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Principal's Readiness to Implement Deep Learning Program

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ABSTRACT

The implementation of deep learning has become a strategic priority for improving the quality of teaching and learning. The success of deep learning implementation is strongly influenced by the readiness of school principals as instructional leaders. This study aims to describe school principals' readiness to implement deep learning program using a descriptive qualitative approach. Data were collected through interviews, observations, and document analysis, and analyzed using data reduction, data display, and conclusion drawing techniques. The findings reveal that principals' readiness is reflected in four core deep learning frameworks: pedagogical practices, learning environment, learning partnerships, and the use of digital technology. Principals demonstrate readiness through a clear understanding of deep learning concepts, support for teachers' instructional innovation, the creation of collaborative learning environments, the strengthening of partnerships with parents and communities, and the integration of digital technology to support learning. However, challenges remain, particularly limited teachers' digital competencies and insufficient cross-stakeholder collaboration. Principals' readiness plays a crucial role in ensuring the successful implementation of deep learning and requires policy support, continuous professional development, and a strong learning ecosystem.

1. INTRODUCTION

Twenty-first century education requires a paradigm shift in learning, moving beyond mere knowledge transmission toward the development of critical thinking, creativity, collaboration, and communication skills. In this context, deep learning has emerged as an approach capable of addressing these demands. Deep learning emphasizes students' active engagement in constructing conceptual understanding, connecting knowledge to real-life contexts, and fostering learner autonomy (Fullan & Langworthy, 2014). The successful implementation of diverse learning models requires strong pedagogical leadership at the school level (Boeskens, Nusche, & Yurita, 2020). Therefore, the implementation of deep learning in schools cannot be separated from the strategic role of the principal as an instructional leader. As highlighted in *Principles and Implementation of Deep Learning*, principals function as learning leaders, educators, and facilitators (Suyanto & Jihad, 2025). Principals who effectively implement deep learning influence school culture and processes that support purposeful collaboration and meaningful learning (Fullan, Quinn, & McEachen, 2018). The implementation of deep learning requires principals who possess the capacity and readiness to enact timely and appropriate change (Fullan

& Langworthy, 2014). Principals' readiness is a key determinant of successful implementation, as it encompasses conceptual understanding, managerial competence, support for teachers, and effective management of educational resources. However, studies on school readiness indicate that many principals still lack sufficient understanding of curriculum implementation needs (Widiansyah, Hidayat, & Kamil, 2025).Previous studies have examined various aspects of deep learning implementation and principal leadership. These studies suggest that the success of deep learning is influenced by factors such as teacher competence, collaborative school culture, technological support, and visionary leadership (Indriyanti et al., 2024; Muslimin & Kartiko, 2021; Nada, Kholis, & Mansyuri, 2024). For example, Akmal et al. (2025), in their study titled *"Deep Learning in Education: A Systematic Literature Review (SLR)"*, focused on conceptual understanding of deep learning and emphasized the importance of digital technology integration. Similarly, Prayoga et al. (2025), in *"Deep Learning: Emphasizing Learning Processes to Improve Student Learning Outcomes"*, explored the relationship between deep learning and student achievement. Their findings indicate that consistent implementation of deep learning improves both instructional quality and student performance.

Other studies highlight the significant role of principals in facilitating pedagogical change through teacher professional development, academic supervision, and the creation of conducive learning environments (Permatasari & Sukartono, 2022). Additionally, research shows that school organizational readiness—including infrastructure and external partnerships plays a crucial role in determining the effectiveness of instructional innovation (Mulyasa, n.d.; Santosa, 2022).However, these studies predominantly focus on the general role of principals without providing an in-depth analysis. Much of the existing research emphasizes teacher-level implementation, leaving a gap in understanding principals' readiness from a comprehensive learning framework perspective, including pedagogical practices, learning environments, partnerships, and digital integration. Furthermore, there is limited use of contextual, case-based approaches in primary education settings to holistically capture principals' readiness in initiating and managing instructional change. Based on this gap, there is a need for a more comprehensive understanding of principals' readiness in implementing deep learning, particularly when examined through a deep learning framework. Therefore, this study aims to analyze and describe principals' readiness in implementing deep learning, with a focus on pedagogical practices, learning environments, partnerships, and digital utilization.This study is expected to contribute theoretically to the development of educational leadership research, particularly in relation to deep learning implementation. Practically, it may serve as a reference for school principals and policymakers in designing effective strategies to improve the quality of teaching and learning in schools. This is particularly important given that principals are responsible for leadership, management, and the overall strategic direction of educational institutions, ensuring academic excellence, a positive school culture, and the well-being of both students and staff (Maolana, Darmiyanti, & Abidin, 2023; Nada et al., 2024).

2. METHODS

This study employed a qualitative descriptive design using a case study approach. This approach was selected to obtain an in-depth and comprehensive understanding of principals' readiness to implement deep learning, analyzed based on four learning framework dimensions. Through a qualitative approach, the researchers sought to explore the phenomenon contextually and holistically in accordance with real conditions in the field.The research participants were determined using purposive sampling, a technique in which informants are intentionally selected based on specific criteria relevant to the research objectives. These criteria included teaching experience and

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the level of involvement in the implementation of deep learning. Based on these criteria, the participants consisted of one principal, one vice principal for curriculum affairs, and three classroom teachers who were considered to possess rich and relevant information related to the focus of the study.Data were collected through observation, interviews, and documentation. Observations were conducted to obtain a direct overview of instructional practices and school conditions. Interviews were used to explore in-depth information regarding participants' perceptions, experiences, and readiness, while documentation served to complement and strengthen the data obtained from observations and interviews. Data analysis was conducted descriptively using the interactive analysis model developed by Miles and Huberman, which consists of three main stages: data reduction, data display, and conclusion drawing/verification. The data analysis process was supported by the use of ATLAS.ti 9 software to facilitate systematic data management, coding, and interpretation. To ensure data validity, this study employed source triangulation techniques. Triangulation was carried out by comparing and confirming data obtained through multiple data collection methods namely observation, interviews, and documentation thereby ensuring that the findings are valid and reliable. The research procedures are illustrated in the following figure.

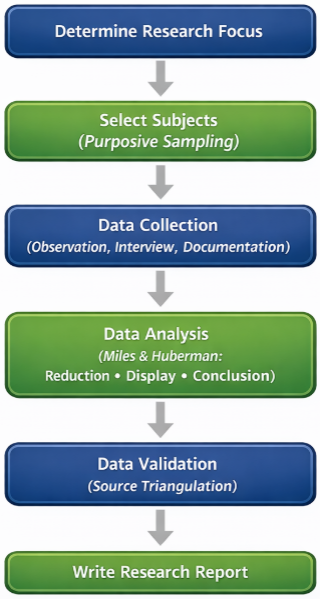

Figure 1. Flowchart of the Research Methodology

3. RESULTS AND DISCUSSION

The findings of this study indicate that principals' readiness to implement deep learning is influenced by six key aspects, namely understanding, pedagogical practices, the learning environment, learning partnerships, and the utilization of digital technologies, while also being confronted with various implementation challenges. With the assistance of the qualitative data analysis software ATLAS.ti, the researchers identified patterns, themes, and relationships within the data, as illustrated below:

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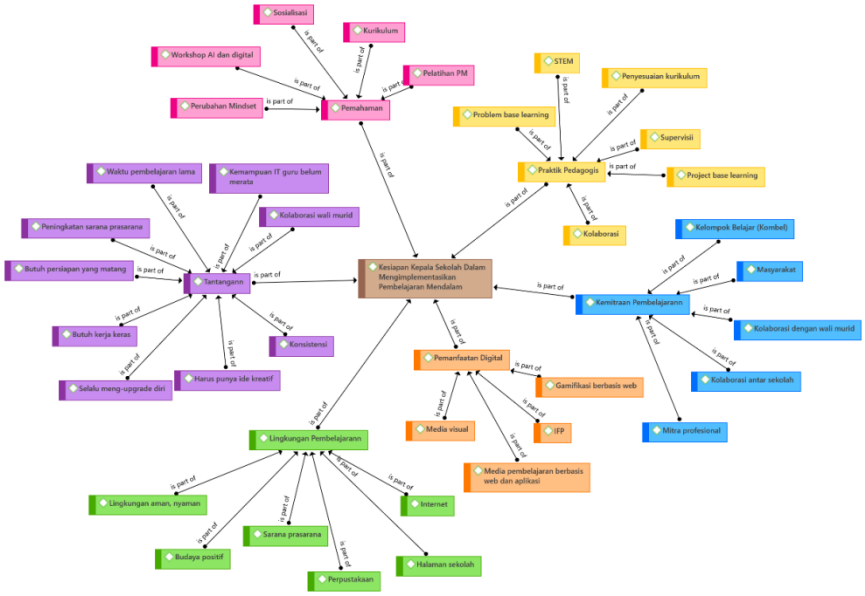

Figure 2. Model of Principals' Readiness in Implementing Deep Learning

3.1 Understanding of Deep Learning

To implement deep learning, the principal undertook a series of preparatory measures. The initial step involved ensuring that teachers had a comprehensive understanding of deep learning. This understanding was fostered through policy socialization sessions, deep learning training programs, and workshops on the utilization of artificial intelligence (AI). Dissemination of information regarding deep learning to teachers and staff was conducted during regular faculty and staff meetings. These socialization and training activities were designed to establish a shared vision and mission concerning deep learning, thereby enabling teachers to effectively implement it in instructional practices. Interviews conducted by the researcher revealed that teachers held positive perspectives toward deep learning. As expressed by Participant 1 (P1): *"Deep learning transforms the learning process by not only emphasizing cognitive aspects, but also encouraging students to identify root problems, seek solutions, and apply them. In this way, students develop genuine understanding, learn with enjoyment, and recognize the relevance and benefits of their learning. Ultimately, students are expected to learn with awareness."* The principal's understanding constitutes the foundational basis for readiness in implementing deep learning. This understanding is developed through policy dissemination, professional training, curriculum comprehension, digital workshops, and deliberate efforts to shift mindsets. The findings indicate that readiness extends beyond administrative preparedness; it reflects the principal's capacity to internalize the philosophy of deep learning and translate it into coherent school policies and practices.

3.2 The Four Deep Learning Framework Components

Principals' readiness is reflected in their capacity to encourage and direct teachers' pedagogical practices. These practices include the implementation of problem-based learning, project-based learning, STEM approaches, curriculum adaptation, academic supervision, and teacher collaboration. STEM-integrated project-based learning combined with collaborative learning was implemented in Grade V in the subject of Science (IPAS) on the topic of electricity. The learning objective was: *"Students recognize the differences between series and parallel electrical circuits."* This was confirmed by Participant 3 (P3), who stated: *"...we have implemented it, most recently through Project-Based Learning, because students created a product and presented it. The topic at that time was electricity."* The learning process also integrated digital utilization through students' use of the Canva application to deliver their presentations**.** According to the teachers, various

instructional methods have been consistently employed in classroom practice. The use of diverse teaching methods enriches students' learning experiences. The principal's policy of conducting academic supervision serves as an effort to cultivate a strong learning culture within the school. These findings indicate that the principal acts as an instructional leader who ensures that deep learning is concretely implemented in classroom practices. Supporting the effective implementation of diverse instructional models requires strong pedagogical leadership at the school level (Boeskens et al., 2020).

In terms of the learning environment, the school provides a spacious playground, a library, a computer laboratory, and well-equipped classrooms. Internet facilities are highly supportive, with bandwidth capacity reaching 100 Mbps. Additional instructional resources include interactive flat panels (IFPs), projectors, and 40 tablets designated for learning activities. The school environment is safe and conducive to the development of a positive culture that supports deep learning. As expressed by P3: *"Teachers collaborate with one another, share ideas and experiences, transform their roles from content deliverers to facilitators of student learning, actively engage students in the learning process, and create an environment characterized by mutual respect and equality."* These conditions collectively demonstrate that a supportive physical and socio-cultural environment plays a critical role in fostering the successful implementation of deep learning. The expected learning environment has begun to materialize through the development of a collaborative culture, the nurturing of curiosity, and the promotion of reflective practices that accommodate diverse student learning styles. Strong collaboration among teachers, students, parents, and the broader community fosters the emergence of a deep learning ecosystem. These findings affirm that the principal serves as a designer of a learning ecosystem that enables meaningful learning processes to occur. Regarding the digital utilization component, teachers have integrated various technology-based instructional media, including visual media such as YouTube videos, web-based learning tools such as Canva, and interactive games using digital platforms such as Wordwall (formerly Quizizz). As expressed by Participant 5 (P5): *"...at the beginning of the lesson, we use a trigger video; during the core activity, we use Canva; and at the end, we use an interactive game, such as Wordwall (previously Quizizz)."* Leveraging digital has emerged as a reinforcing factor in the implementation of deep learning. The use of visual media, web- and application-based instructional tools, web-based gamification, and technological support indicates that technology is positioned as a pedagogical instrument rather than merely an administrative device.

Learning partnerships have been established with parents, professional partners—including lecturers from both public and private universities—local communities, and government institutions. Teacher collaboration is facilitated through professional learning communities (PLCs), in which teachers share experiences, enhance competencies, and collaboratively seek solutions to instructional challenges. In addition to internal school-based PLCs, collaborative groups are also formed with teachers from other schools within the same district. The establishment of teacher PLCs represents a collaborative effort to improve instructional quality. Through the exchange of ideas and best practices, a reflective and continuous learning culture is cultivated among teachers. Partnerships aimed at enhancing teacher capacity are conducted in collaboration with academics from public and private universities. As stated by Participant 1 (P1): *"We collaborate with external parties such as the local education office and universities. There are Memoranda of Understanding (MoUs) with UAD and UNY to support collaboration in improving the quality of instruction. "* Partnerships with parents are implemented through project-based learning activities designed to foster the understanding that education is a shared responsibility between families and schools. The existence of parent association forums serves both as support and as a mechanism of accountability for school

policies. These findings demonstrate the principal's readiness in fostering openness, effective communication, and sustainable partnerships. Moreover, they highlight that deep learning requires cross-stakeholder support, with the principal functioning as a connector within the broader learning network

3.3 Challenges in the Implementation of Deep Learning

Despite ongoing efforts, several challenges remain in implementing deep learning. One of the primary challenges concerns collaboration with parents, which has not yet been fully optimized due to parents' professional commitments and limited availability. Additional challenges include the need for improvement and upgrading of certain facilities and infrastructure. Within the pedagogical practices component, disparities persist in teachers' technological competencies. The implementation of deep learning is perceived to require greater effort, thorough preparation, and extended instructional time. Teachers are expected to creatively explore diverse ideas to ensure that the principles of deep learning are meaningfully realized in classroom practice. A further internal challenge relates to teacher consistency. Participants emphasized that teachers must continuously upgrade their professional competencies in order to sustain deep learning practices. As stated by Participant 3 (P3): *"To create mindful, meaningful, and joyful learning requires extraordinary effort… teachers must continuously upgrade themselves."*

DISCUSSION

The findings of this study are consistent with the concept of deep learning, which emphasizes the integration of cognitive, social, and contextual dimensions in the learning process.

Understanding as the Foundation of Deep Learning

The findings indicate that principals foster teachers' understanding through socialization programs, professional training, and digital workshops. This underscores that readiness for implementing deep learning begins with a transformation of mindset. Principals do not merely function as administrators; rather, they act as instructional leaders who internalize the philosophy of deep learning and transform it into a shared vision within the school. This finding aligns with theoretical perspectives suggesting that deep learning requires a paradigm shift from teacher-centered to student-centered learning, emphasizing meaning-making and learning awareness. Teachers' positive perceptions of deep learning further indicate that instructional practices are shifting toward meaningful learning and metacognitive awareness, which are key characteristics of deep learning.

Pedagogical Practices as The Implementation of Deep Learning

The pedagogical practices identified such as problem-based learning, project-based learning, and the STEM approach demonstrate a shift toward learning that promotes higher-order thinking skills (HOTS). Project-based activities integrated with STEM reflect active student engagement, contextual learning, interdisciplinary integration, and the production of tangible learning outcomes. In this context, the principal serves as an instructional leader who ensures the quality of teaching through academic supervision and the strengthening of teacher collaboration. This is consistent with the view that the success of deep learning is strongly influenced by effective pedagogical leadership at the school level.

The Learning Environment as a Deep Learning Ecosystem

A safe, supportive, and collaborative learning environment is a fundamental prerequisite for deep learning. The findings reveal the presence of adequate facilities and infrastructure, as well as a positive school culture characterized by collaboration, reflection, and mutual respect.Within the

framework of deep learning, such an environment enables independent knowledge exploration, experiential learning, and the development of character and social values. The transformation of teachers' roles from knowledge transmitters to facilitators indicates a significant pedagogical shift. This highlights the principal's role as a designer of a learning ecosystem that fosters creativity, curiosity, and reflective learning.

Digital Utilization as a Reinforcement of Deep Learning

The use of digital technologies in learning such as videos, Canva, and interactive games demonstrates that technology functions as a tool to deepen students' understanding. From a deep learning perspective, technology is not merely a supporting tool; it expands access to learning and enhances student engagement, thereby supporting meaningful and sustained learning processes.

Learning Partnerships: Collaboration as the Key to Deep Learning

Partnerships with various stakeholders indicate that deep learning cannot function in isolation but requires a collaborative network. Teacher Learning Communities reflect the practice of professional learning communities, which constitute a critical pillar of deep learning. Through collective reflection and the sharing of best practices, teachers' capacities are continuously enhanced. Collaboration with higher education institutions and parents further reinforces that deep learning is contextual and relevant to students' real-life experiences. In this regard, the principal plays a pivotal role in connecting multiple stakeholders.

Implementation Challenges from a Deep Learning Perspective

Despite the established readiness, this study identifies several challenges, including limited collaboration with parents, uneven digital competencies among teachers, the need for greater time and effort, and inconsistencies in implementing deep learning practices. These challenges indicate that the implementation of deep learning is not an instantaneous process but requires systemic and sustained transformation. Deep learning demands readiness at multiple levels: individual readiness (teachers' competencies and mindset), organizational readiness (school culture), and system readiness (policy support and infrastructure). The need for teacher creativity and innovation further underscores that deep learning is closely linked to continuous professional development. Without a strong commitment to ongoing learning, the consistent implementation of deep learning is unlikely to be achieved

4. CONCLUSION

The findings indicate that, overall, the principal has implemented various strategies to prepare the school for the implementation of deep learning. Strategy and approach constitute essential components in policy implementation to ensure successful execution (Yuliah, 2020). This study demonstrates that principals' readiness to implement deep learning can be understood as the integration of multiple dimensions of educational leadership. The findings reinforce the perspective that principals function as instructional leaders who bear responsibility for the quality of teaching and learning processes within the school**.**Principals' understanding of deep learning emerges as a crucial determinant of successful implementation. This aligns with transformational leadership theory, which underscores the importance of leaders' mindset transformation in driving organizational change. Principals who possess a strong conceptual understanding are better positioned to translate policy into meaningful instructional practices.The various challenges encountered by principals underscore that the implementation of deep learning requires long-term

commitment, consistency, and adaptability to change. Thus, principals' readiness represents a critical factor in ensuring the successful implementation of deep learning at the school level.

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