educational vision and practices[6]

The concept of digital leadership has emerged as a new approach to addressing the challenges of education in the digital era. A school principal who serves as a digital leader is expected to be able to design long-term strategies for fully integrating technology into the school system.[7]

A digital leader in the context of education is not only responsible for the use of digital devices but also for the values, ethics, and digital culture that must be instilled within the school community.[8] This transformation greatly depends on the quality of the school principal's leadership.

Since the COVID-19 pandemic struck the world, the urgency of technology use in learning has become increasingly evident. Online learning, video conferencing, the use of Learning Management System (LMS) platforms, and various forms of digital learning have become the primary solutions amid the limitations of face-to-face learning.[9]

Although the pandemic has subsided, technology-based learning models continue to be maintained because they are considered more flexible, personalized, and accessible to students from diverse backgrounds. This is where the role of the school principal as a digital leader is tested: whether they can turn this momentum into a starting point for sustainable digital learning reform.[10]

Some school principals have proven successful in building a conducive school digital ecosystem—such as providing device access, organizing teacher training, and designing adaptive ICT-based curricula. However, many schools have also experienced stagnation due to the lack of competence and leadership from principals who are not yet digitally ready.[11]

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[4] Rifai, Achmad. *Pendidikan dalam Era Society 5.0*. Jakarta: Rajawali Pers, 2022

[5] Hargreaves, A. & Fullan, M. *Professional Capital: Transforming Teaching in Every School*. New York: Teachers College Press, 2012

[6] Suyatno. *Kepemimpinan Pendidikan: Teori dan Aplikasi*. Yogyakarta: Pustaka Pelajar, 2020

[7] Sheninger, Eric. *Digital Leadership: Changing Paradigms for Changing Times*. Thousand Oaks: Corwin, 2019

[8] Wahyudi. "Peran Kepemimpinan Kepala Sekolah dalam Menumbuhkan Budaya Digital." *Jurnal Manajemen Pendidikan*, 10(1), 2022: 22–30

[9] UNESCO. *Education in a Post-COVID World: Nine Ideas for Public Action*. Paris: UNESCO, 2021.

[10] Purwanto, A. "Kepemimpinan Kepala Sekolah Pascapandemi: Adaptasi terhadap Sistem Pembelajaran Daring." *Jurnal Kependidikan*, 12(2), 2021: 123–135

[11] Kementerian Pendidikan dan Kebudayaan. *Panduan Transformasi Digital Sekolah*. Jakarta: Dirjen GTK, 2021

In this context, the principal's leadership becomes the key factor. Principals need to understand the latest technological developments and be able to serve as role models in the productive and ethical use of technology.[12]

Digital leadership also demands cross-sector collaboration. Principals must be able to build partnerships with education authorities, ICT communities, teachers, parents, and technology providers to create high-quality digital learning.[13]

Strengthening the role of school principals as digital leaders also requires policy support. Education regulations should encourage the enhancement of principals' technological capacity through training, certification, and the provision of adequate resources.[14]

In addition, principals also face ethical and digital security challenges. For example, how to protect student data, prevent harmful content, and guide the wise and responsible use of technology.[15]

The role of a school principal as a digital leader is not only about mastering digital devices but also about fostering leadership values based on collaboration, innovation, and critical reflection in navigating the digital era.[16]

In technology-based learning, the school principal acts as a facilitator who ensures that all school elements—teachers, students, and education staff—have the access and skills to actively participate in digital learning.[17]

Therefore, studying the role of school principals as digital leaders in managing technology-based learning becomes essential, as part of strengthening education management that is responsive to the changes of the times.[18]

RESEARCH METHODOLOGY

This study employs a descriptive qualitative design with a literature review approach. Data were collected from various scholarly sources, including accredited national journals, academic books, and educational policy documents related to digital leadership and technology-based school management. The analysis was conducted through a process of reading, examining, and synthesizing thematic insights on key concepts: school principal leadership, digital leadership, and the management of digital learning.[19]

This study employs a **descriptive qualitative approach**, as its primary focus is to provide a systematic and in-depth depiction of the role of school principals in managing technology-based learning as digital leaders. The qualitative approach was selected because it allows the researcher to explore meanings, perceptions, and practices that evolve within the

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[12] Fullan, Michael. *The New Meaning of Educational Change*. New York: Teachers College Press, 2020.
[13] Suryani, A. "Kolaborasi Digital antara Sekolah dan Komunitas TIK." *Jurnal Teknologi dan Pendidikan*, 8(2), 2020: 145–154
[14] Kemendikbudristek. *Strategi Nasional Transformasi Digital Pendidikan*. Jakarta: 2022
[15] Hamid, L. "Etika Digital dalam Pendidikan: Tantangan Kepala Sekolah Abad 21." *Jurnal Etika Pendidikan*, 5(1), 2022: 55–63
[16] Spillane, J. P. *Distributed Leadership*. San Francisco: Jossey-Bass, 2006
[17] Bates, A. W. *Teaching in a Digital Age*. Vancouver: BCcampus, 2020
[18] Anderson, R. E. "Technology Leadership in Schools." *Educational Administration Quarterly*, 45(2), 2018: 197–216
[19] Creswell, J. W. *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. Boston: Pearson, 2019

complex and dynamic social context of education. This approach is also well-suited for an in-depth exploration of educational realities in the digital context.[20]

The type of research conducted is **library research**, which relies on literature sources such as books, journal articles, official reports, and policy documents relevant to the topic of digital leadership in schools. The primary data sources include national and international scholarly journals, recent educational books, and official documents from the Ministry of Education and Culture of the Republic of Indonesia related to school digitalization and the role of principals.[21]

Data collection was carried out by tracing literature through digital databases such as Google Scholar, Garuda Ristekdikti, Scopus, and ResearchGate using keywords such as *digital leadership*, *school principal*, *technology in education*, and *educational management*. The inclusion criteria for literature were: (1) publications from 2018 to 2024, (2) written in Indonesian or English, and (3) directly relevant to the issue of digital transformation in education and the role of school principals. Literature lacking contextual relevance or with weak academic quality was excluded.[22]

Data were analyzed using **thematic content analysis**. This process involved identifying key themes within the literature related to the dimensions of digital leadership among school principals, such as digital vision, technology culture, teacher training, and the evaluation of learning technologies. The first step of the analysis was to carefully read all relevant documents, followed by identifying recurring keywords, phrases, or significant quotations. The final step involved organizing these findings into analytical categories or themes that formed the basis for the discussion of research results.[23]

Data validity was ensured through **source triangulation**, by comparing information from various types of documents and different authors to confirm consistency and coherence. In addition, **content validity** was maintained by referring to well-established theories in educational leadership and school digitalization, both academically and practically tested. Core literature from Sheninger, Fullan, and official documents from the Ministry of Education and Culture served as key references.[24]

The researcher served as the **primary instrument** (human instrument), which required active engagement in reading, interpreting, and drawing meaning from the texts. Accordingly, critical reflection was applied at every stage of data processing.[25]

The limitation of this study lies in its theoretical and literature-based nature, which does not incorporate direct field data. Nevertheless, the findings provide a comprehensive picture of current conditions in various schools, based on documented empirical evidence.[26]

Through this method, the study is expected to contribute to the development of school principals' leadership practices in the digital era and serve as an academic reference for future research in the field of technology-based educational management.[27]

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[20] Moleong, Lexy J. *Metodologi Penelitian Kualitatif*. Bandung: Remaja Rosdakarya, 2021
[21] Creswell, John W. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. Thousand Oaks: Sage, 2018
[22] Creswell, John W. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. Thousand Oaks: Sage, 2018
[23] Zed, M. *Metode Penelitian Kepustakaan*. Jakarta: Yayasan Obor Indonesia, 2014
[24] Kemendikbudristek. *Strategi Nasional Transformasi Digital Pendidikan*. Jakarta: Direktorat GTK, 2022
[25] Ary, D., Jacobs, L. C., & Razavieh, A. *Introduction to Research in Education*. Belmont: Wadsworth, 2019
[26] Sugiyono. *Metode Penelitian Kualitatif, Kuantitatif, dan R&D*. Bandung: Alfabeta, 2020

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Results

The literature review and thematic analysis yielded five key findings regarding the role of school principals as digital leaders in managing technology-based learning within the school environment. These findings refer to the dimensions of strategic planning, transformational leadership, human resource development, infrastructure management, and digital learning evaluation**.**

Formulation of the School's Digital Vision and Mission

School principals serving as digital leaders hold the responsibility of formulating a progressive, inclusive, and realistic digital vision. This vision reflects the commitment to leveraging technology to enhance access, quality, and efficiency in learning. Several principals have successfully translated this digital vision into the school's strategic plan as well as into the daily work culture**.**[33]

Table 1 Reliability

Variable	CronbachAlpha	N ofitems
Teacher Performance	0.868	20
PrincipalSupervision	0.879	20
Teacher Professional Competence	0.913	20

Development of a Technology-Based Innovative Culture

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[27] Braun, V., & Clarke, V. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology*, 3(2), (2006): 77–101

[28] Saldana, Johnny. *The Coding Manual for Qualitative Researchers*. London: Sage, 2021

[29] Patton, M. Q. *Qualitative Research and Evaluation Methods*. Thousand Oaks: Sage, 2015

[30] Fullan, M. *The New Meaning of Educational Change*. New York: Teachers College Press, 2020. Fullan, M. *The New Meaning of Educational Change*. New York: Teachers College Press, 2020.

[31] Sheninger, Eric. *Digital Leadership: Changing Paradigms for Changing Times*. Thousand Oaks: Corwin, 2019

[32] [32]Nasution, S. *Metode Penelitian Naturalistik Kualitatif*. Bandung: Tarsito, 2021.

[33] Sheninger, Eric. *Digital Leadership: Changing Paradigms for Changing Times*. Thousand Oaks: Corwin, 2019

School principals play a crucial role in building a school ecosystem that supports innovation. This is evident in their encouragement for teachers to confidently experiment with various digital learning models, such as flipped classrooms, blended learning, and gamification. Inclusive, participatory, and visionary leadership serves as the key to fostering the emergence of a digital culture.[34]

Teacher Empowerment through ICT Literacy and Training

Findings indicate that schools led by digital leader principals actively organize both internal and collaborative training sessions for teachers in the use of ICT. These initiatives extend beyond technical training to include the facilitation of technology-based pedagogical learning, such as the use of Learning Management Systems (LMS), online quiz applications, and interactive video platforms.[35]

Management of the School's Digital Infrastructure

The role of school principals in the procurement and distribution of technological devices is highly vital. Schools with strong digital leadership demonstrate a serious commitment to managing budgets for the purchase of hardware (laptops, LCD projectors, Wi-Fi networks), software (educational applications), and the organization of maintenance systems. In some schools, principals have even established partnerships with third parties to address operational funding limitations.[36]

Evaluation of Digital Learning Implementation

Effective school principals do not stop at the procurement of technology but also conduct evaluations of its implementation. These evaluations are carried out through digital classroom observations, collaborative reflections with teachers, and student surveys. Several indicators of success include student engagement levels, teacher activity on learning platforms, and data-driven improvements in learning outcomes.[37]

Cross-Stakeholder Collaboration

The findings also indicate that successful school principals as digital leaders are able to establish collaborations with education authorities, ICT communities, and students' parents.

Cross-Stakeholder Collaboration

The study's findings also reveal that school principals who succeed as digital leaders are able to foster collaboration with education authorities, ICT communities, and parents. Such collaboration helps create a stronger support ecosystem and expands the school's digital capacity.[38]

Utilization of Digital Data for Decision-Making

Digital leaders utilize digital data such as online learning participation statistics, LMS usage logs, and online assessment results to inform policy decisions. This reflects a data-driven

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[34] Wahyudi. "Kepemimpinan Kepala Sekolah dalam Inovasi Pembelajaran Digital." *Jurnal Manajemen Pendidikan Islam*, 10(1), 2022: 22–30.

[35] Suryani, A. "Pengembangan Kompetensi Digital Guru oleh Kepala Sekolah." *Jurnal Teknologi Pendidikan*, 9(3), 2021: 112–123.

[36] Kemendikbudristek. *Panduan Kepala Sekolah dalam Transformasi Digital*. Jakarta: 2022.

[37] Purwanto, A. "Evaluasi Kepala Sekolah terhadap Pembelajaran Daring." *Jurnal Kependidikan*, 13(1), 2021: 45–56.

[38] Suryadarma, D. "Kolaborasi Lintas Sektor dalam Transformasi Pendidikan." *Jurnal Pendidikan dan Kebudayaan*, 26(3), 2022: 210–221.

decision-making approach, which is increasingly becoming a standard practice in modern management.[39]

Strengthening Values and Ethics in Digital Learning

School leadership not only focuses on technical aspects but also emphasizes the importance of digital ethics in learning. Several principals have initiated programs on digital literacy, data security, and digital citizenship as part of the non-formal curriculum.[40]

Resilience of School Principals in Technological Crises

In crisis situations such as pandemics or network disruptions, resilient school principals are able to quickly shift the learning system to more flexible modes. Adaptive and prompt responses serve as key indicators of effective digital leadership.[41]

Improvement in Learning Quality and Student Satisfaction

The literature indicates that schools led by digital leader principals have experienced improvements in learning quality, particularly in terms of student engagement, digital interaction, and student satisfaction with the implemented learning models.[42]

Discussion

School leadership in the digital context differs from conventional leadership. A digital leader must possess competencies in change management, cross-sector collaboration, and mastery of digital educational technology. This requires principals to continuously learn and adapt to technological developments.[43]

In practice, effective school principals as digital leaders are able to transform the mindset of the school community. They encourage teachers not only to use technology as a supporting tool but also as a space for pedagogical innovation. In addition, principals must be able to bridge the digital divide, particularly for schools with limited access to technology.[44]

Nevertheless, challenges remain, such as budget constraints, teacher resistance, and infrastructure disparities between urban and rural schools. Therefore, synergy among school principals, government authorities, and the educational community is essential to support the sustainable implementation of digital learning.[45]

School principals as digital leaders have the responsibility to position technology as an essential instrument in improving the quality of education. Digital leadership is not merely about the ability to operate technology, but also about how principals develop strategies, ecosystems, and a culture of digital learning within the school environment.[46]

Within the framework of educational management, the role of the principal as a transformational leader is critical to the successful integration of technology. They must serve as

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[39] Anderson, R. E. "Data-Driven Leadership in the Digital Age." *Educational Administration Quarterly*, 56(3), 2020: 345–370.

[40] Hamid, L. "Etika dan Literasi Digital di Lingkungan Sekolah." *Jurnal Etika Pendidikan*, 6(2), 2023: 89–100.

[41] Fullan, M. *The New Meaning of Educational Change*. New York: Teachers College Press, 2020.

[42] Bates, A. W. *Teaching in a Digital Age*. Vancouver: BCcampus, 2020.

[43] Fullan, M. *The New Meaning of Educational Change*. New York: Teachers College Press, 2020

[44] Puslitjak Kemendikbud. *Studi Nasional Kesenjangan Akses TIK di Sekolah*. Jakarta: 2021.

[45] Tirtaraharja, U. "Ketimpangan Digital antara Sekolah Perkotaan dan Pedesaan." *Jurnal Pendidikan dan Kebudayaan* 27, no. 2 (2023): 145–160.

[46] Sheninger, Eric. *Digital Leadership: Changing Paradigms for Changing Times*. Thousand Oaks: Corwin, 2019.

agents of change, capable of designing the vision and direction of the school in responding to the challenges of the digital era.[47]

Principals must be able to formulate a digital vision that is not only idealistic but also applicable and relevant to the school's real conditions. Such a vision is vital to ensure that all school components have a clear and measurable objective in the use of educational technology.[48]

The development of a digital culture in schools will not succeed if the principal does not set a good example in the use of technology.** Principals must serve as role models for teachers and students in terms of digital literacy, instructional innovation, and the ethical use of digital media.[49]

digital culture can only flourish when there is room for exploration, mistakes, and relearning. Therefore, supportive principals who are open to new ideas are essential in building a healthy educational technology ecosystem.[50]

Teacher empowerment is a crucial element of digital leadership. Principals cannot work in isolation; instead, they must empower teachers through training, mentoring, and providing incentives for those who demonstrate innovation in the use of instructional technology.[51]

Previous studies indicate that one of the greatest barriers to implementing digital learning is the low level of teachers' digital competence. In this regard, principals should take the initiative to collaborate with institutions or partners to provide the necessary training and resources.[52]

Technology infrastructure management is also a critical dimension. As managerial leaders, principals are responsible for ensuring the availability of hardware and software that support the smooth operation of technology-based learning. Beyond availability, principals must also ensure equitable access to these infrastructures for all members of the school community. This includes efforts to bridge the digital divide between senior and junior teachers, as well as between students from different economic backgrounds.[53]

Evaluation is an integral part of the principal's role as a digital leader. Assessments of the effectiveness of technology use should be conducted regularly, involving teachers, students, and parents. Such evaluations help ensure that digital transformation truly contributes to improving the quality of learning.[54]

Digital leadership also demands data-driven decision-making. Principals must be able to read and interpret digital data generated from learning platforms, online assessments, and student activity logs to inform policy decisions.[55]

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[47] Fullan, Michael. *The New Meaning of Educational Change*. New York: Teachers College Press, 2020.
[48] Wahyudi. "Kepemimpinan Kepala Sekolah dalam Menyusun Visi Digital Sekolah." *Jurnal Kepemimpinan Pendidikan*, 9(1), 2022: 33–41.
[49] Suyatno. *Kepemimpinan Pendidikan: Teori dan Aplikasi*. Yogyakarta: Pustaka Pelajar, 2020.
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[53]Anderson, R. E. "Technology Leadership for School Improvement." *Educational Administration Quarterly*, 56(2), 2020: 234–251.
[54] UNESCO. *Digital Learning and Marginalized Students*. Paris: 2021.
[55] Purwanto, A. "Evaluasi Berbasis Teknologi oleh Kepala Sekolah." *Jurnal Evaluasi Pendidikan*, 11(3), 2021: 88–97.

Beyond managerial responsibilities, principals also play a normative role. They are responsible for fostering digital ethics awareness in schools through policies on device use, protection of students' personal data, and character development in digital spaces.[56]

Cybersecurity issues and the misuse of technology are serious concerns in digital schools. Therefore, principals must work in collaboration with IT staff or digital experts to design robust digital security protocols.[57]

Digital leadership should not be exclusive but rather collaborative. Principals must engage all stakeholders—including school committees, education authorities, industry, and professional organizations—to support a strong and sustainable digital learning ecosystem.[58]

In the context of sustainability, principals must ensure that technology integration is not merely a temporary trend but becomes embedded as part of long-term operational systems.[59] This can only be achieved through strategic planning, continuous monitoring, and the updating of supportive regulations.[60]

The literature indicates that schools led by strong digital leaders tend to experience increased student learning motivation, greater teacher engagement in innovation, and improved efficiency in learning processes.[61]

Nevertheless, significant challenges remain, such as limited funding, unequal access, teacher resistance, and the lack of continuous professional development. Therefore, systemic support from the government and teacher training institutions is indispensable.[62]

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[59] Suryadarma, D. "Kemitraan Sekolah dengan Komunitas Digital." *Jurnal Pendidikan dan Kebudayaan*, 26(2), 2022: 98–110.

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