

THE CONCEPT OF PRINCIPAL'S TECHNOLOGY COMPETENCY IN SCHOOL MANAGEMENT EFFECTIVENESS

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Keywords	Abstrak
Technology Competence, Management Effectiveness, School Management	<i>This study aims to analyze the concept of school principals' technological competence and its role in the effectiveness of school management in the digital era. Using a qualitative research method with a literature review approach, the study identifies the concepts of school principals' technological competency, the indicators of this competency, and its relationship with the effectiveness of school management. The analysis results reveal three fundamental components of principals' technological competences: digital literacy, technological literacy, and human literacy, which principal's must possess as a foundation to support their leadership duties in the digital era. These competencies are significantly influence the effectiveness of school management, such as efficient and effective administration, innovative technology-based learning, precise and rapid data-driven decision-making, transparency and accountability in school management, effective and productive school communication, and flexible, effective, collaborative, and globally of professional teacher development.</i>
Kompetensi Teknologi, Efektivitas Manajemen, Manajemen Sekolah	Penelitian ini bertujuan menganalisis konsep kompetensi teknologi kepala sekolah dan perannya dalam efektivitas manajemen sekolah di era digital. Menggunakan metode penelitian kualitatif dengan pendekatan kajian pustaka, penelitian ini mengidentifikasi konsep-konsep kompetensi teknologi kepala sekolah, indikator-indikator kompetensi teknologi dan hubungannya dengan efektivitas manajemen sekolah. Hasil analisis menunjukkan ada 3 komponen utama yang mendasar pada kompetensi teknologi kepala sekolah yaitu literasi digital, literasi teknologi dan literasi manusia yang harus dimiliki oleh kepala sekolah sebagai landasan dalam mendukung tugas-tugas kepemimpinan kepala sekolah di era digital dan kompetensi ini memberikan pengaruh signifikan pada efektivitas manajemen sekolah seperti administrasi yang efektif dan efisien, pembelajaran berbasis teknologi yang inovatif, pengambilan keputusan berbasis data yang presisi dan cepat, transparansi dan akuntabilitas dalam pengelolaan sekolah, serta komunikasi efektif dan produktif sekolah, serta pengembangan profesional guru yang flexsible, efektif, kolaboratif, dan global.

1. INTRODUCTION

The rapid advancements in the digital era have become a significant concern in human life, including in the field of education. The integration of technology systems into education, both in terms of learning processes and school management administration, has had a significant impact in facilitating schools' efforts to improve the quality of education. In terms of digital technology systems, many options are now available to support educational processes with features designed to simplify user interactions. However, skills, expertise, and understanding in utilizing technology, along with the readiness of school communities to adopt it, are the key factors in achieving educational goals. As explained, the effectiveness of digital management in the educational process requires attention to the readiness of school members to adapt to digital transformation situations. Therefore, the successful implementation of digital transformation or technology utilization depends on all parties involved in education possessing adequate digital competencies (Zunimova dkk., 2024).

According to data from Indonesia's Central Bureau of Statistics, the Information and Communication Technology (ICT) Usage Sub-Index in 2023 reached a score of 5.91, an increase from 5.82 in 2022. Meanwhile, the ICT Skills Sub-Index scored 6.04, with a slight increase of only 0.04 from the previous year's 6.00. This disparity in growth rates, as reflected in the statistical data, indicates that ICT skills Sub-Index are developing slower compared to Sub-Index usage (E. Sari dkk., 2024). In the educational context, technological competence is crucial for maximizing the utilization of technology. School principals and education stakeholders need to possess technological expertise to effectively integrate technology into school management. This step can create a modern, efficient, and productive learning environment while enhancing the effectiveness, efficiency, transparency, and accountability in the management of assets and resources in educational institutions. Additionally, technology can support school principals in making data-driven decisions, thereby enabling better management of educational institutions (Fransisca, 2023).

Previous research has shown that school principals' technological competence plays a significant role in enhancing school management effectiveness, explained to 50.8%. This means that a principal's ability to integrate technology into all school management processes has a significant impact; the higher the technological competence, the better the school management, especially through the improvement of

teachers' technological literacy, which supports the teaching and overall school management process (MiNaz dkk., 2022). Furthermore, research on digital-based school management indicates that the technological competence of principals contributes 55.90% to teachers' competence (Roihanun dkk., 2023). This shows that the application of technology in school management, led by principals with good technological competence, plays an important role in enhancing school management effectiveness. Moreover, technological leadership by principals also significantly influences the effectiveness of teachers' management tasks, particularly in computer usage. Principals demonstrating high technological leadership can effectively encourage the integration of information and communication technology (ICT) within the school organization (Raman & Shariff, 2018).

Based on previous studies, this research focuses on the concept of school principals' technological competence and the relationship to school management effectiveness. This study includes definitions, dimensions or indicators of principals' technological competence based on a synthesis of various theories on technological competence. This is necessary because, so far, studies on principals' competence generally focus on managerial competence and technological leadership, but there has not been much discussion specifically on principals' technological competence. This research connects the concept with various aspects of school management effectiveness, such as the learning process, administration, and decision-making in schools. So, this study aims to explore the concept of principals' technological competence and elaborating on the role of technological competence to school management effectiveness in the digital era.

2. METHOD

This study employs a qualitative approach with a literature review design. The literature review is conducted to connect existing literature and fill gaps in previous research (Cooper, 1988). This approach aims to analyze the concept of school principals' technological competence and its relationship to school management effectiveness through the exploration of existing literature. The primary sources in this study are related to digital leadership and school management effectiveness. An analysis of the literature is expected to create an ideal conceptual framework regarding school principals' technological competence.

The stages of the research conducted are as follows:

A. References

References are collected from books, theoretical sources, and reputable research journals published in the last 5-10 years. The main focus is on literature discussing technological competence and school management effectiveness.

B. Definition and Identification

Defining the concept of school principals' technological competence and identifying dimensions or indicators of technological competence based on conceptual theories and previous research. This also includes the identification of indicators of school management effectiveness.

C. Theory Analysis

Analysing relevant theories to elaborate on the concept of school principals' technological competence.

D. Elaboration of Conceptual Relationships

Elaborating on the relationship between technological competence and school management effectiveness. This elaboration is through a synthesis of findings from reputable research journals.

The data obtained from the literature and previous research is analyzed in depth with a theoretical synthesis to produce an understanding of school principals' technological competence concept, linking this concept with aspects of school management effectiveness, and providing theoretical contributions to the development of the concept of school principals' technological competence in educational studies.

3. RESULTS AND DISCUSSION

Components of School Principals' Technological Competence

The technological competence of school principals refers to the abilities and leadership skills of principals in utilizing information and communication technology (ICT) to achieve school management effectiveness, such as administration, learning, and decision-making. The study results indicate that ideal educational leadership in the digital era consists of three main literacy components: digital literacy, technological literacy, and human literacy (Aoun, 2017).

- A. Digital Literacy** refers to the knowledge and skills to use digital media wisely, intelligently, and legally. This literacy relates to the principals' knowledge in

managing information, communication, and interactions relevant to their duties and school management while utilizing digital tools (Nasrullah, dkk., 2017).

- B. Technological Literacy is the technical ability to manage and utilize hardware, software, and digital technologies ethically and effectively. This ability pertains to the technical aspects of how principals use technology to support leadership and school management tasks more efficiently (Wiedarti, dkk., 2016).
- C. Human Literacy encompasses attitudes, communication skills, social interactions, and the ability to leverage human potential, namely the members of the school community, to support effective principal leadership (Dewi Ika Sari dkk., 2020).

These components are part of technological competence, aligning with the definition of competence itself according to Law No. 14 of 2005, which includes a set of knowledge, skills/expertise, and attitudes/behaviors that meet established standards (Mesra dkk., 2023). Additionally, competence is defined as a combination of knowledge, skills, and attitudes reflected in habitual actions and thoughts. Although current regulations do not explicitly define the standards for school principals' technological competence, this competence is also viewed as part of the managerial competence components of school principals, as stated in Ministerial Regulation No. 13 of 2007 regarding principal competency standards (St. Wardah Hanafie Das & Abdul Halik, 2019). Thus, the study results indicate that there are three main components in technological competence: digital literacy, technological literacy, and human literacy, which help the principals' mastery of technology to support the execution of leadership tasks and effectively manage schools.

Indicators of Technological Competence

The study findings reveal that the framework of educators' digital competence can serve as a foundation for understanding technological competence in educational leadership. According to Tetyana Blyznyuk (Blyznyuk, 2019), five aspects of educators' digital competence are identified:

- A. Information refers to educators' data literacy skills in managing knowledge or information relevant to learning.
- B. Communication involves educators' skills in interacting, engaging, and collaborating through digital technology.

- C. Educational Content Creation is the ability of educators to create learning materials or content through digital means.
- D. Security refers to educators' prudence in safeguarding and protecting students from the adverse effects of technology use in the learning process.
- E. Education Problem Solving denotes educators' ability to address technical issues in learning, identify technological needs, recognize weaknesses in digital technology, and utilize technology positively and creatively.

Additionally, according to the ISTE Standards for Education Leaders in the research by Ahmad and Husin (Ahmad & Husnin, 2022), the standards for technological leadership that can assist school leaders in maximizing technology use include five dimensions:

1. Equity and Citizenship Advocate refers to the use of technology to support equity, inclusion, and digital citizenship.
2. Visionary Planner involves creating a vision, strategic plans, and ongoing assessments to integrate technology into learning.
3. Empowering Leader is a leader who empowers teachers and students to be innovative and creative in the teaching and learning process using technology.
4. Systems Designer refers to the development of systems that effectively support technology use.
5. Connected Learner is the attitude of continuous learning and staying connected with technological advancements to support education.

Based on these two competence frameworks, an analysis will be conducted to identify relevant technological competence patterns required by principals to support the effectiveness of educational management.

The Role of Technology in the Effectiveness of School Management

The study findings indicate that the role of technology in the effectiveness of school management includes several aspects:

A. Administration

Research shows that information technology plays a significant role in enhancing the effectiveness and efficiency of school administration. Technology-based school administration can automate various administrative aspects and reduce the manual administrative workload that consumes a lot of time (Akhmadi, 2021). Technology-based school systems, such as school data management, scheduling, attendance,

evaluation, and reporting, are carried out digitally, allowing for effective and efficient administration, enabling school performance to be accurately monitored and supervised (Febrianti dkk., 2023).

B. Accessibility of Learning

School learning supported by the application of information technology can positively impact the accessibility of learning. Technology-based learning and educational applications can facilitate the learning process by providing easy and comprehensive access to information for both students and educators (Akbar Iskandar dkk., 2023). With information technology, learning materials become flexible and can be accessed both inside and outside the classroom (Hussaini, 2022). Technology also enables more effective and engaging learning, allowing for complex concepts to be explained more quickly and accurately, speeding up the understanding process, explaining rare events, and demonstrating dangerous situations outside of reach (Jamun, 2018).

C. Data-Driven Decision Making

The role of technology in data management allows school principals to make decisions based on data-driven educational decision-making. Data analytics with technology is more accurate and effective in facilitating the identification of issues and trends in education in the current digital era (Du, 2022).

D. Transparency and Accountability

Studies show that the application of information technology in school management can enhance transparency and accountability in school administration and academic results (Khumaidi & Mursiyah, 2024). The role of technology also provides easy and quick access to information, systematic and structured reporting, effective performance monitoring and evaluation, and increased involvement of parents and the community in monitoring school activity information (Shobri, 2024).

E. Effective Communication

Research reveals that information technology supports communication among teachers, students, parents, and stakeholders through online platforms, facilitating school coordination and enhancing the involvement of all parties in the school management process (Shobri, 2024).

F. Enhancement and Professional Development of Teachers

The study explains that information and communication technology can enhance and develop teachers' professionalism through access to various learning resources and flexible training, such as online courses or webinars, and by simplifying administrative tasks so that teachers can focus on teaching and self-development. Information and communication technology can enhance collaboration among teachers through digital platforms to enrich their experiences and innovations in education (Qamariyah, 2024).

Based on the study results, it is evident that the role of information and communication technology significantly contributes to various aspects of school management, such as administration, learning, decision-making, transparency, accountability, communication, and the professional development of teachers, as explained by findings from various studies.

Concept of Technology Competency for School Principals

The main components of technology competence for school principals include digital literacy, technology literacy, and human literacy as a foundation for principals to maximize the role of technology for the effectiveness and efficiency of school management. These three components outline abilities that are not only technical in nature but also strategic and leadership dimensions. According to the study data, digital literacy refers to the knowledge, abilities, and leadership of school principals in wisely understanding technology or digital media, which significantly impacts the management of information and communication within schools. Technology literacy is a component of the principal's mastery over hardware and software that is technical in nature, supporting school management, such as the effectiveness and efficiency of administration and innovation in online learning through current digital platforms. Simply put, this refers to how leaders can leverage technology to facilitate all school management tasks, which must be underpinned by knowledge and understanding of technology to utilize it for educational purposes. Human literacy pertains to the principal's attitude towards technology and how they empower the available human resources, build productive communication and social relationships by utilizing technology in schools. Moreover, this also indicates the openness and willingness of school principals to continually learn and adopt new technologies in education to remain transformative and solution-oriented in addressing the challenges of digital-era education.

The indications of the components of digital literacy, technology literacy, and human literacy make them fundamental needs for school principals in digital era. Overall, the concept of these three main components of technology competence for school principals is also relevant to the fundamental aspects of technological expertise in education, as outlined by Roblyer and Hughes (Roblyer & Hughes, 2019), which includes three aspects: Knowledge of Technological, Technological Skills, and Attitude towards Technology.

Table 1. Concept of Technology Competences for School Principals

Component	Description
Digital Literacy <i>Knowledge of Technological</i>	Knowledge and mastery of digital media in information and communication management and school management.
Technology Literacy <i>Technological Skills</i>	Technical skills and mastery of digital media hardware and software to support administration and learning in schools.
Human Literacy <i>Attitude Towards Technology</i>	Attitude and adaptation towards technology, empowering resources, communication capacity, and productive social relationships in the school environment

In addition, in the context of regulation, there is still no detailed explicit elaboration of the expected technology competence standards in Law No. 14 of 2005. However, the application of the ISTE-Standards for Education Leaders framework plays an important role in designing strategies, empowering resources, and ensuring continuous learning. Based on the previous description, it is indicated that digital literacy, technology literacy, and human literacy are not merely additional skills but essential basic needs for modern school principals in today's digital era.

Table 2. Analysis Relevances of Technology Competence Concepts

Component	Indicators of Educator Technology Competence	Standards for Digital Leaders Education
Digital Literacy (<i>Knowledge of Technological</i>)	Information	Visionary planner
Technology Literacy (<i>Technological Skills</i>)	Educational Content Creation Security Education Problem Solving	Equity and citizenship advocate Systems designer
Human Literacy (<i>Attitude Towards Technology</i>)	Communication	Empowering leader Connected learner

Relationship Between Technology Competency of School Principals in Effectiveness of School Management

Based on the data analysis, the technology competence of school principals plays a significant role in the use of technology in schools, impacting the effectiveness of school management. Technology has proven to be significant in enhancing the effectiveness of school management; thus, the higher the capability of principals to integrate technology, the more it contributes to creating efficient, transparent, and innovative management. This competence affects several important aspects of school management, including:

A. Administration

Research data indicate that technology enables the automation of operational tasks within the school community, creating more precise and rapid management in administrative aspects.

B. Technology-Based Learning

Technology-based learning is crucial for expanding access and improving the quality of education. It facilitates the provision of interactive digital resources and supports knowledge transfer in various learning environments.

C. Data-Driven Decision Making

By utilizing technology in data analytics, school principals can make decisions that are more accurate and responsive, quickly identifying challenges and opportunities in modern school management.

D. Transparency and Accountability

The research data show that technology can support increased transparency in reporting school activities, academic performance, and financial matters, providing broader and easier access for parents, the community, and all involved parties. With transparency and accountability, this builds public trust in the school's management.

E. Effective Communication

Digital platforms facilitate efficient communication between principals, teachers, students, and parents, optimizing collaboration and coordination while strengthening synergy among stakeholders in school management.

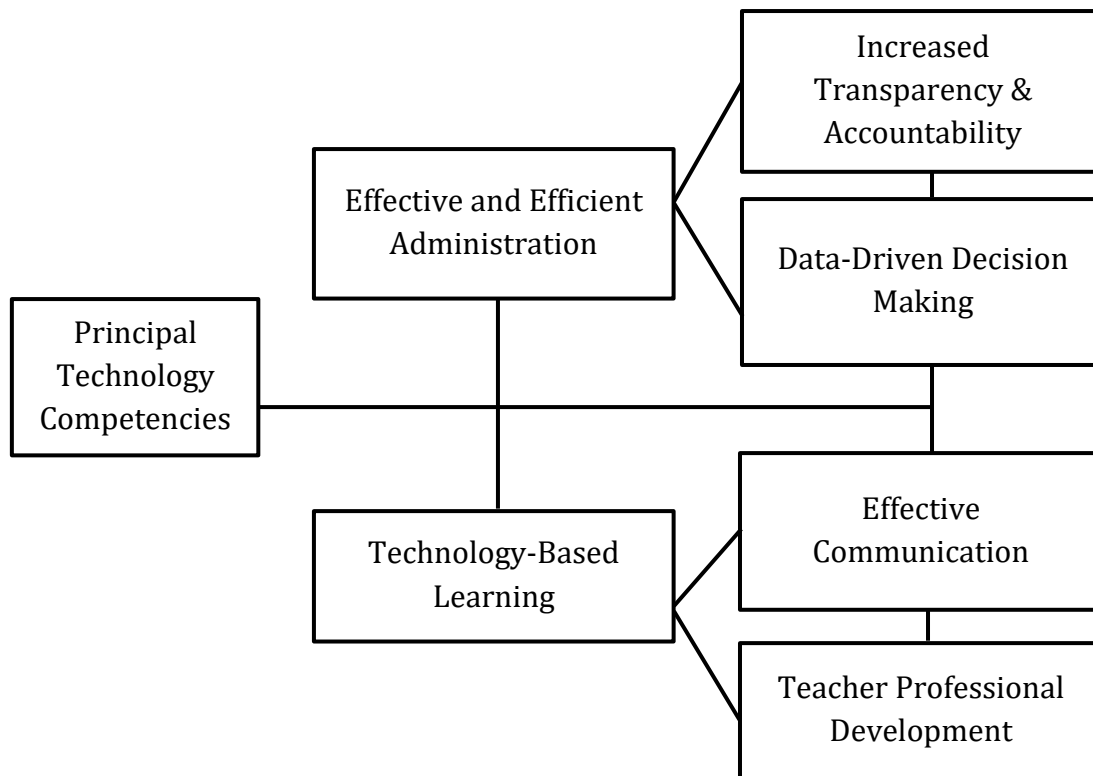
F. Professional Development for Teachers

Through technology, teachers can continually enhance their competencies more flexibly and effectively through online training and global collaboration. This technology-based professional development can significantly and sustainably improve the quality of teaching.

Thus, the technology competence of school principals has a significant relationship and plays a strategic role in promoting the effectiveness of school management. The integration of technology can enhance operational efficiency and strengthen the overall quality of education. Therefore, it is important to develop this competence among educational institution leaders to face challenges and leverage opportunities in the current educational.

Conceptual Framework of Relationship between Technology Competence and School Management Effectiveness

According to the data analysis, a conceptual framework can be created that shows that digital literacy, technology, and human factors complement each other in supporting the effectiveness of school management.



4. CONCLUSION

Based on the findings of the study, it can be concluded that the technology competence of school leaders plays a strategic role in enhancing the effectiveness of school management. The main components of this technology competence, such as digital literacy, technology literacy, and human literacy, form an essential foundation that needs to be mastered to support the leadership tasks of school leaders in the digital era. The application of information technology significantly impacts effective and efficient administration, innovative technology-based learning, precise and rapid data-driven decision-making, as well as transparency and accountability in school management to build community trust. Additionally, technology also supports more effective and productive communication among school stakeholders and facilitates more flexible, effective, collaborative, and global professional development for teachers through various experiences as an effort to improve the quality of education. Therefore, the development of technology competence among school leaders is a fundamental necessity to ensure modern, effective, efficient, and responsive school management in addressing educational challenges. However, this study has some limitations, including its reliance on literature review without field data and empirical validation and the study may not fully represent diverse educational environment, and not exploring other

variables like social competence or external support. The challenged of rapid evolution of technology also potentially limiting the long-term of relevance of the findings. Addressing these limitations in future studies could provide deeper insights into the role of principal's technology competence in education management with in field data and empiricial validation to represent of education environtment.

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