The Role of Educational Management in Developing Teachers' Digital Competencies as the Key to Successful Technology-Based Learning

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Abstrack

The rapid advancement of digital technology has reshaped the educational landscape, yet many elementary school teachers still struggle to integrate technology effectively into instruction. This research addresses the gap between managerial support and teachers' digital competence in achieving successful technology-based education. Guided by educational management theory and the digital competence framework, this study analyzes how the role of educational management and teachers' digital skills affect learning success. Using a quantitative explanatory survey involving 105 elementary school teachers in Karawang Regency, data were collected through a five-point Likert-scale questionnaire and analyzed using SPSS. The results show that both variables significantly influence technology-based learning success ($p = 0.000$, $R^2 = 0.684$). These findings highlight that visionary and adaptive school management, combined with strong teacher digital competence, are key drivers of educational transformation. The study contributes theoretically to the discourse on digital pedagogy and, practically, to strengthening managerial strategies in digital-era schooling.

Keywords: educational management, teachers' digital competencies, technology-based learning, educational transformation

Abstrak

Perkembangan teknologi digital yang pesat telah mengubah lanskap pendidikan, namun banyak guru sekolah dasar masih menghadapi tantangan dalam mengintegrasikan teknologi secara efektif ke dalam pembelajaran. Penelitian ini dilakukan untuk menjawab kesenjangan antara dukungan manajerial dan kompetensi digital guru dalam mewujudkan keberhasilan pembelajaran berbasis teknologi. Berlandaskan teori manajemen pendidikan dan kerangka kompetensi digital guru, penelitian ini bertujuan menganalisis pengaruh peran manajemen pendidikan dan kompetensi digital guru terhadap keberhasilan pembelajaran berbasis teknologi. Pendekatan penelitian menggunakan metode kuantitatif dengan desain explanatory survey terhadap 105 guru sekolah dasar di Kabupaten Karawang. Data dikumpulkan melalui kuesioner berskala Likert lima poin dan dianalisis menggunakan SPSS. Hasil menunjukkan kedua variabel berpengaruh signifikan terhadap keberhasilan pembelajaran berbasis teknologi ($p = 0{,}000$; $R^2 = 0{,}684$). Temuan ini menegaskan bahwa manajemen sekolah yang visioner serta kompetensi digital guru yang kuat menjadi faktor kunci transformasi pendidikan. Penelitian ini berkontribusi secara teoretis pada penguatan wacana pedagogi digital dan secara praktis terhadap strategi manajerial sekolah di era digital.

***Kata Kunci**: manajemen pendidikan, kompetensi digital guru, pembelajaran berbasis teknologi, transformasi pendidikan*

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INTRODUCTION

The development of information and communication technology has brought major changes in various aspects of life, including education. This transformation became increasingly evident after the pandemic, which accelerated the adoption of technology in teaching and learning activities at all levels of education (Echeverría et al., 2025). The education sector is now required to adapt quickly to the digital era, which introduces a new paradigm in the learning process. The use of technology is no longer an option but a necessity that must be integrated into the education system to enhance learning effectiveness, efficiency, and engagement (Bicalho et al., 2023). In line with this, the success of technology integration depends heavily on teachers' digital competence, which is a key element in realizing meaningful technology-based learning (Jakaria et al., 2025). Schools, as educational institutions, must be able to transform toward technology-based learning that demands the readiness of all components, especially teachers.

Teachers are the main actors in the successful implementation of technology-based learning. Their digital competence is a key factor in ensuring the learning process is interactive, engaging, and relevant to the demands of the times. Such competence not only includes technical abilities in operating devices but also pedagogical skills in designing, implementing, and evaluating learning supported by technology (Hutagalung & Purbani, 2021). Teachers with high digital literacy can effectively use technology to enhance student engagement and create meaningful learning experiences (Rodrigues-Silva & Alsina, 2024). Therefore, mastering digital competence has become a professional requirement for teachers in the rapidly evolving and dynamic education era 4.0 (Susilowati & Haryono, 2025).

In reality, teachers' digital competence varies widely. Some teachers have successfully integrated technology creatively into their teaching, such as using digital platforms, interactive videos, or educational applications. However, others still face various challenges in applying it. These obstacles may stem from a lack of continuous training, limited facilities and internet connectivity, insufficient institutional support, or resistance to change (Fazis et al., 2024). This condition is consistent with findings that many elementary school teachers in Indonesia are still at an early stage of technology adoption due to limited knowledge and inadequate infrastructure support (Ibda et al., 2023). As a result, the implementation of technology-based learning often remains suboptimal and ceremonial, failing to address the deeper pedagogical aspects that foster meaningful learning for students (Maulyda et al., 2024).

The problem becomes even more relevant when observed in the context of elementary schools in Karawang Regency, where digital transformation in education has not been evenly distributed. Preliminary observations indicate that although some schools have begun adopting technology, many teachers still rely on conventional learning models due to limited digital competence and a lack of managerial support. This situation highlights the urgent need for a systematic approach to educational management that can strengthen teachers' digital readiness and foster a supportive learning ecosystem for technology-based instruction.

In this situation, the role of educational management becomes crucial. Educational management is not only responsible for organizing school administration and resources but also serves as the driving force in developing teachers' professional capacities, including their digital competencies. Effective management must be able to design sustainable human resource development strategies through training, supervision, and motivation programs (Anwar & Warman, 2025). Support from visionary and adaptive

school leadership has also proven essential in fostering a culture of digital innovation within schools (Rasdiana et al., 2024). Thus, teachers not only understand the importance of technology but are also skilled in using it productively in technology-based learning (Tobondo, 2025).

The leadership role of principals and management teams determines the direction and success of technology implementation in learning (Ridlo, 2025). Visionary principals can build a digital innovation culture in schools through supportive policies and exemplary technology use (Reis-Andersson, 2024). They act as facilitators, connecting teachers' needs with available resources such as training, digital tools, and technical assistance. Moreover, principals must create a conducive work environment that encourages creativity, collaboration, and the sharing of best practices among teachers. Adaptive, open, and participatory leadership nurtures teachers' confidence in developing their digital abilities and increases their motivation to innovate in the learning process (Tusmiarifudin et al., 2024).

In addition, educational management serves as an internal policy-making body that regulates school development strategies and priorities. Research by Riski et al. (2023) shows that principals' digital leadership plays a vital role in shaping the direction and strategies of school policy in the era of technological transformation. Digital education programs will not be effective without clear, consistent policy support. As emphasized by Mohzana et al (2024), the effectiveness of school policies is a key factor in the successful implementation of digital learning. Such policies may include the provision of technological infrastructure, special budget allocation for digital training, and the implementation of continuous monitoring and evaluation systems for teachers' competencies. With well-directed policies, the process of developing teachers' digital competence will have a strong, measurable foundation, in line with the digital education transformation policy model proposed by Rusdinal et al (2025) to accelerate sustainable education development in Indonesia.

In 21st-century education, digital capability has become an essential part of teachers' core professional competence. Globalization, the industrial revolution 4.0, and advances in artificial intelligence demand that teachers go beyond being mere information transmitters. They must serve as facilitators in cultivating students' critical thinking, collaboration, communication, and creativity skills (Siregar et al., 2024). Digital competence now extends beyond technical skills to encompass pedagogical, social, and ethical capacities in leveraging technology to create meaningful learning experiences (Domínguez-González et al., 2025). Therefore, the development of digital competence cannot be pursued individually but must be an integral part of an educational management system that is well-planned, measurable, and oriented toward continuous improvement of learning quality (Karmin et al., 2025).

Effective educational management must foster a culture of continuous learning within schools as the foundation for improving education quality (Mustafa, 2025). Every teacher should be encouraged to continuously update their knowledge, skills, and digital literacy in line with technological developments (Sulaiman et al., 2022). Through a managerial approach grounded in collaboration, innovation, and active participation, schools can evolve into healthy, dynamic digital learning ecosystems where teachers, students, and school leaders work together to create adaptive, contextual, and relevant learning processes (Jailani, 2025).

Furthermore, the integration between educational management and teachers' digital competence will significantly determine the effectiveness of technology-based

learning outcomes (Domínguez-González et al., 2025). A harmonious relationship toamong school policies, institutional support, and teachers' individual capacities will generate positive synergy in improve both learning processes and outcomes (Koniari, 2023). When management provides systematic support through training, mentoring, and facilities, teachers become more motivated to innovate and explore creative, interactive, and relevant digital learning models that meet 21st-century education needs (Ofita et al., 2024).

Based on this background, and supported by the argument of Rasdiana et al., (2024) that visionary and adaptive school management plays a crucial role in promoting digital innovation, this research focuses on two main problems: how the role of educational management supports the development of teachers' digital competence in elementary schools, and to what extent educational management and teachers' digital competence influence the success of technology-based learning. The purpose of this study is to analyze the causal relationships between these variables and provide strategic recommendations for strengthening digital management and improving teacher capacity in adapting to educational transformation in the digital era.

METHOD

This study employed an Explanatory Survey method with a quantitative approach, aiming to explain the causal relationship between independent and dependent variables (Sari et al., 2022). This method was chosen because it enables a deeper understanding of the interrelationships among variables through inferential statistical analysis. The independent variables in this study include Educational Management Role (X_1) and Teachers' Digital Competence (X_2), while the dependent variable is Technology-Based Learning Success (Y). The explanatory survey design was used to obtain a systematic, factual, and accurate picture of the extent to which educational management influences the development of teachers' digital competence, and how these two variables together contribute to the success of technology-based learning in elementary schools.

The study population comprised all public elementary school teachers in Karawang Regency, West Java, Indonesia. Sampling was conducted using a purposive sampling technique, taking into account the readiness of the school's technology infrastructure, teachers' experience with digital media, and their willingness to participate in the research. A total of 105 teachers from several public elementary schools participated in this study. The researcher ensured the confidentiality of respondents' data and adhered to ethical principles of educational research, including voluntary participation and informed consent.

This study uses a closed questionnaire as the main instrument for collecting quantitative data from respondents (Evangelou, 2023). This questionnaire was designed to measure teachers' perceptions of the role of educational management, digital competence, and the success of technology-based learning. The research questionnaire covers three main variables, namely the Role of Educational Management, Teachers' Digital Competence, and the Success of Technology-Based Learning. Each variable is broken down into a number of statements designed to measure conceptual dimensions quantitatively. All questionnaire items were developed based on educational management theory, the teacher digital competency framework, and relevant prior research. The use of a closed-ended questionnaire is considered effective in survey research because it can yield structured data and enable objective statistical analysis of relationships between variables (Sari et al., 2022). The statements for each variable are presented in Table 1.

Table 1.
Research Variable Operations

Variable	Statements
The Role of Educational Management	The principal develops a technology-based school development plan
	The school has a strategic policy on the implementation of digital learning
	Management allocates a special budget to support digitization activities
	The principal plays an active role in coordinating the use of learning technology
	There are regular evaluations of the effectiveness of digital learning programs
Teachers' Digital Competence	Teachers can use various online learning platforms (such as Google Classroom or Canva for Education)
	Teachers understand how to operate digital devices to support learning
	Teachers are able to integrate multimedia into teaching and learning activities
	Teachers independently develop digital teaching materials for classroom needs
	Teachers innovate using digital applications to increase student motivation to learn.
The Success of Technology-Based Learning	The use of technology helps teachers deliver material more clearly and interestingly
	Students interact more actively during learning using digital media
	Technology-based learning improves students' understanding of concepts
	Student learning outcomes improve after the implementation of digital learning
	Teachers feel that technology-based learning makes the learning process more efficient and enjoyable

To measure respondents' level of agreement with each questionnaire statement, a five-point Likert scale was used. This scale provides a range of ratings from “strongly disagree” to “strongly agree” based on respondents' perceptions of the statements presented (Sugiyono, 2022). The measurement scale used in this study is shown in Table 2.

Table 2.
Likert Scale

Score	Rating Categories
1	Strongly Disagree (STD)
2	Disagree (D)
3	Neutral (N)
4	Agree (A)
5	Strongly Agree (SA)

The data obtained from the questionnaire responses were analyzed using SPSS software. The analysis was carried out in two main stages, namely descriptive analysis and inferential analysis (Waruwu et al., 2025).

1. The first stage was descriptive analysis, which aimed to describe the characteristics of the respondents and provide a general overview of each research variable. The results of this analysis present the mean values, percentages, and distributions of respondents' answers for each variable: the role of educational management, teachers' digital competence, and the success of technology-based learning.
2. The second stage was an inferential analysis, used to examine the relationships and influences among variables. Before conducting the main test, the data were tested for normality and homogeneity to ensure they met the requirements for statistical analysis. Afterward, multiple linear regression analysis was performed to determine the effect of independent variables on the dependent variable.

In this study, the independent variables consisted of the role of educational management and teachers' digital competence, while the dependent variable was the success of technology-based learning. The regression analysis results were evaluated using two main measures: the coefficient of determination (R^2) and the significance value ($p < 0.05$). The R^2 value indicates the magnitude of the contribution of the independent variables to the dependent variable, while the significance value is used to determine whether the effect is statistically meaningful. The results of this analysis were then interpreted to explain the extent to which educational management contributes to improving teachers' digital competence and how these two variables together influence the success of technology-based learning in elementary schools.

RESULTS AND DISCUSSION

Results

Based on the results of processing questionnaire data from 105 elementary school teachers in Karawang Regency, an overview of the three research variables was obtained, namely the Role of Educational Management, Teacher Digital Competence, and the Success of Technology-Based Learning. Descriptive analysis shows that the three variables have average scores above 4.00 on a 1–5 Likert scale, indicating they are in the high to very high category.

Table 3.
Results of Descriptive Analysis of Each Variable

Research Variable	Number of Item	Mean	Standard Deviation (SD)	Category
The Role of Educational Management	5	4,44	0,58	Very Good
Teachers' Digital Competence	5	4,45	0,59	Very Good
The Success of Technology-Based Learning	5	4,28	0,68	Good

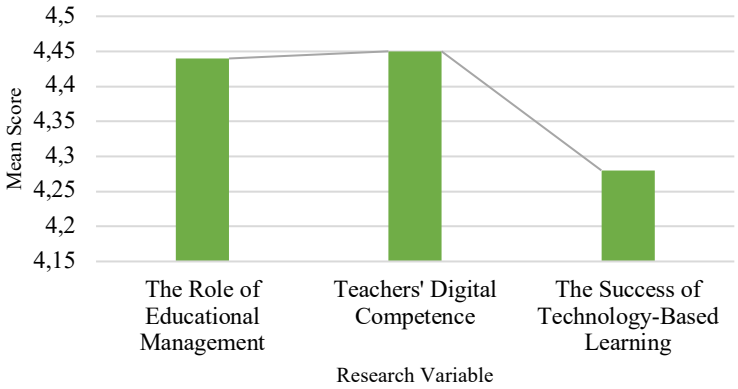
The high mean scores across the three variables indicate that teachers hold a positive perception of school management support, their level of digital competence, and the effectiveness of technology implementation in learning activities. More specifically, the mean score for the Educational Management Role was 4.44, suggesting that principals

and management teams are perceived as being actively involved in supporting the digitalization of learning. Such support is reflected in school policies, the provision of facilities, and teacher training programs. Meanwhile, the mean score for Teachers' Digital Competence, at 4.45, indicates that teachers feel confident integrating technology into their teaching, whether through creating digital learning media or using educational applications.

Furthermore, the mean score for Technology-Based Learning Success was 4.28, indicating that the implementation of digital learning has been effective. Teachers believe that technology-enhanced learning increases student engagement and makes the learning process more interesting, although certain challenges remain, such as limited infrastructure and internet access in some schools.

To provide a clearer illustration of the descriptive findings, Graph 1. presents a comparison of the mean scores of the three main research variables: the role of educational management, teachers' digital competence, and the success of technology-based learning.

Graph 1.
Results of Descriptive Analysis



The visualization shows that teachers' digital competence (4.45) has a slightly higher mean score than educational management (4.44), while the success of technology-based learning has a lower mean score (4.28). This indicates that, although both management and teachers demonstrate strong readiness in implementing digital transformation, the effectiveness of technology-based learning still faces several challenges at the implementation level.

To determine the influence among the variables, multiple linear regression analysis was conducted, with Technology-Based Learning Success as the dependent variable and Educational Management Role and Teachers' Digital Competence as the independent variables. This statistical test was chosen to examine the extent to which both factors, either partially or simultaneously, affect the success of digital learning in elementary schools. The results of the analysis are presented in Table 4 below.

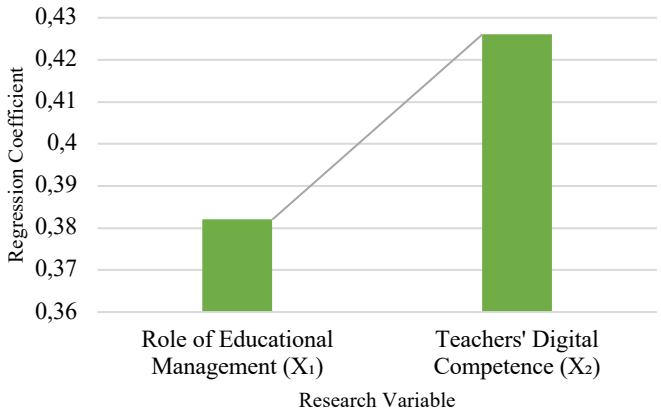
Table 4.
Multiple Linear Regression Analysis Results

Variable	Regression Coefficient (β)	Standard Error	t-value	Sig. (p)	Description
Constant	0,912	0,219	4,158	0,000	–
Role of Educational Management (X_1)	0,382	0,083	4,615	0,000	Significant
Teachers' Digital Competence (X_2)	0,426	0,081	5,232	0,000	Significant
R^2 = 0,684					The model explains 68.4% of the variation in Y.
F-test = 109,21 (Sig. = 0,000)					The model is simultaneously significant.

The regression results show that both independent variables have a positive and significant influence on the Success of Technology-Based Learning. The R^2 value of 0.684 indicates that 68.4% of the variation in technology-based learning success can be explained by the Role of Educational Management and Teachers' Digital Competence, while the remaining 31.6% is influenced by other factors outside the research model. The regression coefficients indicate that Teachers' Digital Competence has a slightly stronger influence (β = 0.426) than the Role of Educational Management (β = 0.382). This means that, in addition to managerial support, teachers' ability to master and apply technology is crucial to the success of digital learning in elementary schools.

To provide a clearer understanding of the magnitude of influence between variables, Graph 2 presents a visual comparison of the standardized regression coefficients. The bar chart illustrates the relative contributions of the independent variables, educational management role (β = 0.382) and teachers' digital competence (β = 0.426), to the success of technology-based learning. It can be observed that teachers' digital competence exerts a slightly stronger influence compared to educational management. This visualization reinforces the interpretation that while teachers' digital competence is the main driver of digital learning innovation, its success remains highly dependent on the managerial support and strategic direction provided by school leadership.

Graph 2.
Results Regression Analysis



The findings of this study show that the role of educational management and teachers' digital competence contribute significantly to the success of technology-based learning. Effective educational management has proven to be an important factor in supporting digital learning transformation.

Discussion

These descriptive findings suggest that the synergy between management support and teachers' digital competence is essential to ensuring the success of technology-based learning implementation (Suleman & Idayanti, 2023). Principals and management teams with a clear vision can create a conducive working environment for teacher innovation (Rosita & Iskandar, 2022). Support in the form of policies, facilities, and continuous evaluation plays a major role in enhancing teachers' motivation and readiness to adapt to digital learning changes. These findings align with the studies of Riski et al. (2023) and Tusmiarifudin et al. (2024), which emphasize that the effectiveness of technology-based learning implementation is influenced by participatory leadership styles and managerial strategies.

Teachers' digital competence also strongly influences learning success. Teachers with high digital literacy are not only capable of using technological tools but also of integrating them into creative and collaborative teaching strategies (Rahmandani et al., 2025). This is consistent with the DigCompEdu framework, which explains that teachers' digital competence encompasses pedagogical, technical, and ethical aspects in managing digital learning. This finding is further supported by Domínguez-González et al. (2025), who assert that digital competence is key for teachers in creating adaptive, learner-centered learning environments. Similarly, Siregar et al. (2024) note that mastery of digital literacy and pedagogical knowledge directly contributes to the effectiveness of technology integration in elementary school learning. Consistent with this, Rahim et al. (2023) found that teachers with well-developed digital competence can manage technology-based learning activities collaboratively and ethically, thereby enhancing students' motivation and learning outcomes.

The success of technology-based learning results from the synergy between school management and teacher competence. The F-test result of 109.21 with a significance value of 0.000 indicates that both variables have a simultaneous and significant effect on digital learning success. This synergy creates an educational

ecosystem in which management provides direction and resources, while teachers act as the main drivers of classroom innovation. These findings are consistent with Mustafa (2025), who emphasizes that strategic school leadership plays an essential role in fostering a sustainable digital learning culture. Furthermore, Tobondo (2025) also found that the success of technology integration is influenced by the alignment between managerial policies and teachers' readiness to adapt to digital transformation. This result is reinforced by Karmin et al. (2025), who state that collaboration between management and teachers is the key to developing effective, student-oriented digital learning innovations.

This study provides several important implications for elementary education institutions. School principals need to strengthen their digital leadership roles by focusing on policies and programs that support technology integration in learning. The enhancement of teachers' digital competence must be sustained, not only through technical training but also through reflective, collaborative, and practice-based approaches in the classroom. This aligns with Ridlo (2025), who highlights the importance of school leadership in continuously developing teachers' digital pedagogical competence. In addition, Rahmandani et al. (2025) argue that collaboration between teachers and school management is an effective strategy for creating a culture of innovation in technology-based learning. By strengthening managerial aspects and teachers' digital competence, elementary schools can build an adaptive, innovative, and future-ready learning ecosystem, as also emphasized by Mustafa (2025) in the context of digital learning culture within smart school ecosystems.

CONCLUSION

This study demonstrates that the success of technology-based learning is strongly influenced by two key factors: the role of educational management and teachers' digital competence. The findings confirm that effective educational management creates supportive policies, resource systems, and a collaborative work culture that motivate teachers to strengthen their digital competence. Teachers with high digital competence can integrate technology creatively, interactively, and contextually into the learning process, making it more engaging and meaningful. The synergy between managerial support and teacher capability serves as a solid foundation for achieving digital transformation in elementary education. Strengthening digital managerial leadership and providing continuous, integrated professional development for teachers are essential steps toward building adaptive and sustainable technology-based learning ecosystems. This study contributes to understanding how management practices and teacher competencies interact to shape the success of educational digitalization, offering practical insights for school leaders and policymakers in the digital era.

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