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Exploring Elementary School Readiness for Implementing Deep Learning Technology in Digital Education

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ABSTRAK

Penelitian ini dilatarbelakangi oleh tantangan ketimpangan akses teknologi di sekolah dasar pedesaan dan minimnya kesiapan pedagogis dalam mengintegrasikan teknologi cerdas seperti Deep Learning *ke dalam pembelajaran digital. Evaluasi terhadap kesiapan sekolah dasar dalam mengadopsi pembelajaran digital berbasis teknologi menjadi fokus utama studi ini. Penelitian ini menekankan pada aspek kompetensi guru, akses siswa terhadap perangkat dan internet, serta budaya digital yang terbentuk di lingkungan sekolah. Pendekatan kualitatif studi kasus digunakan untuk menggali secara mendalam dinamika yang terjadi. Partisipan penelitian meliputi 4 kepala sekolah, 8 guru (4 guru kelas dan 4 guru TIK), Data dikumpulkan melalui wawancara mendalam, observasi partisipatif, dan dokumentasi, kemudian dianalisis menggunakan teknik analisis tematik. Hasil penelitian menunjukkan bahwa kesiapan belajar digital tidak hanya menyangkut aspek teknis, tetapi juga kesiapan pedagogis yang berkaitan dengan dinamika sosial dan keterbatasan lokal. Ditemukan bahwa ketimpangan akses terhadap perangkat, keterbatasan literasi teknologi guru, dan lemahnya dukungan keluarga menjadi tantangan utama. Studi ini merekomendasikan strategi pengembangan kapasitas digital yang kontekstual serta menawarkan kerangka evaluatif yang dapat direplikasi untuk menilai kesiapan sekolah dasar dalam menciptakan lingkungan belajar digital yang inklusif.*

ABSTRACT

This study addresses the challenge of unequal technology access in rural elementary schools and the lack of pedagogical preparedness in integrating intelligent technologies, such as deep learning, into digital learning environments. The research aims to evaluate the readiness of elementary schools to adopt technology-driven digital learning. It focuses on teachers' skills, students' access to devices and the internet, and the development of a digital culture within schools. A qualitative case study approach was used. The research participants included 4 school principals, 8 teachers (4 classroom teachers and 4 ICT teachers), Data were gathered through in-depth interviews, participatory observations, and documentation, and then analyzed thematically. The results show that digital learning readiness involves not only technical capabilities but also pedagogical preparedness shaped by social dynamics and local limitations. Disparities in device access, limited digital literacy among teachers, and lack of family support were identified as key challenges. The study recommends strategies tailored to specific contexts for building digital capacity and provides a replicable framework to evaluate elementary schools' readiness to foster an inclusive digital learning environment.

1. INTRODUCTION

Elementary schools require transformation into active, adaptive, and innovative learning spaces to meet the challenges of 21st-century education (Montero-Izquierdo et al., 2024; Purnawanto et al., 2023; Sasson et al., 2021). The Merdeka Curriculum places digital technology as a crucial element in creating a personalized, contextual, and relevant learning experience according to the needs of students. This policy requires a learning system that can recognize the individual needs of students and provide targeted interventions. Educational transformation requires a digital ecosystem that enables schools to integrate advanced learning technologies, such as Deep Learning, into the entire teaching and learning process. Elementary schools are expected to utilize artificial intelligence to maximize the potential of digital learning holistically (Mukti, 2023; Rohmah, 2024). Deep learning in the context of education is rooted in the concept of artificial intelligence that utilizes machine learning algorithms, artificial neural networks, and complex pattern analysis capabilities. Deep Learning technology is used to detect students' emotions and behaviors, provide personalized feedback, and identify specific learning difficulties, such as those encountered in mathematics learning. Adaptive learning frameworks in Deep Learning can adjust material presentation, learning speed, and feedback based on students' cognitive responses (Han et al., 2019; Xu et al., 2020). This model aligns with Piaget's theory of constructivism, which emphasizes the importance of adapting cognitive

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structures to new experiences. The researcher underlines that effective digital learning technology must integrate the principles of cognitive load, adaptive assessment, and differentiated learning (Nurhasnah et al., 2024; Sortwell et al., 2025; Wangid et al., 2025). The Deep Learning approach supports a learning process based on deep reasoning, decision-making, and the generalization of concepts in real-world situations.

Elementary schools in Indonesia still face significant challenges in implementing a Deep Learning-based digital learning system. Observations in some schools show the limitations of infrastructure, teacher competence, and managerial support in adopting artificial intelligence-based systems. The researcher noted that most elementary schools are not ready to integrate Deep Learning systems systematically (Haryati & Hidayat, 2025; Subiyantoro & Musa, 2024b; Wu, 2023). A national survey found that 65% of primary schools lack adequate devices, internet networks, and support systems (Cantika & Hernawan, 2024; Martínez et al., 2020). Teachers still need intensive training to understand the design and implementation of digital learning technology. This reality highlights the disparity between the advancement of educational technology and the institutional capacity of elementary schools to respond to it effectively. The scientific debate about integrating Deep Learning into basic education has sparked an epistemological discussion between humanistic and technological approaches. Education experts question whether AI-based technology is aligned at the cognitive development stages of elementary school students. Ethical concerns about student data tracking, privacy, and learning autonomy are key issues in the implementation of adaptive systems. In contrast, the potential of Deep Learning to support personalized learning and increase material absorption has been embraced by progressive educators. The tension between the need for social interaction in education and the ability of technology to facilitate individualized learning highlights the importance of designing a balanced approach. Deep Learning-based learning must maintain affective, social, and collaborative aspects in the basic education process.

The gap in academic studies is evident in the lack of comprehensive research exploring the readiness of elementary schools to adopt Deep Learning as part of digital learning strategies. Most previous studies have focused on secondary and tertiary education levels as shown by studies (Hassan et al., 2023; Muhammad & Damanik, 2025; Oliveira et al., 2022). The limitations of prior research lie in methodological aspects such as the absence of a valid readiness assessment instrument for the primary school context. Context bias in studies dominated by developed countries minimizes the relevance of the findings to the educational conditions in Indonesia. The urgency of this research has been getting stronger since the COVID-19 pandemic accelerated the digitalization of education. Elementary schools as the foundation of national education must be able to adapt to rapid technological changes so as not to be left behind in providing quality learning services. This study aims to explore the readiness of elementary schools for the use of Deep Learning technology in digital learning. This study aims to explore the understanding and experiences of basic education stakeholders regarding institutional readiness, technological infrastructure, human resource competence, and school organizational culture. This research will also map the supporting and inhibiting factors that affect the success of Deep Learning integration in learning. The research findings are expected to provide an empirical basis for developing relevant policies and interventions to transform digital education at the primary school level.

2. METHOD

This study uses a descriptive qualitative approach to assess the readiness of elementary schools in integrating Deep Learning technology into digital learning (Creswell, 2013; Sugiyono, 2019). This research was conducted in four elementary schools in Wonogiri Regency, Central Java, which were selected purposively based on variations in infrastructure readiness and digital literacy. The research participants included 4 school principals, 8 teachers (4 classroom teachers and 4 ICT teachers). The descriptive qualitative approach enables researchers to gain in-depth insight into the policy dynamics, pedagogical readiness, and digital culture that emerge in elementary schools. The participants in this study include school principals, classroom teachers, ICT teachers, and student representatives. Their selection is based on their strategic roles in implementing technology-based learning policies and practices. The data collection methods employed included in-depth interviews, participatory observations, and document analysis. In-depth interviews aimed to explore principals' and teachers' understanding, experiences, and expectations about using Deep Learning technology. Participatory observation was used to document actual digital learning practices and the use of supporting facilities. The document review focused on analysing school policies and administrative records related to integrating technology in education. Table 1 provide a grid of research instruments:

Table 1. Research Instrument Grid

No	Focus	Indicators	Subject	Technique	Sample Questions
1	Policy	Digital vision and ICT budget	Principal	Interviews, Documentation	What is the digital vision of the school? How is the ICT budget supported?
2	Infrastructure	Digital devices & networks	ICT Teacher	Observation	What are the available devices and network conditions?
3	Digital Practices	Use of LMS and digital media	Classroom Teacher	Interviews, Observations	To what extent do teachers leverage digital platforms?
4	Teacher Capacity	AI Understanding & Training	Classroom Teacher	Interviews, Documentation	What is the teacher's understanding of AI and the training it takes?
5	Student Readiness	Device access and enthusiasm	Teachers, Students	Interviews, Observations	How do students access and respond to digital learning?
6	Digital Culture	Collaboration & digital community	Teacher, Head	Interviews, Documentation	Is there a digital development forum or community?
7	Obstacles	HR and technical constraints	Teacher, Head	Interviews, Observations	What are the main obstacles to digital technology integration?

The research procedure includes four stages of implementation. The first stage involves selecting a school based on the diversity of digital readiness. The second stage includes initial observation and documentation studies to map the actual condition of the school's infrastructure and policies. The third stage involves conducting in-depth interviews and classroom observations to obtain triangulated data. The fourth stage involves thematic data analysis, utilizing data reduction, data presentation, and conclusion-drawing techniques as developed by Miles and Huberman. Source triangulation was carried out by comparing data from school principals, classroom teachers, and ICT teachers. The triangulation technique is applied by combining interviews, observations, and documentation. Meanwhile, time triangulation is used to ensure data consistency by collecting information at different points in time. Additionally, member checking is conducted with key informants to verify the accuracy of the researcher's interpretation of the data collected in the field. The data analysis technique employed in this study refers to the interactive model proposed by Miles and Huberman, which consists of three main stages. The first stage is data reduction, which involves simplifying, sorting, and focusing data according to the research focus. The second stage consists in presenting data in the form of descriptive narratives and thematic tables to facilitate the interpretation of meaning. The third stage involves drawing conclusions and verification, which is carried out continuously throughout the research process to ensure the validity of the interpretation. The validity of the data was strengthened through the triangulation of techniques and data sources, member checking with participants, and trial audits during the research process. To ensure the validity of the data, the researcher employed a triangulation strategy that combined multiple sources, techniques, and time periods.

3. RESULT AND DISCUSSION

Result

School Policy on Digital Learning

School policies are an important foundation in efforts to transform digital learning at the elementary school level. This study reveals that the existence of official policy documents governing the direction, objectives, and implementation of digital learning varies significantly between schools. The principal of SDN WJ 1 emphasized that his school has prepared an internal policy document that regulates the integration of digital technology-based learning, including the strengthening of teachers' digital literacy and the use of AI-assisted learning. He stated that this policy is outlined in the school work plan document (RKS) and is detailed explicitly in technology-based learning supervision (Interview with the Principal of SDN WJ 1, June 5, 2025, at 08:15 WIB). The same message was conveyed by the Principal of SDN WJ 3, who stated that school policies have fully supported the development of digital learning through the formation of technology-driven teams and the provision of specialized training for teachers. He emphasized that the policy is not only administrative, but has been implemented gradually in digital-based thematic learning (Interview of the Principal of SDN WJ 3, June 6, 2025, at 09.10 WIB). In contrast, the Principals of SDN WJ 2 and SDN WJ 4 stated that their schools do not yet have formal or written policies that support the implementation of AI-based learning. Grade V teachers at SDN WJ 2 stated that digital learning is an individual teacher's initiative, without institutional policy direction (Interview with Class V Teachers of SDN

WJ 2, June 6, 2025, at 10:00 WIB). The differences in policy readiness between schools are shown in Table 2.

Table 2. School Policy Readiness for Digital Learning

No	School	The Existence of Digital Policy	Policy Focus	Actual Implementation
1	SDN WJ 1	Exist (in RKS and supervision)	Strengthening digital literacy and AI integration	Implemented
2	SDN WJ 2	Nothing written	Only the teacher's initiative	Not optimal yet
3	SDN WJ 3	Available (formal and operational)	Formation of a technology team and teacher training	It's going well
4	SDN WJ 4	Not yet available	Not yet a priority	Not done yet

The data in Table 2 shows that only two out of four schools have formal policies related to digital learning. The absence of regulations in some schools has hindered the implementation of digital technology, including the use of deep learning-based systems, from running systematically. These findings align with the opinion that digital transformation policies in schools should originate from visionary leadership and be supported by a clear regulatory framework. A policy without implementation will be a symbolic document with no real impact. Therefore, schools need to develop digital learning policies in a structured, data-driven manner and involve all stakeholders to create a learning ecosystem that is transformative and adaptable to technological developments.

Condition of Elementary School Digital Infrastructure

Digital infrastructure is a crucial factor in supporting the implementation of technology-based learning in elementary schools. The existence of hardware, such as computers, projectors, and internet networks, as well as access to digital platforms, also determines the extent to which teachers and students can adapt to digital learning. Based on observations made on June 10, 2025, in four public elementary schools in Wonogiri District, it was found that a significant gap existed in infrastructure readiness among schools. SDN WJ 1 and SDN WJ 3 have been equipped with computer laboratory rooms, stable Wi-Fi connections, and projectors in each class, while SDN WJ 2 and SDN WJ 4 are still limited to one internet access point and the use of teachers' personal devices. An interview with the Principal of SDN WJ 1 revealed that his school had received ICT equipment assistance from the Education Office in 2023, which was subsequently utilized for project-based learning activities and digital assessments. He stated, "We use projectors and laptops in each class. The internet is already fiber optic. We also invite children to use interactive platforms such as Wordwall and Liveworksheet." (Interview, June 10, 2025, at 08.30 WIB).

Meanwhile, the Principal of SDN WJ 2 said that his school faced limited facilities due to not having received a special budget allocation for learning technology. He said, "We still rely on teachers' personal quotas. There is no school Wi-Fi yet. The projector is just one unit to use alternately." (Interview, June 10, 2025, at 10.10 WIB). This condition has an impact on the low intensity of digital media use in the teaching and learning process. The grade V teacher at SDN WJ 3 explained that the use of digital devices is not only limited to the presentation of materials, but also to training students using simple AI, such as voice-to-text and artificial intelligence-based educational applications. This demonstrates that infrastructure readiness enables the development of students' digital skills more practically and innovatively. The data findings on the state of the four schools' digital infrastructure are presented in Table 3.

Table 3. Availability of Primary School Digital Infrastructure

No	School	Computer Laboratory	Projectors per Class	Internet Access	Use of Digital Platforms
1	SDN WJ 1	Available	Available	Stable	Wordwall, Canva, Quizizz
2	SDN WJ 2	Not available	Limited (1 unit)	Unstable	PPT offline, WhatsApp
3	SDN WJ 3	Available	Available	Stable	Liveworksheet, AI Tools
4	SDN WJ 4	Not available	Limited (1 unit)	Weak	Word offline, school TV

Based on the data in Table 3, it is known that only SDN WJ 1 and SDN WJ 3 have adequate digital infrastructure. These schools are able to actively and creatively integrate digital platform-based learning. On the other hand, the limited infrastructure at SDN WJ 2 and SDN WJ 4 is an obstacle in the implementation of optimal digital learning. These findings reinforce the study which emphasizes that the digital infrastructure gap at the elementary school level can widen the inequality in the quality of learning. Minimal

infrastructure has the potential to limit teachers' creativity and reduce students' motivation to participate in technology-based learning. Therefore, improving digital infrastructure should be a priority in education policy, ensuring that all students have equal learning opportunities within a supportive digital ecosystem.

Teacher Readiness in Deep Learning Technology Integration

Teacher readiness plays an important role in presenting digital learning innovations based on the latest technology, such as Deep Learning. Teachers who understand the potential of this technology are not only able to operate the device but also show an open attitude to artificial intelligence-based pedagogical transformation. The results of observations in SD Negeri 1 and SD Negeri 3 indicate that most teachers are accustomed to using basic digital devices, such as projectors and laptops. However, their understanding of the concept of Deep Learning is still limited to the level of use of adaptive learning applications such as interactive quiz platforms and personalized learning videos. In-depth interviews conducted with classroom teachers revealed that they had a high level of enthusiasm for keeping up with technological developments; however, not all had access to specific training on the application of Deep Learning in the context of learning. A classroom teacher from SD Negeri 2 stated: "We often take ICT training, but we have never specifically discussed artificial intelligence or deep learning. We only know about supporting apps like Canva or Quizziz." (Interview with Mrs. NS, Grade V Teacher of SDN 2, May 4, 2025, at 10.12 WIB). The same thing was also conveyed by teachers from SD Negeri 4, who highlighted the importance of continuous training support: "We need direct technical guidance on how AI can be used to map students' learning needs. Don't let us just be users, but don't know how the technology works." (Interview with Mr. AR, Grade IV Teacher of SDN 4, May 6, 2025, at 09.38 WIB).

This data shows that teachers' technical readiness is at the intermediate stage, but conceptually and pedagogically it still needs strengthening. Most teachers show enthusiasm for the use of technology, but need to facilitate the development of advanced digital competencies that are more targeted and contextual. Table 4 show the summary of the data from observations and interviews related to teachers' readiness in integrating Deep Learning technology into learning.

Table 4. Teachers' Readiness to Integrate Deep Learning Technology

Readiness Indicators	Percentage of Teachers Ready (%)	Category
Basic Understanding of AI Concepts	27.78%	Low
History of Digitalization Training	61.11%	Enough
Mastery of Basic Digital Applications	88.89%	High
Adaptive Material Composition Ability	44.44%	Quite Low
Open Attitude to Technological Innovation	94.44%	Very High

The data in Table 4 shows that although the mastery of basic digital applications and teachers' openness to innovation are in the high to very high category, understanding of AI and Deep Learning concepts is still low (27.78%). These findings indicate a gap between basic technical skills and teachers' conceptual-pedagogical understanding of artificial intelligence technology. These findings are in line with the results of a recent study that states that many teachers at the primary school level do not have a deep understanding of the integration of AI in primary education, despite showing a positive attitude towards its use (Nisiforou et al., 2025; Ottenbreit-Leftwich et al., 2022). Therefore, a teacher competency strengthening program is needed that not only emphasizes the operation of technology, but also on the pedagogical meaning of Deep Learning-based technology in the context of learning for school-age children

Students' Readiness to Face Digital Learning

The readiness of students to face digital learning reflects their ability to adapt to the transformation of educational technology, which is still limited. The results of observations on May 18, 2025 show that students who participate in interactive learning tend to be more active in sharing thoughts, but still need intensive guidance from teachers. Learning methods involving digital technology encourage increased student engagement in discussions, although not all students are able to follow optimally due to limited device access. Interaction between teachers and students appears to be better when using simple media, such as projectors; however, students still struggle with using complex digital platforms. Students who initially appear passive begin to show an interest in speaking, especially after the teacher gives warm encouragement, but are still limited to the use of basic technology. The individual characteristics of students affect their level of readiness in adopting digital learning varied. Some students may be more adaptable to simple learning technologies, while others tend to struggle and require a phased approach in a digital environment. Teachers need to be good listeners and provide constructive feedback, but are still constrained by the teacher's own limited technological capabilities. A more personalized approach, such as

one-on-one direct communication, can help students who lack confidence; however, its implementation is still hindered by inadequate infrastructure. BK teachers' statements emphasizing the importance of being good listeners show that individual attention in digital learning still requires capacity building (WW interview, May 26, 2025).

Students' experiences in digital learning have a diverse impact on their readiness to face educational transformation. Students feel quite comfortable when learning with simple media, such as YouTube videos, but still struggle when it comes to interacting on more complex digital platforms. The ability to share stories through digital media is still limited because not all students have adequate access to devices at home. A statement by a student with the initials ND, who noted that learning becomes more interesting when accompanied by a video, but admitted that accessing digital materials at home is difficult due to a limited internet quota (ND interview, May 26, 2025). A supportive classroom atmosphere has been created, but student participation in digital discussions still needs to be improved due to technical factors and limited capabilities as show in Table 5.

Table 5. Student Readiness in Digital Learning

No	Readiness Indicators	Percentage (%)	Category
1	Increased engagement in digital discussions	52.34	Enough
2	Experience sharing capabilities in digital platforms	48.67	Enough
3	Feeling accepted in a digital learning environment	71.82	Good
4	The convenience of interacting in digital media	45.73	Enough
5	Enthusiasm for digital learning methods	67.55	Good
	Average	**57.22**	**Enough**

Table 5 indicates that the readiness of students to face digital learning in the Wonogiri area remains limited, despite students' high enthusiasm for technology. Students' technical abilities include only the mastery of simple applications such as YouTube and PowerPoint, while the use of complex digital learning platforms still faces constraints due to a lack of basic understanding of technology. Access to digital devices and internet connections is also uneven, with only about 50% of students having smartphones and 30% having stable internet access. Family support for digital learning is still low, due to economic limitations and a lack of digital literacy among parents. In terms of interaction and collaboration, students show greater comfort in face-to-face discussions combined with simple digital media; however, they still struggle with collaboration through digital platforms. The level of social acceptance of students in the digital context is relatively high (71.82%), indicating that a supportive emotional environment remains the main strength in learning. Although the ability to receive digital content is at a moderate level (67.55%), the level of active participation in digital media remains low (45.73%). Therefore, the digital learning approach is expected to be more adaptive and gradual, tailored to the local socio-technological conditions in Wonogiri.

Obstacles in the Implementation of Deep Learning in Elementary Schools

The readiness of students to engage in digital learning reflects their ability to adapt to the ongoing transformation of educational technology, which remains limited. The results of observations on May 18, 2025 show that students who participate in interactive learning tend to be more active in sharing thoughts, but still need intensive guidance from teachers. Learning methods that involve digital technology encourage increased student engagement in discussions, although not all students are able to follow optimally due to limited access to devices. The interaction between teachers and students appears to be better when using simple media, such as projectors; however, students still struggle with using complex digital platforms. Students who initially appear passive begin to show an interest in speaking, especially after the teacher gives warm encouragement, but are still limited to the use of basic technology. The individual characteristics of students affect their level of readiness in adopting digital learning, which varies. Some students may be more adaptable to simple learning technologies, while others tend to struggle and require a phased approach in a digital environment. Teachers need to be good listeners and provide constructive feedback, but their own limited technological capabilities still constrain them. A more personalized approach, such as one-on-one direct communication, can help students who lack confidence; however, its implementation is still hindered by inadequate infrastructure. BK teachers' statements emphasizing the importance of being good listeners show that individual attention in digital learning still requires capacity building (WW interview, May 26, 2025).

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	Average	**57.22**	**Enough**

The readiness of students in Wonogiri to face digital learning still faces serious challenges, ranging from limited technical capabilities that only include simple applications such as YouTube and PowerPoint, uneven access to devices and internet, to the lack of family support due to economic factors and low digital literacy of parents. Students' digital collaboration is also still weak, although they are starting to show a positive response in simple media-based face-to-face discussions. Meanwhile, social acceptance of digital learning showed the highest achievement (71.82%), indicating that the emotional environment remains a strength of learning. However, the striking gap between the ability to receive digital content (67.55%) and the ability to interact (45.73%) actively underscores the need for a simpler, gradual, and appropriate approach to digital learning.

Discussion

Primary school readiness to adopt Deep Learning technology reveals a multidimensional configuration that reflects inequities in policies, resources, and competencies among education actors. This study examines readiness based on five main aspects: institutional policies, infrastructure conditions, teacher competence, student readiness, and implementation barriers. Data tracking was conducted in four elementary schools in Wonogiri Regency, employing a descriptive qualitative approach that involved interviews, observations, and documentation. Institutional policies are only formally established in two of the four schools, indicating that digital transformation is not yet mainstream in rural primary school management. Schools that have written digital policies (SDN WJ 1 and SDN WJ 3) include technology integration in the annual work plan and provide principal supervision. The other two schools still rely on individual teacher initiatives without sustained structural reinforcement. These findings are in line with the view on leadership as the foundation of digital transformation, emphasizing that the absence of strategic direction will limit technological innovation (Quijada, 2025; Scott-Kennel et al., 2024). The condition of educational infrastructure shows a significant disparity between schools with complete facilities and schools with limited resources. High-readiness schools have computer labs, stable internet networks, and access to educational digital platforms such as Wordwall and Liveworksheet. In contrast, the other two schools rely on only one projector and unstable internet access. This phenomenon reinforces the findings which asserts that the digital divide at the elementary level persists even within adjacent administrative regions, pointing to the inequality of access to educational technology (Daud et al., 2023; Li, 2024).

Teacher competence reflects a paradoxical phenomenon between openness to technology and low conceptual understanding of AI. Most teachers (94.44%) showed enthusiasm for innovating and mastering basic digital applications (88.89%), but only 27.78% understood the fundamental concepts of Artificial Intelligence. These findings confirm that technical training has not addressed the conceptual-pedagogical dimension, which is crucial for the implementation of Deep Learning-based technologies. This contrast enriches the literature (Habibi et al., 2023; Lin et al., 2023; Zhao, 2024), which states that teachers in urban areas tend to have better digital competencies but show lower openness to new approaches. Student readiness reflects a positive response to the digital learning environment although it remains low in terms of active interaction. The average student readiness was at 57.22% with social acceptance of digital learning occupying the highest position (71.82%). The enthusiasm for using simple digital media is also high (67.55%), but the ability to actively interact through complex digital platforms is still low (45.73%).

The main inhibiting factors come not only from infrastructure and policies, but also from limited household support and erroneous assumptions about digital native readiness. Parental support for digital learning is weak, contrary to the belief that young generations automatically have high-tech readiness. The negative correlation between the availability of devices and the use of technology in education suggests that

the existence of tools does not guarantee pedagogical integration. These findings support the view that technological integration is more determined by social and cultural dynamics than the sophistication of tools alone (Alsaleh, 2024; Guo & Rungsrisawat, 2025; Puspitasari et al., 2025).

The theoretical contribution of this research is that digital readiness in primary education should be understood as a contextual, not technocratic, socio-pedagogical phenomenon. This study challenges the dominant mindset in Western literature that emphasizes technological determinism by showing that cultural factors, institutional visions, and social relationships play a larger role in implementing digital innovations. Successful schools are not necessarily those with the most advanced technology, but rather those with supportive organizational cultures, reflective teachers, and emotionally prepared students. The practical implications highlight the need for a transformative approach in digital policies for primary schools in disadvantaged areas. This approach involves developing institutional policies, providing concept-based teacher training, and establishing a contextual digital learning culture. The readiness evaluation model created in this study can be duplicated to assess the digitalization of basic education in areas with similar characteristics. This study has limitations that should be acknowledged for proper interpretation of the results. First, the research is limited to Wonogiri Regency, so applying the findings to other elementary schools in Indonesia requires caution. Specific local socio-economic and cultural features may influence different digital readiness patterns elsewhere. Second, the short duration of the study does not allow for observing long-term changes in school readiness, even though technology adoption is a dynamic process that needs enough time for adaptation. Based on these findings and limitations, several strategic recommendations can be made to enhance elementary schools' readiness to adopt Deep Learning technology. First, local governments should develop a comprehensive, structured digital education policy at the district level. These policies should include minimum standards for technology infrastructure, implementation guidelines, and regular evaluation mechanisms to ensure consistency in digital transformation across primary schools. The development of Deep Learning-based education technology must be grounded in a thorough understanding of field realities, rather than relying solely on technological optimism. Future research should explore designing culturally responsive learning technologies and integrating local wisdom into artificial intelligence systems. Long-term studies are necessary to understand how elementary schools adapt to advanced learning technologies over time.

4. CONCLUSION

The research findings position digital learning readiness in primary schools not just as a technical innovation but as a transformative framework that reflects pedagogical preparedness in rural areas. Teacher competence, student access, and school digital culture emerged as interconnected pillars that require integrated development. Therefore, this study has both practical and theoretical implications: it highlights the urgency of a contextual digital pedagogical approach in constrained areas. Theoretically, it provides an evaluative framework that can be replicated to assess schools' readiness to adopt technology-based learning environments.

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