

**School Management in Utilizing Deep Learning Methods and Supporting
Technology-Based Learning in the Classroom**

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ARTICLE INFO	ABSTRACT
<p>Published: July, 31st 2025</p> <p>Key words: school management, deep learning, technology</p>	<p>This study explores the critical role of school management in adopting deep learning methods and supporting technology-based learning in classrooms. Rapid advancements in artificial intelligence have significantly impacted educational efficiency and quality, yet challenges such as infrastructure limitations and the need for continuous teacher training hinder widespread implementation. The qualitative research approach was employed, involving interviews and document analysis with seven teachers and the principal of a high school in Depok, conducted from January to March 2023. Data were analyzed through thematic analysis with triangulation to ensure validity. The findings highlight key factors necessary for successful integration, including adequate technological infrastructure, high-quality data, teacher capacity building, supportive policies, strong leadership, and fostering a collaborative digital culture. The study emphasizes that strategic resource management and ongoing evaluation are vital to overcoming challenges and ensuring the sustainability of deep learning initiatives. Effective school management must align policies, resources, and stakeholder collaboration to enhance pedagogical skills and create an innovative, inclusive learning environment. Recommendations include increasing infrastructural support, conducting regular teacher training, developing clear policy frameworks, and maintaining continuous monitoring and evaluation to optimize technology adoption. Overall, the research underscores that strategic management is essential to harness the full potential of deep learning, fostering educational innovations that can improve student motivation, understanding, and overall learning outcomes. Schools that prioritize these components will be better equipped to face future educational challenges and promote sustainable digital transformation in education.</p>

INTRODUCTION

The emergence of the need for school management that utilizes deep learning methods in technology-based learning is driven by rapid technological advancements in artificial intelligence, which have significantly impacted the efficiency and effectiveness of the educational process. According to Muttaqin et al. (2025), although deep learning technology is still limited in application, its benefits in improving learning quality – such as increased student motivation, better understanding of material, and more accurate analysis of student development – are substantial. However, challenges such as infrastructure limitations and the ongoing need for teacher training must be managed properly for this technology to be utilized optimally. Therefore, school management must strategically and systematically integrate this technology to achieve better learning outcomes.

Deep learning is a subset of artificial intelligence that mimics how the human brain works through layered neural networks capable of recognizing complex patterns in large data sets. Jayatri & Safitri (2025) add that the success of applying deep learning, especially in social sciences like social studies, depends on data standardization, strengthening teachers' competencies, protecting students' personal data, and transforming the digital culture within schools. This technology has the potential to develop an inclusive, collaborative, and sustainable AI-based educational innovation ecosystem, making it relevant toward building a modern and future-oriented education system. Thus, a deep understanding of deep learning is essential for school management to guide and address various implementation challenges effectively.

The implementation of deep learning in education can significantly improve teachers' pedagogical skills and the efficiency of teaching and learning processes. Atmojo et al. (2025) report that about 20 teachers in Surakarta showed a 45% increase in pedagogical abilities in designing and implementing deep learning strategies focused on critical thinking, creativity, and joyful learning. This technology facilitates the creation of a dynamic and meaningful learning environment, which in turn fosters student motivation. Overall, the adoption of deep learning in schools, supported by effective management, can create an interactive and innovative learning environment.

Applying deep learning in education also enhances students' conceptual understanding and encourages active involvement in discussions, collaboration, and problem-solving. Royani et al. (2024) state that this model not only supports conceptual comprehension but also strengthens student participation in collaborative learning activities. However, main challenges in implementing this technology include resource limitations and teachers' readiness. Therefore, increasing teacher training and strengthening technological infrastructure are recommended to support broader and more effective adoption of deep learning.

In the national education context, adopting deep learning requires well-planned management strategies to overcome challenges. Wijaya, Haryati, & Wuryandini (2025) exemplify that the application of this approach at SDN 1 Wulung significantly improved learning quality, indicating that technology success heavily depends on resource management and educators' competence. School management must be capable of organizing infrastructure

development, teacher training, and curriculum planning to maximize the technology's benefits. Effective management will reinforce the success of educational innovations and produce long-term positive impacts on the national education quality.

Several studies emphasize that the integration of intelligent technologies such as deep learning into the education system will greatly enhance learning effectiveness and resource management. According to recent research, the success of this technology's implementation depends heavily on infrastructure readiness, teacher training, and supportive policy development. Therefore, the role of school management becomes highly strategic in promoting the adoption and sustainable development of this technology. When managed properly, deep learning can produce educational innovations capable of competing globally and preparing students for increasingly complex future challenges. This integration should be based on managerial commitment and collaboration among all school elements to achieve the best possible results efficiently and effectively.

METHOD

Research Design

The research method used for the study titled "School Management in Utilizing Deep Learning Methods and Supporting Technology-Based Learning in the Classroom" is qualitative in nature. This approach was chosen to gain a deep and comprehensive understanding of how school management adopts and implements deep learning methods within a specific educational context. Data collection was conducted through interviews and document analysis, providing rich and detailed information from various perspectives. The sample consisted of seven teachers and the school principal from one high school in Depok, selected purposively to represent different roles and experiences related to the integration of deep learning in classroom settings. The data collection process took place from early January to March 2023, allowing sufficient time for in-depth engagement and gathering of relevant information.

Interviews were conducted face-to-face with the selected teachers and the principal, focusing on their experiences, perceptions, and challenges related to the implementation of deep learning methods and technology-based learning strategies. These interviews were semi-structured to allow flexibility while covering key topics such as management support, infrastructure, training, and pedagogical practices. Additionally, document analysis was carried out by reviewing relevant school documents, such as curriculum plans, training reports, and policy guidelines related to the integration of technology and deep learning. This helped to triangulate data from multiple sources and ensure the validity of the findings.

The collected data were then analyzed using thematic analysis, where the researcher identified patterns, themes, and categories related to school management strategies, challenges, and success factors in utilizing deep learning methods. The process involved coding the interview transcripts and document data, organizing these codes into meaningful themes, and interpreting the data in relation to the research questions. To enhance the credibility and reliability of the findings, triangulation was applied by cross-checking data from different sources and methods, ensuring a comprehensive understanding of the phenomenon.

Finally, the analysis results were synthesized into findings that describe the current practices, challenges, and opportunities of school management in supporting deep learning-based technology integration. Based on these findings, conclusions were drawn regarding effective management strategies and critical factors that influence successful implementation. This qualitative approach provided a nuanced understanding of the complexities and contextual factors involved in managing technology-driven educational innovations at the school level.

RESULT AND DISCUSSION

Supporting effective school management in utilizing deep learning methods and fostering technology-based learning in classrooms requires a comprehensive approach that encompasses infrastructural readiness, data quality, teacher training, policy support, leadership, cultural adaptation, financial resources, continuous evaluation, and strategic management. According to Muttaqin et al. (2025), although deep learning technology is still being applied on a limited scale, its potential to significantly enhance learning quality – such as boosting student motivation, improving understanding of subject matter, and providing more precise analysis of student development – is quite notable. However, their study also highlights the challenges faced in implementation, particularly related to infrastructure deficiencies and the ongoing need for teacher capacity building, emphasizing the necessity for robust school management systems to bridge these gaps.

Adequate technological infrastructure is fundamental, including devices like computers and servers, high-speed internet access, and specialized AI-based learning platforms capable of supporting deep learning models (Muttaqin et al., 2025). Without reliable access to such technology, schools will struggle to implement innovative teaching strategies effectively. The importance of standardized, high-quality data cannot be overstated, as it forms the backbone for training deep learning systems to deliver relevant, accurate, and personalized learning experiences. Jayatri & Safitri (2025) stress that the success of deep learning in education also hinges on data standardization and the protection of students' privacy, which requires cohesive efforts in establishing clear policies and ethical standards within the school environment.

Teacher capacity development is another critical factor, as deep learning strategies require educators proficient in AI concepts and capable of integrating them into their pedagogical practices. As Atmojo et al. (2025) observe, as many as 20 elementary school teachers in Surakarta demonstrated a 45% improvement in pedagogical skills regarding the design and implementation of deep learning approaches that focus on critical thinking, creativity, and joyful learning. This indicates that ongoing professional development programs are essential to empower teachers and help them create dynamic, engaging, and meaningful learning environments. Such training not only improves pedagogical abilities but also encourages teachers to innovate their teaching methods using deep learning technologies.

School policies and regulations play a vital role in creating a conducive environment for adopting deep learning. The establishment of internal policies aligned with national

regulations can facilitate the ethical and secure use of AI tools in classrooms (Jayatri & Safitri, 2025). Such policies should address data privacy, ethical AI use, and the long-term sustainability of AI integration, fostering a culture that embraces digital transformation. Building this culture requires concerted efforts from school leadership and stakeholders, emphasizing the importance of vision and commitment from principals and governors to spearhead digital innovation initiatives (Muttaqin et al., 2025).

Strong leadership and committed school principals are imperative to push forward technological adoption and community engagement. As Wijaya, Haryati, & Wuryandini (2025) found in their study at SDN 1 Wulung, effective leadership directly correlates with successful implementation of deep learning strategies, as it mobilizes resources, sets priorities, and creates a supportive environment for change. Leaders need to serve as catalysts for digital transformation, ensuring that sufficient resources, infrastructure, and training opportunities are available and accessible. Their role includes fostering collaboration among teachers, students, and parents to build a collective commitment to the digital shift in education.

Developing a strong digital culture coupled with collaborative efforts among all stakeholders is essential for a seamless integration process. Creating an environment that encourages innovation, experimentation, and shared learning enables educators and students to adapt to AI-enabled pedagogical approaches more comfortably (Muttaqin et al., 2025). Collaboration among teachers, administrators, students, and parents creates a feedback loop that helps identify challenges and opportunities for improvement, ensuring continual growth in technology integration. This collaborative culture strengthens the sustainability of deep learning initiatives and promotes shared responsibilities in managing digital transformation.

Financial resources are equally vital, as the procurement and maintenance of technological tools, devices, AI software, and supporting infrastructure require significant funding. Adequate budgeting is essential to sustain long-term initiatives, including periodic system upgrades, training, and maintenance costs. As Royani et al. (2024) emphasize, the success of deep learning models in education is also limited by resource constraints, which can hamper the scaling and effectiveness of implementations. Schools need to develop clear financial plans and seek support from government grants, private sector partnerships, or community contributions to ensure the ongoing availability of funding.

Continuous evaluation and monitoring are necessary to measure the effectiveness of deep learning applications and adapt strategies accordingly. Regular assessment of teaching practices, student engagement, and learning outcomes provides valuable insights into what works and what needs adjustment (Muttaqin et al., 2025). These evaluations should involve multiple stakeholders, including teachers, students, and administrators, and employ qualitative and quantitative methods to gather comprehensive data. Effective monitoring enables schools to refine implementation processes, address emerging challenges, and optimize the overall impact of deep learning on teaching and learning. Finally, strategic and managerial capabilities are crucial for orchestrating successful AI integration in education. School managers must possess strong planning, organizing, and controlling skills to coordinate various

CONCLUSION

In conclusion, effective school management is essential for the successful integration of deep learning methods and support for technology-based learning in classrooms. This integration requires a comprehensive approach that includes robust technological infrastructure, high-quality standardized data, and continuous professional development for teachers. As highlighted by Muttaqin et al. (2025), infrastructural limitations and ongoing training needs pose significant challenges; hence, strategic planning and resource allocation are vital to address these issues. Teachers must be equipped with the necessary skills to effectively implement deep learning strategies, which can be achieved through regular training programs, as evidenced by Atmojo et al. (2025), who observed notable pedagogical improvements among teachers trained in deep learning techniques. Furthermore, school policies and regulations play a crucial role in creating an ethical and secure environment for AI application, emphasizing the importance of data privacy and ethical standards, as noted by Jayatri & Safitri (2025). Strong leadership from school principals and administrative staff is also critical in fostering a supportive culture of digital innovation, motivating stakeholders, and mobilizing resources, as demonstrated by Wijaya, Haryati, & Wuryandini (2025). A collaborative culture that encourages openness, experimentation, and shared learning enhances the sustainability of deep learning initiatives. Financial support is another vital element, requiring careful planning to fund technological tools, infrastructure, and maintenance, which Royani et al. (2024) identified as limiting factors when resources are insufficient. Finally, continuous evaluation and monitoring ensure the effectiveness of deep learning applications, allowing for timely adjustments to improve outcomes. Overall, the success of implementing deep learning in education depends heavily on strategic management that aligns resources, policies, training, and collaboration, ensuring sustainable technological advancement and improved educational quality. Schools that prioritize these elements will be better positioned to harness the full potential of deep learning, ultimately transforming teaching and learning processes into more innovative and effective experiences.

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