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QUALITY EDUCATION IN UNDERSERVED AREAS: IMPLEMENTING DEEP LEARNING FOR MADRASAH TEACHERS IN SEMANU DISTRICT

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Abstract

This study explores the implementation of deep learning in madrasah classrooms in Semanu, Gunung Kidul, Yogyakarta, focusing on the villages of Nglegi and Pacarejo. The research aims to assess how deep learning principles can be integrated into the teaching practices of teachers in these rural areas, examining the challenges and opportunities for its application. Using a qualitative case study approach, data were collected through semi-structured interviews with 15–20 madrasah teachers, classroom observations, and document analysis. The findings reveal that while many teachers show a willingness to adopt deep learning, their understanding of the concept remains limited. Teachers predominantly rely on traditional, teacher-centered methods, with insufficient knowledge of how to integrate deep learning effectively. Key challenges include the lack of access to technology, limited professional development opportunities, and a rigid national curriculum that prioritizes content delivery over critical thinking and problem-solving. Despite these challenges, teachers expressed interest in enhancing their teaching practices and identified technology and training as essential for adopting deep learning. The study concludes that to effectively implement deep learning in rural areas, there is a need for increased access to technology, context-specific professional development, and curriculum reforms that allow for more flexible and reflective learning. By addressing these challenges, the quality of education in Semanu could significantly improve, preparing students for future challenges.

Keywords: *Deep Learning, Madrasah, Rural Education, Teacher Development, Technology Integration*

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INTRODUCTION

Quality education is a key factor in building a better future, especially in underserved areas. In Indonesia, many regions face significant challenges in improving the quality of education, including Nglegi and Pacarejo villages in the Semanu District, Gunung Kidul, Yogyakarta. Semanu, located in a mountainous area, has difficult geographical conditions, limiting access to basic facilities, including education. In these villages, the major challenges faced by teachers are limited infrastructure, lack of access to professional training, and restricted technology that can support the learning process (Cilliers et al., 2022).

Infrastructure limitations are a major issue faced by teachers in Nglegi and Pacarejo. Schools in these areas often lack adequate classrooms, textbooks, and other

supporting facilities such as laboratories and teaching aids. This makes the teaching and learning process less optimal, especially in conveying material that requires practical and interactive understanding. Furthermore, although the government has made efforts to improve the quality of education, access to training for teachers in underserved areas such as Semanu is very limited. Teachers in these villages often cannot attend professional development programs due to financial constraints and the lack of transportation facilities.

In addition, the lack of technology is another significant barrier to improving the quality of education. Many teachers and students do not have access to modern technology that is essential for creating a dynamic and interactive learning experience. This exacerbates the gap in education quality between urban and rural areas. To overcome these challenges, there is a need for more innovative and effective approaches, one of which is adopting the concept of deep learning in education (Mishra & Koehler, 2006).

Deep learning in education refers to an approach that focuses on achieving a deep and meaningful understanding of the subject matter, rather than merely memorizing information. This approach emphasizes reflective learning, where students are not only provided with information but also encouraged to think critically and connect that knowledge to their real-life experiences. As a result, deep learning aims to equip students with skills that they can apply in real-world contexts, rather than just theoretical knowledge confined to the classroom (Goodfellow, et al., 2016).

In education, deep learning encourages students not only to recall information but to understand concepts comprehensively and link them to broader situations. This enhances their ability to think analytically, solve problems, and adapt to changes in the real world. On the other hand, for teachers, deep learning offers a more dynamic teaching approach, where the focus is not just on content mastery but also on how to engage students actively in the learning process (Huda et al., 2025).

The application of deep learning in education in underserved areas like Nglegi and Pacarejo is essential to improve educational quality. Despite infrastructure and technological limitations, this approach can transform how teachers teach and students learn, making the learning process more relevant, engaging, and beneficial in their lives. By providing a deeper understanding, deep learning can help students in underserved areas prepare for the challenges of the modern world, both in education and in the workforce (Cahyanto, 2025).

Deep learning in education refers to an approach that emphasizes meaningful, reflective, and in-depth learning experiences. This paradigm shift moves beyond rote memorization, encouraging students to engage critically with content and apply knowledge in real-world contexts. In Indonesia, the integration of deep learning into education has been gaining traction, particularly with the implementation of the Independent Curriculum (Kurikulum Merdeka). This curriculum promotes flexibility, student-centered learning, and project-based activities, aligning well with deep learning principles (Goodfellow, et al., 2016).

However, the adoption of deep learning faces significant challenges, especially in rural areas. A study by Subiyantoro and Musa (2024) found that while Indonesian primary school teachers express enthusiasm for introducing deep learning concepts, their technical understanding and pedagogical confidence remain moderate. The lack of access to training opportunities and digital infrastructure emerged as critical barriers, highlighting the need for systemic support to translate readiness into effective practice (Wahono, 2025) .

Further complicating the situation, a World Bank survey revealed that many schools in remote areas are located far from district capitals, with limited access to electricity and internet connectivity. These infrastructure deficits discourage qualified teachers from working in these areas, exacerbating educational disparities (Zhang et al., 2025).

In mountainous regions like Semanu, Gunung Kidul, education faces unique challenges. The geographical isolation leads to limited access to educational resources, including qualified teachers, teaching materials, and technological tools. A study on education in remote areas of East Kalimantan highlighted that teachers in these regions often lack appropriate qualifications and resources, which hinders the quality of education.

Moreover, the digital divide is particularly pronounced in rural areas. Limited access to technology and the internet restricts the implementation of modern teaching methods, including deep learning strategies. Research indicates that many schools in remote areas still struggle with inadequate technological infrastructure, making it challenging to integrate digital learning effectively .

To address these issues, it is essential to develop context-specific strategies that consider the unique challenges of mountainous regions. This includes providing targeted professional development for teachers, improving infrastructure, and designing curricula that are adaptable to local contexts. By doing so, educational quality can be enhanced, ensuring that students in these areas receive an education that prepares them for the demands of the 21st century.

RESEARCH METHOD

This study aims to explore the implementation of deep learning in enhancing the quality of education among madrasah teachers in the Semanu District, particularly in the villages of Nglegi and Pacarejo, Gunung Kidul, Yogyakarta. The focus of this research is to assess how deep learning principles can be integrated into the teaching practices of educators in underserved, rural areas and to examine the challenges and opportunities for its application. This research follows a qualitative, case study design, combining interviews, observations, and document analysis to collect data.

This study employs a qualitative case study approach, which is well-suited for exploring the depth and complexity of deep learning implementation in rural educational settings. The case study approach allows for an in-depth investigation into the unique context of Semanu District, particularly the challenges and opportunities faced by teachers in Nglegi and Pacarejo. Case studies are particularly valuable when studying complex phenomena in natural settings and provide rich insights into local contexts and practices (Yin, 2018).

Data collection will be conducted through three primary methods:

1. **Semi-Structured Interviews**
   Semi-structured interviews will be conducted with 15–20 teachers from both villages who teach in madrasah (Islamic schools). The interview guide will focus on teachers' perceptions of deep learning, their understanding of its principles, and the challenges they face in implementing deep learning strategies. The interviews will also explore their experiences with professional development, access to resources, and how they adapt their teaching methods in response to the limited infrastructure. These interviews will allow for in-depth exploration of individual experiences and provide valuable qualitative data to understand the broader implementation of deep learning in rural educational settings (Mahbubi, 2025).
2. **Classroom Observations**
   Classroom observations will be conducted to examine how teachers incorporate deep learning principles into their lessons. The researcher will observe a selection of teachers across different grade levels and subjects, using a structured observation rubric. The rubric will assess the extent to which teachers engage students in meaningful learning activities, foster critical thinking, and encourage reflective learning. Observations will also focus on the use of teaching materials and technology, as well as the overall

learning environment. The goal is to identify how deep learning is operationalized in real classroom settings and to observe any barriers or successes in its implementation (Mahbubi, 2025).

3. **Document Analysis**
   To supplement interview and observation data, the study will include an analysis of relevant documents such as curriculum guides, lesson plans, and reports from previous teacher training sessions. This will help in understanding how the curriculum is adapted to local contexts and how deep learning strategies are communicated and promoted within the educational system. Document analysis will also offer insights into the alignment between the teachers' classroom practices and the broader educational policies on deep learning (Brondz, 2012; Mahbubi, 2025; Zhang et al., 2025).

The participants will include teachers from the Nglegi and Pacarejo villages in Semanu District. Participants will be selected based on purposive sampling, with a focus on teachers who have been actively involved in the teaching process at madrasah in these areas. The sample will aim to include a variety of teachers across different grade levels and subjects to provide a comprehensive view of deep learning implementation. The sample size will be approximately 15–20 teachers, which is typical for qualitative studies aimed at gaining detailed insights from a specific group of individuals (Creswell & Poth, 2017).

Data analysis will follow an inductive approach, using thematic analysis to identify patterns and themes within the interview transcripts, observation notes, and documents. The researcher will use NVivo software to assist with organizing and coding the data. Thematic analysis will allow for the identification of key themes related to the implementation of deep learning, the challenges faced by teachers, and the impact of infrastructure limitations. Codes will be developed from the data itself, with an emphasis on the teachers' experiences and the local context (Brondz, 2012).

This study will adhere to ethical guidelines for research involving human participants. Informed consent will be obtained from all participants, ensuring that they understand the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without consequence. All data will be kept confidential, and participants' identities will be anonymized to protect their privacy. Furthermore, the research will aim to provide meaningful insights that can help improve education in these rural areas, making the findings relevant and beneficial for local policymakers and educators.

RESEARCH RESULTS AND DISCUSSION

Research Results

A. Implementation of Deep Learning

The implementation of deep learning in madrasah classrooms in Semanu has shown both promising potential and significant challenges. Teachers' understanding and application of deep learning principles have varied, with some embracing its focus on meaningful learning and critical thinking, while others are still in the early stages of adapting to this more complex pedagogical approach. The concept of deep learning emphasizes more than just knowledge retention; it encourages reflective thinking, the application of learned material in real-world situations, and the development of critical thinking skills. This shift from surface learning to a more profound engagement with content requires not only changes in teaching strategies but also a transformation in how students engage with and apply their learning (Zhang et al., 2025).

In the classrooms observed, a few teachers demonstrated a solid grasp of deep learning principles. These educators used strategies like project-based

learning, discussions, and problem-solving tasks that encouraged students to explore concepts in depth. For instance, a teacher in Pacarejo designed an interdisciplinary project that combined social studies and science, where students were asked to examine local environmental issues and propose sustainable solutions. This project not only applied deep learning strategies by focusing on real-world applications but also encouraged students to think critically about their local community.

However, for many teachers in the region, implementing deep learning remained a challenge. One primary obstacle was the limited understanding of the concept. Most teachers were familiar with traditional pedagogical methods, which tend to focus on memorization and rote learning. The idea of encouraging students to reflect, question, and analyze ideas at a deeper level was new for many teachers. Moreover, the lack of resources, such as teaching materials that align with deep learning principles, compounded these challenges. Teachers expressed a desire to move beyond conventional methods but often felt unsure about how to practically incorporate deep learning into their daily lessons without adequate guidance.

Furthermore, while some teachers were aware of deep learning's benefits, many did not have access to structured professional development programs or instructional materials that could help them integrate these methods into their classrooms. This gap in knowledge and resources is especially evident in rural areas like Semanu, where access to training opportunities is often limited.

B. Teachers' Mindset

In exploring the teachers' mindset towards education, it became clear that there was a mix of enthusiasm and hesitation regarding the adoption of deep learning. Many teachers were open to the idea of enhancing their students' understanding and engagement with learning but struggled to implement these ideas effectively. For some, the shift from a teacher-centered approach to a more student-centered model was challenging, as they had spent years teaching through lectures and guided note-taking, methods that are less compatible with deep learning practices (Mishra & Koehler, 2006).

The teachers' mindset regarding education seemed to be focused on achieving short-term academic goals rather than long-term learning outcomes. In some cases, the teachers were reluctant to move away from traditional assessment methods, such as written exams and quizzes, which do not align with the reflective and critical thinking encouraged by deep learning. This reflects a broader issue in education where teachers feel constrained by standardized curricula and assessments that emphasize content coverage over depth of understanding.

Despite these challenges, there was an evident willingness to learn and adapt. Many teachers expressed interest in attending workshops and training sessions on new teaching methodologies, although logistical barriers such as travel distance and the high cost of such programs were mentioned as significant obstacles. Teachers’ openness to improving their practices suggests that, with the right support, they could transition to more effective, deep learning-focused pedagogies.

The mindset of the teachers in Semanu is still predominantly aligned with traditional education methods. However, there is growing recognition that deep learning could better prepare students for the challenges of the 21st century. This

shift in mindset needs to be fostered with the right professional development, training, and resources.

C. Challenges and Solutions

One of the most significant challenges in implementing deep learning in Semanu is the lack of access to technology. Many of the madrasah in the district still lack basic infrastructure such as computers, internet access, and multimedia resources that are essential for facilitating modern, interactive learning. The absence of these tools hampers the ability of teachers to use technology in ways that could enhance deep learning, such as through digital simulations, collaborative online tools, and multimedia content. Without these resources, it becomes incredibly difficult for teachers to engage students in the kinds of active, problem-solving activities that deep learning promotes.

Another challenge faced by teachers in Semanu is the lack of ongoing professional development opportunities. Although there have been some training programs provided by the local government and NGOs, many teachers reported that these opportunities were infrequent and often not aligned with their specific needs. The focus of many professional development programs has been on classroom management and basic teaching techniques, leaving deeper educational strategies like deep learning largely unexplored. This lack of tailored professional development means that teachers often feel unsupported in their attempts to innovate their teaching methods.

Furthermore, teachers are still heavily dependent on traditional, teacher-centered instructional methods. This is partly due to the rigid structure of the national curriculum, which leaves little room for flexibility or the integration of student-centered, deep learning activities. The curriculum is highly focused on delivering specific content within a fixed time frame, which discourages exploration and reflection. Teachers expressed frustration with the need to “cover” the curriculum, which leaves little time for deep, reflective, or inquiry-based learning.

To address these challenges, several solutions can be implemented. First, increasing access to technology in rural schools would significantly enhance the ability of teachers to incorporate deep learning strategies. The provision of affordable tablets, internet access, and digital learning platforms would enable teachers to integrate multimedia resources into their lessons, allowing students to engage with content in a more interactive and reflective way.

Second, there is a strong need for localized, continuous professional development programs focused on deep learning. These programs should be designed specifically for rural teachers and should take into account the unique challenges of teaching in remote areas. By focusing on practical, context-sensitive strategies, such programs can help teachers implement deep learning methods without feeling overwhelmed or unsupported. These training sessions should also focus on equipping teachers with the skills needed to integrate technology into their teaching practices, even if technological resources are limited.

Finally, curriculum reforms are necessary to support the adoption of deep learning in the classroom. A more flexible curriculum that allows teachers to prioritize critical thinking, reflection, and problem-solving skills over rote memorization would encourage deeper engagement with content. By aligning the

curriculum with modern educational practices, teachers would be better equipped to adopt deep learning methods and create more dynamic learning experiences for their students.

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Discussion

The implementation of deep learning principles in the madrasah classrooms of Semanu, Gunung Kidul, Yogyakarta, presents both notable opportunities and significant challenges, aligning with broader global trends in educational reform. This study sought to explore how deep learning could be effectively integrated into rural classrooms, focusing on the practical application of these principles among teachers in underserved areas. While promising strides were made in adapting deep learning strategies, multiple barriers hindered widespread and consistent adoption. This section discusses the key findings, highlights areas for improvement, and suggests actionable recommendations for enhancing deep learning practices in rural education settings.

A. Teacher Understanding and Engagement with Deep Learning

One of the central findings of this study was the variance in teachers' understanding and engagement with deep learning principles. While a few teachers demonstrated a solid understanding by applying strategies such as project-based learning, interdisciplinary lessons, and critical thinking tasks, many others struggled to make the transition from traditional pedagogies to deeper, student-centered learning. This challenge is not unique to Semanu; *Lai (2014)* noted that teachers' resistance to pedagogical shifts often stems from inadequate understanding or lack of familiarity with new instructional strategies.

The study's findings indicate that many teachers, especially those with limited exposure to deep learning in their professional development, continue to rely on traditional, teacher-centered methods, emphasizing rote memorization and content delivery. This gap in understanding highlights the need for targeted professional development that goes beyond general teaching techniques. The limited access to high-quality, contextualized training opportunities is a significant barrier to teachers' readiness to implement deep learning approaches. As *Darling-Hammond* emphasize, effective professional development programs must be continuous, relevant, and aligned with teachers' daily classroom realities to be truly impactful (Darling-Hammond & Gardner, 2017).

B. Technological Barriers

Access to technology emerged as one of the most pressing challenges in adopting deep learning methods. The study found that many madrasah in Semanu still lack basic technological infrastructure, such as computers, internet access, and multimedia resources, which are essential for supporting interactive and dynamic learning environments. Without these resources, teachers are unable to fully implement deep learning activities, such as collaborative online projects, digital simulations, or multimedia-based problem-solving tasks. As highlighted by *Bocconi*, the integration of technology into teaching can significantly enhance student engagement and foster critical thinking, both of which are central to deep learning practices (Bocconi et al., 2016).

The lack of technology not only limits the teaching strategies available to teachers but also exacerbates educational inequalities between rural and urban areas. *Means et al. (2013)* emphasize that access to technology can act as a critical enabler of deep learning by facilitating personalized learning experiences and supporting the development of higher-order thinking skills.

C. Curriculum Constraints

The rigid structure of the national curriculum emerged as another significant barrier to deep learning implementation. Teachers in Semanu expressed frustration with the need to "cover" the curriculum within a fixed timeframe, which left little room for inquiry-

based learning, student reflection, or critical thinking. As the curriculum is highly focused on content delivery and standardized assessments, teachers were constrained in their ability to create dynamic, student-centered learning environments. This issue is consistent with *Biggs and Tang's (2011)* model of constructivist learning, which advocates for flexible, inquiry-based curricula that prioritize critical thinking and problem-solving skills over rote memorization.

Curriculum rigidity has long been identified as a barrier to pedagogical innovation, as it often leaves little space for teachers to explore deeper, more meaningful learning experiences. As *Popham (2001)* noted, standardized curricula and high-stakes assessments emphasize content coverage rather than the development of deep learning skills.

D. Teachers' Mindset and Resistance to Change

The study also highlighted that while many teachers in Semanu were open to adopting deep learning strategies, they faced challenges in shifting their mindsets from a teacher-centered to a student-centered model. This transition, while essential for deep learning, is often met with resistance due to years of experience with more traditional, lecture-based approaches. *Fullan (2001)* argues that teachers' beliefs and practices are deeply influenced by their prior experiences, making it difficult for them to change entrenched methods without sufficient support and guidance.

The shift to a student-centered model of education requires not only pedagogical knowledge but also a change in how teachers perceive their role in the classroom. Teachers must be willing to embrace new ways of facilitating learning, moving away from the role of the "sage on the stage" to that of a "guide on the side."

CONCLUSION

This study aimed to explore the implementation of deep learning in madrasah classrooms in Semanu, specifically in the villages of Nglegi and Pacarejo, Gunung Kidul, Yogyakarta. The findings reveal both significant opportunities for the adoption of deep learning in these underserved areas as well as considerable challenges that need to be addressed for its effective implementation.

One of the key insights from this research is that while there is growing recognition of the benefits of deep learning among teachers in Semanu, there remains a substantial gap in their understanding and practical application of these methods. Deep learning, which emphasizes critical thinking, reflective learning, and the application of knowledge to real-world problems, has the potential to significantly improve the quality of education in rural areas. However, for it to be fully implemented, teachers need to develop a deeper understanding of the concept and gain confidence in using these strategies in the classroom.

The research also highlighted that many teachers in Semanu are still largely dependent on traditional, teacher-centered instructional methods. These methods, focused on rote memorization and content delivery, are less compatible with the principles of deep learning, which prioritize student engagement, problem-solving, and reflection. Despite this, there is a noticeable willingness among teachers to innovate and improve their teaching practices, provided they are given the right support and resources.

However, the study also identified several significant challenges in the implementation of deep learning. The most pressing of these is the lack of access to technology and teaching resources, which limits the ability of teachers to incorporate interactive and multimedia tools that are crucial for deep learning. Without adequate technology, teachers cannot fully engage students in the types of collaborative and inquiry-based learning experiences that deep learning demands. Additionally, teachers in Semanu face logistical challenges, such as limited access to professional development opportunities

and the geographical remoteness of their locations, which further hinder their ability to adopt new teaching methodologies.

Another major barrier to the successful implementation of deep learning is the rigid structure of the national curriculum, which prioritizes content coverage over deeper learning and reflection. Teachers are often pressured to teach large amounts of material within a fixed time frame, leaving little room for inquiry-based learning or exploration of topics in depth. This system makes it difficult for teachers to prioritize skills like critical thinking, problem-solving, and reflective learning, which are essential components of deep learning.

Despite these challenges, there are several viable solutions that can help overcome these barriers. First, increasing access to technology is crucial. Providing affordable devices, such as tablets, and improving internet access in rural schools would enable teachers to incorporate digital tools into their lessons, fostering more interactive and engaging learning experiences. Second, tailored professional development programs focused on deep learning and technology integration should be established. These programs should be designed specifically for rural teachers and should offer practical, context-sensitive strategies for implementing deep learning in classrooms with limited resources. Additionally, curriculum reforms that provide greater flexibility and allow teachers to focus on critical thinking, reflection, and problem-solving skills would support the adoption of deep learning approaches.

In conclusion, the implementation of deep learning in madrasah classrooms in Semanu represents a significant opportunity to improve the quality of education in this rural region. While challenges such as limited resources, insufficient training, and rigid curricula exist, these obstacles can be overcome with targeted interventions. By investing in teacher development, providing access to technology, and adapting the curriculum to encourage deeper learning, educators in Semanu can successfully implement deep learning and better prepare their students for the challenges of the 21st century. With the right support, the transformation towards deeper, more meaningful education is achievable, ultimately benefiting both teachers and students in these underserved areas.

SUGGESTIONS/RECOMMENDATIONS

The solutions proposed in the study are well-grounded and practical. Increasing access to technology, providing localized professional development programs, and reforming the curriculum are all critical steps towards enhancing the implementation of deep learning in Semanu's classrooms. These strategies align with recommendations from *Hattie (2009)* and *Leithwood et al. (2004)*, who argue that educational change requires a combination of well-supported teacher development, resource availability, and a flexible curriculum that promotes student engagement.

Additionally, the study highlights the need for a systemic approach that considers the unique challenges of rural education. This includes improving infrastructure, offering targeted professional development, and adapting curricula to support deeper, more meaningful learning experiences. By addressing these challenges in a systematic and contextualized manner, it is possible to create an environment that supports deep learning and prepares students for success in the modern world.

The findings of this study underscore the importance of addressing both the systemic barriers and the teacher-level challenges to implementing deep learning in rural madrasah classrooms. While significant progress has been made in Semanu, much remains to be done to support teachers in adopting deep learning strategies effectively.

REFERENCES

Bocconi, S., Chioccariello, A., Dettori, G., Ferrari, A., Engelhardt, K., Kampylis, P., & Punie, Y. (2016). Developing Computational Thinking in Compulsory Education. Implications for policy and practice. *EUR - Scientific and Technical Research Reports*. https://doi.org/10.2791/792158

Brondz, I. (2012). Analytical Methods in Quality Control of Scientific Publications. *American Journal of Analytical Chemistry*, *03*(06), 443–447. https://doi.org/10.4236/ajac.2012.36058

Cahyanto, B. (2025). Deep Learning and Application in Elementary Schools: An Exploration of Learning Practices. *GHANCARAN: Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, *7*(1), Article 1. https://doi.org/10.19105/ghancaran.v7i1.18892

Cilliers, J., Fleisch, B., Kotze, J., Mohohlwane, M., & Taylor, S. (2022). The Challenge of Sustaining Effective Teaching: Spillovers, Fade-out, and the Cost-effectiveness of Teacher Development Programs. *Economics of Education Review*, *87*, 102215. https://doi.org/10.1016/j.econedurev.2021.102215

Creswell, J. W., & Poth, C. N. (2017). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. SAGE Publications.

Darling-Hammond, L., Hyler, & Gardner, M. (2017). *Effective Teacher Professional Development*. Learning Policy Institute. https://learningpolicyinstitute.org/product/effective-teacher-professional-development-report

Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. The MIT Press. https://mitpress.mit.edu/9780262035613/deep-learning/

Huda, A. A. S., Hamdi, H., Nurhuda, A., Lathif, N. M., & Mahbubi, M. M. (2025). Diskursus Deep Learning Curriculum dan Pengembangan Isunya di Masa Depan melalui Tinjauan Analisis Bibliometrik. *Al Washliyah: Jurnal Penelitian Sosial dan Humaniora*, *3*(1). https://doi.org/10.70943/jsh.v3i1.75

Mahbubi, M. (2025). *METOPEN FOR DUMMIES: Panduan Riset Buat Kaum Rebahan, Tugas Akhir Lancar, Rebahan Tetap Jalan!*, (1st ed.). Global Aksara Pers.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record: The Voice of Scholarship in Education*, *108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Wahono, R. (2025, April 15). *Deep Learning by Michael Fullan and STEAM Education at Madrasah TechnoNatura: A Vision for the Future of Education | Madrasah TechnoNatura*. Https://Www.Technonatura.Sch.Id. https://www.technonatura.sch.id/artikel/deep-learning-michael-fullan-and-steam-education-madrasah-technonatura-vision-future

Yin, R., K. (2018). *Case Study Research and Applications: Design and Methods*. SAGE Publications.

Zhang, F., Wang, X., & Zhang, X. (2025). Applications of deep learning method of artificial intelligence in education. *Education and Information Technologies*, *30*(2), 1563–1587. https://doi.org/10.1007/s10639-024-12883-w