

Principal Managerial Competence and Readiness for Deep Learning Implementation: The Moderating Role of Teacher Digital Literacy

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Article info	Abstract
Article History Recieved: 18/04/2026 Revised: 30/06/2026 Accepted: 09/08/2026 ✉ Corresponding author	<i>This research is driven by suboptimal teacher digital literacy, inadequate school facilities, and the need to enhance principals' managerial competence due to limited training and misconceptions regarding deep learning. The study aims to analyze the influence of principals' managerial competence and teachers' digital literacy on the readiness to implement deep learning, including the role of digital literacy as a moderating variable at public elementary schools in Kupitan District, Sijunjung Regency. The study employed a quantitative causal-associative approach involving 101 respondents selected via simple random sampling. Data were collected using Likert scale questionnaires and analyzed through simple linear regression and Moderated Regression Analysis (MRA). The research findings indicate that: Principals' managerial competence significantly influences implementation readiness (t count 5.372 > t table 1.984); Teachers' digital literacy significantly influences implementation readiness (t count 3.850 > t table 1.984), and; Digital literacy significantly moderates the effect of managerial competence on implementation readiness (sig. value 0.002 < 0.05). These findings underscore that the synergy between leadership and teachers' digital proficiency is key to educational transformation in elementary schools.</i> Keywords: Managerial Competence, Deep Learning, Digital Literacy
	Abstrak Penelitian ini dilatarbelakangi oleh literasi digital guru yang belum optimal, fasilitas sekolah yang belum memadai, serta perlunya peningkatan kompetensi manajerial kepala sekolah akibat terbatasnya pelatihan dan miskonsepsi mengenai pembelajaran mendalam. Tujuan penelitian adalah untuk menganalisis pengaruh kompetensi manajerial kepala sekolah dan literasi digital guru terhadap kesiapan penerapan pembelajaran mendalam, termasuk peran literasi digital guru sebagai variabel moderasi di SDN Kecamatan Kupitan, Kabupaten Sijunjung. Penelitian menggunakan pendekatan kuantitatif dengan jenis asosiatif kausal yang melibatkan 101 responden melalui teknik simple random sampling. Data dikumpulkan dengan angket skala Likert dan dianalisis menggunakan regresi linear sederhana, serta Moderated Regression Analysis (MRA). Hasil penelitian menunjukkan bahwa: Kompetensi manajerial kepala sekolah berpengaruh signifikan terhadap kesiapan penerapan (t hitung 5,372 > t tabel 1,984); Literasi digital guru berpengaruh signifikan terhadap kesiapan tersebut (t hitung 3,850 > t tabel 1,984), dan; Literasi digital terbukti memoderasi pengaruh kompetensi manajerial terhadap kesiapan penerapan secara signifikan (nilai sig. 0,002 < 0,05). Temuan ini menegaskan bahwa sinergi kepemimpinan dan kecakapan digital guru adalah kunci transformasi pendidikan di sekolah dasar.

Kata Kunci: Kompetensi Manajerial, Pembelajaran Mendalam, Literasi Digital

INTRODUCTION

Improving the quality of education is a crucial agenda for Indonesia amidst increasingly competitive global competition. Data from the United Nations Development Programme (UNDP), as cited by Anisa et al., (2021), indicates that Indonesia's Human Development Index (HDI) in the education sector remains relatively low at 14.6%, lagging significantly behind neighboring countries such as Malaysia, which has reached 28%. This low quality poses a major challenge for teachers as professional educators who play a key role in the learning transformation process. The overall quality of education depends heavily on the competence and performance of teachers, as direct interaction within the classroom is the core of educational success (Anisa et al., 2021).

In response to these challenges, the Indonesian government has begun integrating the concept of deep learning into the national education system, a move strengthened by the Regulation of the Minister of Primary and Secondary Education of the Republic of Indonesia Number 13 (2025). Deep learning is not merely an addition of material but an approach focused on comprehensive conceptual mastery and active student engagement through three key elements: meaningful learning, mindful learning, and joyful learning (Nafi'ah & Faruq, 2025). Its objective is to build a foundation of basic literacy, critical thinking competencies, and adaptive character qualities in line with World Economic Forum standards (Fullan et al., 2017; Amalia et al., 2025). However, at the implementation level, a misconception has emerged among educators that deep learning is a rigid new curriculum similar to the Kurikulum Merdeka or the 2013 Curriculum. In reality, deep learning is a philosophy and teaching strategy that prioritizes the quality of understanding over the quantity of rote memorization (Setiani et al., 2025). Teachers are expected to act as facilitators who design meaningful, challenging, and relevant learning experiences without necessarily replacing the existing curriculum (Tribuana et al., 2025). Consequently, institutional readiness, particularly at the elementary school level, becomes a decisive variable in determining how effectively this approach can shape future generations (Amalia et al., 2025).

Field phenomena, particularly in public elementary schools (Sekolah Dasar Negeri or SDN) within the Kupitan District of Sijunjung Regency, reveal serious obstacles regarding the readiness to implement this policy. Based on data from the Performance School Operational Assistance (BOS Kinerja) funding, only 8.33% or a single school (SDN 11 Padang Sibusuk), received such financial support, while the remaining 91.67% did not receive a similar allocation. This condition has a direct

impact on the lack of formal training for principals and teachers regarding deep learning, given that current training programs from the Center for Teachers and Education Personnel (Balai Guru dan Tenaga Kependidikan or BGTK) are still focused on schools receiving BOS Kinerja. Consequently, the majority of educators in this region must rely on independent online training, the effectiveness of which remains uneven.

Readiness for deep learning implementation is significantly influenced by the principal's managerial competence. As top managers, principals are responsible for strategic planning, resource organization, and the oversight of innovative program implementation (Kholidi, 2025). From a leadership perspective, this task is a mandate (amanah) that must be carried out with integrity and justice, as reflected in the relevance of Surah An-Nisa (4): Verse 58, which emphasizes delivering trusts to those to whom they are due and judging with justice. Without solid management in allocating budgets and inspiring staff, pedagogical innovations tend to stagnate (Prihatin & Sutangsa, 2025).

Teacher digital literacy has emerged as a primary pillar in educational transformation within the digital era. Teachers are required to strategically utilize technology to create interactive and personalized learning experiences, as well as to manage secure virtual classroom environments (Peraturan Menteri Pendidikan Dasar dan Menengah Republik Indonesia Nomor 13, 2025). However, observations in public elementary schools (SDN) across Kupitan District reveal that teacher digital literacy remains suboptimal; technology is still frequently used merely as a tool for presentation or administration, rather than as a medium to facilitate critical thinking and collaboration, the core components of deep learning.

The relationship between a principal's managerial competence and school readiness is grounded in Transformational Leadership Theory. Makmuriana (2021) states that leaders with high managerial competence are capable of creating an environment ready for change by empowering teachers. Meanwhile, the influence of digital literacy on readiness is supported by the Theory of Readiness for Change by Hidayatullah (2022), which emphasizes that technological mastery increases teachers' confidence in adopting new methods. The integration of these two factors is crucial to ensure that individuals do not feel coerced or frustrated when facing systemic changes (Junaidi, 2024).

This study positions teacher digital literacy as a moderating variable based on Michael Fullan's theory, as cited in Kumbangsila (2025). This theory explains that the success of educational implementation depends on the interaction between leadership and teacher capacity. The effectiveness of a principal's managerial competence in fostering deep learning will be strengthened if teachers possess high digital literacy, as they are able to respond to such managerial efforts through the appropriate use of

technology. Conversely, low digital literacy among teachers will act as a barrier, even if the principal's managerial performance is at a high level.

Based on the urgency and research gaps identified in previous studies, such as those by Aisyah (2024) and Fina (2024), which have not yet addressed the specific variables of deep learning at the elementary school level, this study aims to integrate these variables into a comprehensive model. The primary objective of this research is to analyze the influence of principal managerial competence on the readiness for deep learning implementation, the direct influence of teacher digital literacy, and the role of teacher digital literacy in moderating the relationship between these two variables. Through the study titled 'The Influence of Principal Managerial Competence on the Readiness for Deep Learning Implementation with Teacher Digital Literacy as a Moderating Variable in Public Elementary Schools of Kupitan District,' it is expected to provide a contextual overview for educational transformation at the local level.

METHODS

Research Design and Participants

This study employs a quantitative approach with a causal-associative research design. This design was selected to analyze the cause and effect relationships and the extent of the influence of the independent variables namely Principal Managerial Competence (X) and Teacher Digital Literacy (Z) on the dependent variable, Readiness for Deep Learning Implementation (Y). The research was conducted at Public Elementary Schools (SDN) throughout the Kupitan District, Sijunjung Regency, over a four-month period from September to December 2025. The population of this study consists of 126 individuals, comprising 13 principals and 113 teachers. Sampling was carried out using two techniques: total sampling for principals ($n=13$) and simple random sampling for teachers. The teacher sample size was determined using the Slovin formula with a 5% margin of error, resulting in 88 teacher respondents. Consequently, the total number of participants in this study is 101 individuals. The sample size for each school was determined proportionally to ensure data representativeness across the 13 schools in the region (Sugiyono, 2024).

Instruments and Data Collection Procedures

The primary instrument used for data collection is a structured questionnaire employing a Likert scale. The instrument development followed a systematic process, including defining variable concepts, blueprinting, drafting items, and validation stages. The questionnaire consists of 62 items covering Managerial Competence (21 items), Teacher Digital Literacy (21 items), and Deep Learning Readiness (20 items). To ensure the quality of the measurement tool, two stages of testing were conducted. First, content validity was assessed through expert judgment by three academic validators, resulting in

an average score of 77.14% (Valid). Second, empirical validity and reliability tests were performed based on field trials processed with SPSS. The validity test results indicated that one item in variable X (item number 21) was invalid as its calculated r-value was less than 0.396 ($r < 0.396$). Following the elimination of this item, the remaining 61 items were declared highly reliable, with Cronbach's Alpha values of 0.876 for variable X, 0.888 for variable Y, and 0.920 for variable Z. The data collection procedure involved administrative permitting, distributing questionnaires to respondents across 13 public elementary schools, and verifying data completeness prior to analysis (Arikunto, 2021).

Data Analysis Techniques and Ethical Considerations

Data analysis was performed using the IBM Statistical Product and Service Solutions (SPSS) software. The analysis process was divided into three primary stages: (1) Descriptive analysis was employed to characterize each variable through the Respondent Achievement Level (TCR); (2) Classical assumption tests, including the Kolmogorov-Smirnov test for normality and heteroscedasticity tests, were conducted to ensure the data met the requirements for regression; and (3) Hypothesis testing in this study utilized Simple Linear Regression to determine partial effects (t-test), and Moderated Regression Analysis (MRA) to examine whether Teacher Digital Literacy (Z) moderates the influence of Principal Managerial Competence (X) on the Readiness for Deep Learning Implementation (Y). Research ethical standards were strictly implemented by providing informed consent to respondents, ensuring voluntary participation, and maintaining the anonymity and confidentiality of all personal data in accordance with scientific publication codes of ethics (Arikunto, 2021).

RESULTS AND DISCUSSIN

Results

The results of this study aim to determine: (1) the influence of principal managerial competence on the readiness for deep learning implementation; (2) the influence of teacher digital literacy on the readiness for deep learning implementation; and (3) the role of teacher digital literacy in moderating the influence of principal managerial competence on the readiness for deep learning implementation.

The data measurement results are classified into respondent achievement level categories. For the principal managerial competence variable, the categories are defined as follows: highly competent for the percentage range of 82%-100%, competent for 63%-81%, fairly competent for 44%-62%, and less competent for 25%-43%. Meanwhile, for the teacher digital literacy and readiness for deep learning implementation variables, the categories are: excellent for the range of 82%-100%, good for 63%-81%, fair for 44%-62%, and poor for 25%-43%. The description of the

principal managerial competence variable, which comprises seven indicators, is presented in Table 1:

Tabel 1. Percentage of Indicators for Principal Managerial Competence Variable

No.	Indicator	Percentage (%)	Category
1.	Planning	80,25%	Competent
2.	Organizing	81,25%	Competent
3.	Leading	80,5%	Competent
4.	Controlling	81,75%	Competent
5.	Decision Making	81,25%	Competent
6.	Communication	81%	Competent
7.	Problem Solving	83%	Highly Competent
Mean		81,28%	Competent

Based on Table 1, the Respondent Achievement Level (TCR) results in percentage form are as follows: (1) the planning indicator achieved a score of 80.25%, categorized as competent; thus, it can be concluded that the principals possess competent managerial skills in the aspect of planning; (2) the organizing indicator reached 81.25%, categorized as competent, indicating that the principals are competent in the aspect of organization; (3) the directing indicator obtained 80.5%, categorized as competent, showing that the principals have competent managerial skills in the aspect of direction; (4) the supervising indicator scored 81.75%, categorized as competent, which implies that the principals possess competent managerial skills in the aspect of supervision; (5) the decision-making indicator reached 81.25%, categorized as competent, suggesting that the principals are competent in the aspect of decision-making; (6) the communication indicator obtained 81%, categorized as competent, indicating that the principals have competent managerial skills in the aspect of communication; and (7) the problem-solving indicator achieved 83%, categorized as highly competent, which leads to the conclusion that the principals possess highly competent managerial skills in the aspect of problem-solving.

Overall, the average percentage (mean indicator) for the Respondent Achievement Level (TCR) reached 81.28%. This result of 81.28% for the principal managerial competence variable is categorized as competent. Therefore, based on the analysis, it can be concluded that the principals at public elementary schools (SDN) in Kupitan District, Sijunjung Regency, possess competent managerial skills. Furthermore, the description of the teacher digital literacy variable, which consists of seven indicators, can be found in Table 2:

Table 2. Percentage of Indicators for Teacher Digital Literacy Variable

No.	Indicator	Percentage (%)	Category
1.	Technology Access and Usage	83,5%	Excellent
2.	Digital Information Mastery	81,5%	Good
3.	Digital Communication and Collaboration	80,5%	Good
4.	Digital Creativity and Innovation	81,75%	Good
5.	Digital Ethics and Responsibility	79,75%	Good
6.	Digital Security and Protection	81%	Good
7.	Digital Problem Solving	80,25%	Good
Mean		81,18%	Good

Based on Table 2, the Respondent Achievement Level (TCR) results in percentage form are as follows: (1) the technology access and usage indicator achieved 83.5%, categorized as excellent thus, it can be concluded that the teachers possess excellent digital literacy in terms of technology access and usage; (2) the digital information mastery indicator reached 81.5%, categorized as good, indicating that the teachers have good digital literacy in the aspect of digital information mastery; (3) the digital communication and collaboration indicator obtained 80.5%, categorized as good, showing that the teachers possess good digital literacy in digital communication and collaboration; (4) the digital creativity and innovation indicator scored 81.75%, categorized as good, which implies that the teachers have good digital literacy in digital creativity and innovation; (5) the digital ethics and responsibility indicator reached 79.75%, categorized as good, suggesting that the teachers possess good digital literacy in digital ethics and responsibility; (6) the digital security and protection indicator obtained 81%, categorized as good, indicating that the teachers have good digital literacy in digital security and protection; and (7) the digital problem-solving indicator achieved 80.25%, categorized as good, leading to the conclusion that the teachers possess good digital literacy in the aspect of digital problem-solving.

Overall, the average percentage (mean indicator) for the Respondent Achievement Level (TCR) yielded a result of 81.18%. This percentage of 81.18% for the teacher digital literacy variable is categorized as good; therefore, based on the analysis, it can be concluded that the teachers at public elementary schools (SDN) in Kupitan District, Sijunjung Regency, possess good digital literacy. Furthermore, the description of the variable for readiness for deep learning implementation, which consists of six indicators, can be found in Table 3:

Tabel 3. Percentage of Indicators for Readiness to Implement Deep Learning Variable

No.	Indicator	Percentage (%)	Category
1.	Understanding of Deep Learning Concepts	80,25%	Good
2.	Curriculum and Teaching Material Readiness	81%	Good
3.	Teacher Readiness (Pedagogical and Professional)	79,75%	Good
4.	Availability of Supporting Facilities and Infrastructure	80,5%	Good
5.	Policy and Leadership Support	80,25%	Good
6.	Assessment System Readiness	81,75%	Good
	Mean	80,58%	Good

Based on Table 3, the Respondent Achievement Level (TCR) results in percentage form are as follows: (1) the understanding of deep learning concepts indicator achieved 80.25%, categorized as good; thus, it can be concluded that the teachers possess good readiness for deep learning implementation in terms of conceptual understanding; (2) the curriculum and teaching material readiness indicator reached 81%, categorized as good, indicating that the teachers have good readiness in the aspect of curriculum and instructional materials; (3) the teacher readiness (pedagogical and professional) indicator obtained 79.75%, categorized as good, showing that the teachers possess good readiness in both pedagogical and professional aspects; (4) the availability of supporting facilities and infrastructure indicator scored 80.5%, categorized as good, which implies that the teachers have good readiness regarding supporting facilities and infrastructure; (5) the policy and leadership support indicator reached 80.25%, categorized as good, suggesting that the teachers possess good readiness in the aspect of policy and leadership support; and (6) the assessment system readiness indicator achieved 81.75%, categorized as good, leading to the conclusion that the teachers have good readiness in the aspect of assessment system readiness.

Overall, the average percentage (mean indicator) for the Respondent Achievement Level (TCR) yielded a result of 80.58%. This percentage of 80.58% for the readiness for deep learning implementation variable is categorized as good; therefore, based on the analysis, it can be concluded that the teachers at public elementary schools (SDN) in Kupitan District, Sijunjung Regency, possess good readiness for the implementation of deep learning.

Hypothesis testing in this study, utilizing the simple linear regression analysis model, requires a series of classical assumption tests. These include the normality test to examine the distribution of data residuals and the heteroscedasticity test to ensure variance stability. The results of the normality test for this research data are presented in Table 4:

Tabel 4. One-Sample Kolmogorov-Smirnov Test (Normality Test)

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		101
Normal Parameters ^{a,b}	Mean	,0000000
	Std. Deviation	5,23317772
Most Extreme Differences	Absolute	,077
	Positive	,057
	Negative	-,077
Test Statistic		,077
Asymp. Sig. (2-tailed)		,143 ^c
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		

Based on Table 4, it can be observed that the Asymp. Sig. (2-tailed) value is 0.143. This value is greater than 0.05 ($0.143 > 0.05$); therefore, it can be stated that the data are normally distributed. Based on the normality test analysis in this study, it can be concluded that all data have met the assumption of normality and are eligible for further parametric statistical testing. The results of the heteroscedasticity test in this study are presented in Table 5:

Tabel 5. ANOVA^a (Heteroscedasticity Test)

ANOVA ^a						
Model	Sum of Squares	df	Mean Square	F	Sig.	
1 Regression	57,144	2	28,572	2,525	,085 ^b	
Residual	1108,802	98	11,314			
Total	1165,946	100				
a. Dependent Variable: Abs Res						
b. Predictors: (Constant), PersenZ, PersenX						

Based on Table 5, it is found that the regression model meets the assumption of homoscedasticity. This is evidenced by a significance value of 0.085, which is greater than 0.05 ($0.085 > 0.05$). Therefore, from the heteroscedasticity test analysis, it can be concluded that no symptoms of heteroscedasticity were found in the regression model of this study. This indicates that there is an equality of variance in the residuals for all observations within the regression model; thus, the model used in this research is valid and reliable for predicting the relationships between variables.

Based on the series of prerequisite analysis tests (classical assumptions) presented previously, the research data have been proven to be normally distributed, and no symptoms of heteroscedasticity were found. Therefore, the analysis can proceed to

the hypothesis testing stage to address the research questions of this study. To determine the partial influence of the variables in this study, the results are presented in Table 6:

Tabel 6. Coefficients^a (t-Test/Partial Test)

Coefficients ^a					
Model	Unstandardized Coefficients			t	Sig.
	B	Std. Error	Beta		
1 (Constant)	9,787	5,768		1,697	,093
PersenX	,537	,100	,489	5,372	,000
PersenZ	,335	,087	,351	3,850	,000

a. Dependent Variable: PersenY

Table 6 shows a significance value of 0.000 for the effect of variable X on Y, as well as a significance value of 0.000 for variable Z on Y. Both values are less than 0.05 ($p < 0.05$). Additionally, the calculated t-value is 5.372, which is greater than the t-table value of 1.98447 ($5.372 > 1.98447$). Based on these analysis results, it can be concluded that: 'There is a significant influence of Principal Managerial Competence on the Readiness for Deep Learning Implementation in Public Elementary Schools of Kupitan District, Sijunjung Regency,' and 'There is a significant influence of Teacher Digital Literacy on the Readiness for Deep Learning Implementation in Public Elementary Schools of Kupitan District, Sijunjung Regency.' These findings indicate that more optimal managerial competence possessed by the principal leads to higher institutional readiness in implementing learning concepts. Similarly, more optimal digital literacy demonstrated by teachers results in higher readiness for the implementation of learning concepts within the school environment.

The Moderated Regression Analysis (MRA) in this study aims to determine the role of teacher digital literacy in moderating the influence of principal managerial competence on the readiness for deep learning implementation in public elementary schools (SDN) of Kupitan District, Sijunjung Regency. The results of the data processing using the SPSS application are presented in Table 7:

Tabel 7. Coefficients^a (Moderated Regression Analysis)

Coefficients ^a					
Model	Unstandardized Coefficients			t	Sig.
	B	Std. Error	Beta		
1 (Constant)	110,946	38,370		2,891	,005
PersenX	2,127	,509	1,938	4,178	,000
PersenZ	1,916	,504	2,007	3,800	,000
XZ	,021	,006	2,888	3,180	,002

a. Dependent Variable: PersenY

Based on Table 7 regarding the moderation t-test, the results show a significance value of 0.002, which is lower than 0.05 ($p < 0.05$). Based on this analysis, it can be concluded that: 'Teacher Digital Literacy Moderates the Influence of Principal Managerial Competence on the Readiness for Deep Learning Implementation in Public Elementary Schools of Kupitan District, Sijunjung Regency.' This indicates that teacher digital literacy acts as a factor that can either strengthen or weaken the relationship between the principal's managerial competence and school readiness. In other words, the level of digital literacy proficiency possessed by teachers, whether high or low, is capable of altering the magnitude of the impact of the principal's managerial leadership in preparing for the implementation of deep learning within the school environment of Kupitan District, Sijunjung Regency.

Discussion

Based on the research findings in public elementary schools (SDN) of Kupitan District, principal managerial competence has been proven to be a key determinant in establishing school readiness. The successful implementation of deep learning at the elementary level is highly dependent on the synergy of various internal organizational variables. Empirically, the t-test results demonstrate a significant influence, providing legitimacy to the premise that a leader's capacity to manage resources serves as the primary foundation for any curriculum transformation (Makmuriana, 2021).

This managerial competence aligns with the transformational leadership theory, where the principal serves not only as an administrator but also as an inspiration for teachers. Exceptional principals in Kupitan District are capable of developing strategic planning and minimizing resistance to change through effective organizing. Strong managerial support creates a conducive school climate, ensuring that teachers feel systemically supported in transitioning from conventional patterns to more meaningful learning methods (Khasanah, 2025).

The teacher digital literacy variable emerges as another crucial factor that independently influences school readiness. In the era of modern education, digital proficiency is no longer an option but a necessity to embrace educational transformation. This finding is supported by Hidayatullah (2022), who states that robust digital literacy enhances teachers' self-confidence in adopting innovations, which in turn accelerates institutional readiness for the implementation of deep learning.

Teacher digital literacy in public elementary schools (SDN) of Kupitan District encompasses the ability to manage information and create technology-based interactive learning content. Digitally literate teachers tend to have easier access to various learning resources to optimally stimulate students' cognitive development. Without this proficiency, the implementation of deep learning will be hindered, as teachers will face

technical difficulties in managing instructional data and utilizing the necessary digital platforms (Safitri et al., 2025).

The role of teacher digital literacy as a moderating variable demonstrates that digital literacy acts as a catalyst that strengthens the influence of principal managerial competence on school readiness. This implies that sound managerial policies from a principal will yield a significantly greater and more drastic impact when met with teachers who possess proficient technological mastery (Kumbangsila, 2025).

This interaction creates the essential synergy required for educational transformation in Sijunjung Regency. When the principal provides the framework and systems through their managerial functions, digitally literate teachers populate these systems with creative and profound pedagogical practices. Conversely, regardless of how exceptional a principal's managerial planning may be, its impact will be blunted if teachers in the field are unable to adapt to the digital tools that serve as the primary instruments of modern learning (Hidayatullah, 2022).

Deep learning demands flexibility and a depth of material that can only be achieved if the physical infrastructure is supported by competent human resource capacity. Principals in Kupitan District who are capable of performing coordination functions effectively tend to have teaching staff who are more mentally and technically prepared. This confirms that managerial factors are variables that cannot be overlooked by local governments in efforts to accelerate the implementation of new learning methods (Makki et al., 2021).

The optimization of digital literacy also creates a more dynamic educational ecosystem that is not confined to physical classrooms. Teachers in Kupitan District with high digital competence are capable of fostering a more explorative learning environment, which is a primary characteristic of deep learning implementation. The readiness of educational units is highly dependent on the sustainability of this digital competence development to ensure it remains relevant to the needs of students (Suryaningsih & Purnomo, 2023).

Enhancing teachers' digital capacity has proven to be an efficient strategic step for local educational authorities. By ensuring that teachers are not left behind in technological proficiency, managerial directives from school leadership can be translated into concrete classroom practices without significant technical obstacles. The alignment between managerial vision and field-level technical skills is the primary key to minimizing barriers during curriculum transitions (Fina, 2024). This study illustrates that every improvement in the quality of principal managerial competence, followed by the strengthening of teacher digital literacy, will result in a linear increase in the institution's academic readiness. The synergy of these two variables serves as the primary asset for public elementary schools in Kupitan District to produce graduates

with robust critical thinking and problem-solving skills, in accordance with deep learning standards (Sidik, 2024).

Based on the discussion above, it can be concluded that principal managerial competence and teacher digital literacy are the two primary pillars determining the readiness for deep learning implementation in public elementary schools of Kupitan District. Managerial competence provides systemic direction and support, while teacher digital literacy functions as both a technical instrument and a moderating reinforcer that accelerates leadership policies. High-quality educational transformation can only be achieved when there is a balance between strategic leadership and technologically proficient educators, occurring simultaneously and in an integrated manner.

CONCLUSION

The findings of this article can be summarized as follows: (1) Principal managerial competence has a significant influence on the readiness for deep learning implementation in public elementary schools of Kupitan District, Sijunjung Regency. This is evidenced by a significance value of $0.000 < 0.05$ ($p < 0.05$) and a calculated t-value of 5.372, which exceeds the t-table value of 1.98447 ($t_{\text{count}} > t_{\text{table}}$). This condition indicates that higher managerial competence in leading the institution leads to a higher level of school readiness in implementing deep learning concepts; (2) Teacher digital literacy significantly influences the readiness for deep learning implementation in public elementary schools of Kupitan District, Sijunjung Regency, as indicated by a significance value of $0.000 < 0.05$ ($p < 0.05$) and a calculated t-value of 3.850, which is greater than the t-table value of 1.98447 ($t_{\text{count}} > t_{\text{table}}$). This suggests that better digital literacy proficiency among teachers results in higher institutional readiness to implement learning concepts within the school environment; (3) Teacher digital literacy strengthens the influence of managerial competence on the readiness for deep learning implementation in public elementary schools of Kupitan District, Sijunjung Regency, with a significance value of $0.002 < 0.05$ ($p < 0.05$). This confirms that teacher digital literacy is significantly capable of moderating (strengthening or weakening) the impact of managerial competence.

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DECLARATION ON THE USE OF ARTIFICIAL INTELLIGENCE (AI)

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) solely to assist with language refinement, grammar checking, sentence restructuring, and improving the clarity and readability of the manuscript. The AI tool was also used to assist in organizing references and enhancing the presentation of the manuscript. The authors critically reviewed, verified, and revised all AI-assisted outputs and take full responsibility for the accuracy, originality, and integrity of the final manuscript. All aspects of the research, including the conceptualization of the study, research design, instrument development, data collection, statistical analysis, interpretation of findings, and conclusions, were conducted independently by the authors.

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