

The Urgency of Implementing Deep Learning Models to Improve the Quality of Learning in the Merdeka Curriculum at Islamic Elementary Schools

Zubaidi¹, Feny Nida Fitriyani², Fitriana Siregar³, Suliyono⁴

^{1,2,3}Institut Daarul Qur'an Jakarta

⁴Institut Binamadani Tangerang

zubaidi@idaqu.ac.id¹, fenynieda@gmail.com², fitrianisiregar@gmail.com³,
mubaroksuliyono@gmail.com⁴

Abstract

This study examines the urgency of implementing deep learning models to improve the quality of learning within the framework of the Merdeka Curriculum in Islamic Elementary Schools. The study employed a multi-site case study design with a qualitative approach conducted at three Islamic Elementary Schools in Cipondoh District, Tangerang City. The participants consisted of 25 informants, including teachers, principals, students, parents, and community representatives. Data were collected through in-depth interviews, classroom observations, and document analysis, and were analyzed using thematic and cross-case analysis to identify similarities and differences in implementation across research sites. The findings reveal that the implementation of deep learning is considered important in supporting adaptive, differentiated, and student-centered learning in line with the principles of the Merdeka Curriculum. Teachers perceived that this approach could enhance student engagement, critical thinking skills, collaboration, and the quality of formative assessment. However, its implementation still faces several challenges, including limited infrastructure, inadequate digital and pedagogical competence among teachers, limited access to professional development, and uneven institutional readiness. In addition, structural challenges related to curriculum alignment, madrasah administrative systems, and the integration of Islamic educational values also influence the effectiveness of deep learning implementation. This study concludes that deep learning should not only be understood as a pedagogical innovation, but also as a systemic transformation that requires policy support, teacher capacity building, institutional readiness, and the development of a contextual, ethical, and sustainable learning ecosystem within Islamic Elementary Schools. The findings provide both theoretical and practical contributions to the development of technology-based learning and the transformation of Islamic education in the era of the Merdeka Curriculum.

Keywords: Deep Learning Literacy; Teaching Quality; Independent Curriculum; Islamic Elementary Schools.

Abstrak

Penelitian ini mengkaji urgensi penerapan model pembelajaran mendalam (deep learning) untuk meningkatkan kualitas pembelajaran dalam kerangka Kurikulum Merdeka di Sekolah Dasar Islam. Penelitian menggunakan desain studi kasus multisitus dengan pendekatan kualitatif yang dilaksanakan di tiga Sekolah Dasar Islam di Kecamatan Cipondoh, Kota Tangerang. Informan

penelitian berjumlah 25 orang yang terdiri atas guru, kepala sekolah, siswa, orang tua, dan perwakilan masyarakat. Data dikumpulkan melalui wawancara mendalam, observasi kelas, dan analisis dokumen, kemudian dianalisis menggunakan analisis tematik dan analisis lintas kasus untuk mengidentifikasi persamaan dan perbedaan implementasi antar lokasi penelitian. Hasil penelitian menunjukkan bahwa implementasi pembelajaran mendalam dipandang penting dalam mendukung pembelajaran adaptif, diferensiatif, dan berpusat pada peserta didik sesuai prinsip Kurikulum Merdeka. Guru menilai pendekatan ini mampu meningkatkan keterlibatan siswa, kemampuan berpikir kritis, kolaborasi, dan kualitas asesmen formatif. Namun demikian, implementasinya masih menghadapi berbagai tantangan, seperti keterbatasan infrastruktur, rendahnya kompetensi digital dan pedagogis guru, minimnya akses terhadap pengembangan profesional, serta kesiapan kelembagaan yang belum merata. Selain itu, tantangan struktural terkait penyelarasan kurikulum, sistem administrasi madrasah, dan integrasi nilai-nilai pendidikan Islam juga memengaruhi efektivitas penerapan pembelajaran mendalam. Penelitian ini menyimpulkan bahwa pembelajaran mendalam tidak hanya dipahami sebagai inovasi pedagogis, tetapi juga sebagai transformasi sistemik yang memerlukan dukungan kebijakan, penguatan kapasitas guru, kesiapan institusi, dan pengembangan ekosistem pembelajaran yang kontekstual, etis, serta berkelanjutan di lingkungan Sekolah Dasar Islam. Temuan penelitian ini memberikan kontribusi teoritis dan praktis bagi pengembangan pembelajaran berbasis teknologi dan transformasi pendidikan Islam pada era Kurikulum Merdeka.

Kata kunci: Pembelajaran Deep Learning; Mutu Pendidikan; Kurikulum Merdeka; MI.

INTRODUCTION

The rapid advancement of digital transformation in education over the past decade has significantly reshaped instructional practices, particularly through the emergence of deep learning approaches that emphasize meaningful understanding, critical thinking, and reflective learning processes in classroom instruction. In the context of this study, the term “deep learning” does not refer to artificial intelligence (AI)-based computational models, but rather to pedagogical approaches that encourage students to develop comprehensive understanding and higher-order thinking skills. Global studies indicate that the integration of AI in education can enhance personalized learning, improve assessment accuracy, and support data-driven pedagogical decision-making (Ahmad et al., 2023; Sajja et al., 2025). However, most AI-based implementations remain concentrated in secondary and higher education contexts, while primary education—especially within Islamic elementary schools—has received comparatively limited scholarly attention (Muslim, 2024; Rohman et al., 2025). In Indonesia, the Merdeka Curriculum was introduced to promote differentiated instruction, strengthen literacy and numeracy competencies, and foster the development of the Pancasila Student Profile (Hakim et al., 2024). Conceptually, this curriculum emphasizes student-

centered learning and continuous formative assessment (Ma et al., 2023; Bhardwaj et al., 2025). Nevertheless, various policy evaluations reveal a gap between curriculum design and classroom implementation, particularly concerning teacher readiness, technology integration, and the effective use of learning data to improve instructional quality (Abedi, 2024; OECD, 2019; World Bank, 2020). Within Islamic Elementary Schools institutions, these challenges are further compounded by the need to harmonize national curriculum standards with Islamic educational values (Bakar et al., 2024; Jailani et al., 2025).

From a theoretical standpoint, the quality of learning is shaped by the interaction between pedagogical strategies, teacher competence, and data-informed instructional systems (Zheng & Li 2025; Saar et al., 2022). Yet, efforts to enhance learning quality at the Islamic Elementary Schools level tend to remain administrative rather than analytically driven (Alfoudari et al., 2023; Chang et al., 2023). This creates a conceptual disconnect: while the Merdeka Curriculum advocates adaptive and reflective learning environments, systematic support through deep learning-based analytics capable of comprehensively examining student learning patterns has not been extensively explored in the madrasah context (Hidayat, 2025; Parasti & Murwaningsih, 2025).

Research on educational innovation demonstrates that deep learning-oriented instructional models play an important role in improving students' conceptual understanding, critical thinking skills, collaborative learning, and reflective learning experiences (Chen et al., 2020; Bressane et al., 2024). In the context of primary education, particularly in Islamic Elementary Schools, the implementation of deep learning is considered important because it encourages students not only to memorize concepts, but also to understand, interpret, and apply knowledge meaningfully in everyday life. Previous studies indicate that deep learning approaches can strengthen literacy and numeracy competencies, increase student engagement, and foster higher-order thinking skills through student-centered and inquiry-based learning activities (Bang et al., 2023; Moltuda et al., 2022). Furthermore, within Islamic educational settings, deep learning models are viewed as relevant for integrating cognitive, affective, and spiritual dimensions of learning, thereby supporting the development of students' character and values alongside academic achievement (Ahmad et al., 2025; Turós et al., 2025).

Research on artificial intelligence in education demonstrates that deep learning algorithms can predict student performance, detect early signs of learning difficulties, and recommend targeted interventions (Chen et al., 2020; Bressane et al., 2024). Moreover,

Zawacki-Richter et al. (2019) highlight the significant potential of AI in enabling personalized learning environments, although the majority of empirical investigations focus on higher education settings.

At the primary education level, several studies have examined adaptive learning systems powered by machine learning to support early literacy and numeracy development (Bang et al., 2023; Moltuda et al., 2022). However, such research has predominantly been conducted in technologically advanced countries with robust digital infrastructures (Mhlanga & Ndhlovu, 2023; Thompson & Rust, 2023). Empirical studies addressing educational innovation and deep learning implementation within faith-based educational systems, such as Islamic elementary schools, remain scarce (Ahmad et al., 2025; Turós et al., 2025). In Indonesia, research related to the Merdeka Curriculum has largely centered on teacher preparedness and policy implementation rather than on the utilization of deep learning-oriented instruction as a strategic instrument for improving learning quality (Fitrah et al., 2025; Kusumawati et al., 2025).

The novelty of this study lies in its effort to conceptualize deep learning models as analytical frameworks that support the implementation of the Merdeka Curriculum in Islamic Elementary Schools. Rather than positioning deep learning merely as a technological tool, this research frames it as a pedagogical decision-support system aligned with differentiated instruction principles and Islamic educational values. This integrative approach contributes to bridging the gap between AI-driven analytics, instructional quality improvement, and the distinctive characteristics of madrasah education. This study aims to analyze the urgency of implementing deep learning models to enhance the quality of learning within the Merdeka Curriculum framework at Islamic Elementary Schools, and to propose a conceptual integration model that aligns learning analytics technologies with Islamic educational principles and 21st-century learning demands.

The central argument of this study is that the successful implementation of the Merdeka Curriculum in Islamic Elementary Schools depends not only on pedagogical transformation but also on the availability of data-driven systems capable of sustaining adaptive learning practices. Deep learning models offer analytical mechanisms that can identify individual learning needs, thereby strengthening differentiated instruction and improving formative assessment quality. This research is significant both theoretically and practically. Theoretically, it contributes to the limited body of literature on AI integration in faith-based primary education. Practically, it provides insights for policymakers, school leaders, and

teachers in designing data-informed strategies to enhance learning quality within the distinctive context of Islamic elementary education.

RESEARCH METHOD

This study employed a qualitative approach with a multi-site case study design to examine the urgency of implementing deep learning models in improving the quality of learning within the Merdeka Curriculum at Islamic Elementary Schools. A case study approach was selected because it enables an in-depth and contextual exploration of contemporary educational phenomena within real-life settings (Yin, 2018). Through this design, the study sought to capture the perspectives, experiences, and contextual realities of various stakeholders regarding the integration of artificial intelligence-based systems into primary education. The research was conceptually grounded in the framework of data-informed decision making in education (Ifenthaler & Yau, 2020) and broader discussions on digital transformation in educational policy (OECD, 2021).

The research was conducted in four Islamic Elementary Schools located in Cipondoh District, Tangerang City, Banten Province, Indonesia. The selection of these schools was based on purposive sampling, taking into account differences in accreditation status, technological readiness, and institutional characteristics (public and private madrasahs). The study was carried out over a three-month period, from November 2025 to January 2026. This timeframe included the preparation of research instruments, field data collection, data analysis, and validation of findings.

The participants consisted of 25 informants representing multiple stakeholder groups, including eight teachers, four school principals, five students, four parents, and four community representatives or school committee members. Informants were selected using purposive and snowball sampling techniques to ensure that individuals with relevant knowledge and experience related to the implementation of the Merdeka Curriculum and educational technology integration were adequately represented (Creswell & Poth, 2021). This diversity of participants enabled the study to capture a comprehensive understanding of institutional readiness, pedagogical needs, and community expectations.

Data were collected through in-depth semi-structured interviews, participant observation, and document analysis. The interviews explored participants' perceptions of learning quality, challenges in implementing the Merdeka Curriculum, and readiness to integrate deep learning-based systems into instructional practices. All interviews were audio-

recorded and transcribed verbatim for analysis. Classroom observations were conducted to examine differentiated instructional strategies, technology use in assessment, and patterns of teacher–student interaction. In addition, relevant documents such as teaching modules, learning plans, student assessment records, and school policies on digital learning were analyzed to triangulate findings and strengthen contextual interpretation.

Data analysis was conducted using thematic analysis, following the interactive model proposed by Miles et al., (2020). The analytical process involved data reduction, coding, theme development, and conclusion drawing in an iterative manner. In addition, a cross-case analysis was conducted to compare patterns across the research sites in order to identify similarities, differences, and contextual variations in the implementation of deep learning models within Islamic Elementary Schools. This approach enabled the researchers to examine how institutional readiness, pedagogical practices, and policy support influenced the implementation process across different locations. To ensure credibility and trustworthiness, the study employed source triangulation, methodological triangulation, member checking, and audit trail documentation. This analytical strategy aligns with contemporary research standards in technology-enhanced education, which emphasize methodological rigor and validity (Bond et al., 2021).

Operationally, the study examined the urgency of implementing deep learning models through three interrelated dimensions: system readiness, pedagogical needs, and policy support (Fullan et al., 2018; Darling-Hammond et al., 2020). System readiness encompassed the availability of digital infrastructure and teachers’ technological competence. Pedagogical needs referred to the demand for differentiated instruction and formative assessment practices aligned with the Merdeka Curriculum. Policy support included institutional and regulatory alignment with curriculum implementation in the madrasah context. The analysis mapped the gap between existing conditions and ideal standards derived from current literature on artificial intelligence in education (Holmes et al., 2022; Chen et al., 2020). Ethical considerations were strictly observed throughout the study. Informed consent was obtained from all participants, confidentiality and anonymity were guaranteed, and all collected data were used solely for academic purposes. These procedures were guided by internationally recognized ethical standards for educational research (McCulloch, 2021).

RESULT AND DISCUSSION

Result

Overview of Research Context

The findings of this study were derived from classroom observations, in-depth interviews with 25 informants, and document analysis conducted across four Islamic Elementary Schools in Cipondoh District, Tangerang City. The results are presented based on three key pieces of evidence that demonstrate the urgency of implementing deep learning models to support learning quality within the Merdeka Curriculum framework.

Diverse Perspectives from Teachers and Parents

The interview results revealed diverse perspectives regarding the use of deep learning-based technology in instructional practices. Several teachers expressed that AI-based analytical systems have the potential to assist in mapping students' abilities more accurately, particularly in implementing differentiated instruction, which is a core characteristic of the Merdeka Curriculum. Teachers with stronger digital literacy skills tended to view technology as a supportive tool for simplifying formative assessment and identifying individual learning needs.

However, other teachers expressed concerns about infrastructure readiness and technical competence. They argued that without adequate training, the implementation of deep learning-based systems might increase administrative burdens rather than enhance instructional effectiveness. Classroom observations indicated that differentiated instruction was still conducted manually and had not yet been supported by systematic data analysis.

From the parents' perspective, perceptions were similarly varied. Some parents supported digital innovation, believing that it could improve learning quality and better prepare students for 21st-century challenges. Conversely, others expressed concerns regarding potential technology dependency, excessive screen exposure, and student data security. Documentation from school committee meetings confirmed that data protection and system transparency were primary concerns within the community.

These findings indicate that acceptance of deep learning integration remains in a transitional phase, where normative support exists but practical readiness is uneven across stakeholders.

Limited Access to Teacher Professional Development

Interviews with school principals and teachers revealed that professional development related to educational technology remains general in nature and does not

specifically address learning analytics or deep learning model implementation. Most training sessions received by teachers focused primarily on administrative aspects of the Merdeka Curriculum, such as preparing teaching modules and learning outcome frameworks.

Documentation of teacher professional development programs during the three-month research period showed no specific training agenda related to artificial intelligence or data-driven learning analysis. Teachers reported that their understanding of AI was largely self-acquired through social media, independent webinars, or informal professional networks rather than through structured institutional programs.

Observations further indicated that classroom technology use was limited to digital presentations and basic learning platforms. No system capable of automatically analyzing student performance or providing adaptive learning recommendations was identified. This reinforces the finding that limited access to specialized training constitutes a significant barrier to data-driven instructional transformation.

Therefore, the urgency of implementing deep learning models lies not only in technological availability but also in strengthening teachers' competencies as primary actors in curriculum implementation.

Challenges in Integration with the Curriculum and Madrasah System

Challenges in Integration with the Curriculum and Madrasah System The study also identified structural challenges in integrating deep learning models within the Merdeka Curriculum system at Islamic Elementary Schools. School principals reported that administrative and reporting systems remain aligned with regulations established by the Ministry of Religious Affairs. Consequently, technological innovation must adapt to standardized reporting formats that may not yet accommodate deep learning-based analytics.

Furthermore, the integration of Islamic values within instructional practices represents a distinctive characteristic of Islamic Elementary Schools. Teachers emphasized that AI-based systems must align with character education and moral development objectives rather than focusing solely on academic achievement. Curriculum documentation revealed that the Pancasila Student Profile and religious character development are implemented simultaneously, requiring any analytical system to accommodate both cognitive and character-based assessment dimensions.

Observations of Project Penguatan Profil Pelajar Pancasila (P5) practices across the research sites revealed both similarities and contextual differences in the implementation of deep learning-oriented instruction (Darling-Hammond et al., 2020; Bond et al., 2021).

In Islamic Elementary Schools A, project-based learning activities were more systematically integrated into classroom instruction, with teachers emphasizing collaborative discussion, reflective learning, and contextual problem-solving (Guo et al., 2020). Assessment practices in this site combined descriptive evaluation with portfolio-based documentation to capture students' cognitive and character development (Fraile et al., 2020). In contrast, Islamic Elementary Schools B demonstrated more conventional implementation patterns, where project activities were conducted periodically and assessment practices remained predominantly qualitative and descriptive without systematic documentation of learning progress. Meanwhile, Islamic Elementary Schools C showed stronger integration of Islamic values within project activities, particularly through reflective and character-based learning tasks, although technological and administrative limitations constrained the broader implementation of data-driven learning evaluation (Jailani et al., 2025).

Across all sites, a common challenge emerged regarding the adaptation of deep learning-oriented assessment systems to evaluate indicators of character development, collaboration, and social competence, which are often difficult to measure quantitatively (Darling-Hammond et al., 2020; Bond et al., 2021). The cross-case analysis further demonstrated that differences in institutional readiness, teacher competence, infrastructure availability, and leadership support significantly influenced the effectiveness of implementation at each madrasah (Ridder et al., 2021).

Overall, these findings demonstrate that the urgency of implementing deep learning models in Islamic Elementary Schools extends beyond technical considerations. It requires an integrative design aligned with curriculum characteristics, madrasah regulatory frameworks, and Islamic educational values.

Table 1. Finding Research

No	Focus of Findings	Data Source	Summary of Findings	Implications for the Urgency of Deep Learning
1	Teachers' Perspectives on Deep Learning	Teacher Interviews, Classroom Observations	Teachers with strong digital literacy support the use of AI for differentiated instruction and formative assessment. However, some teachers feel technically unprepared and are concerned about increased administrative workload.	A deep learning system must be simple, adaptive, and supported by technical training to avoid increasing teachers' workload.

2	Parents' Perceptions	Parent Interviews, School Committee Documentation	Parents are divided between supporting digital innovation and worrying about screen exposure and student data security.	Implementation of deep learning must include system transparency, data protection, and parent socialization.
3	Differentiated Instruction Practices	Classroom Observations	Differentiated instruction is still conducted manually without data-driven analytical support.	Deep learning models have the potential to systematically and in real-time map students' abilities.
4	Access to Teacher Professional Development	Teacher & Principal Interviews, Program Documentation	Available training focuses mainly on administrative aspects of the Merdeka Curriculum and does not address AI or learning analytics.	Strengthening teachers' capacity is a key prerequisite before implementing deep learning systems.
5	Technology Use in Classrooms	Observations	Technology use is limited to digital presentations and basic learning platforms; no automated analytical system is in place.	There is a gap between the adaptive curriculum demands and the availability of data-driven support systems.
6	Integration with the Madrasah System	Principal Interviews, Regulatory Documentation	Reporting systems still follow Ministry of Religious Affairs regulations that do not yet accommodate AI-based analytics.	An integrative design aligned with madrasah regulations and national reporting systems is required.
7	Integration of Islamic Values and Character Education	Teacher Interviews, Curriculum Analysis	Instruction emphasizes a balance between academic achievement and religious character development. AI systems must be able to capture non-cognitive indicators.	Deep learning models need to be developed using a multidimensional approach (cognitive and character-based).

8	Project-Based Assessment (P5)	Observations & Documentation	Assessment practices are descriptive and qualitative rather than analytically structured.	Algorithms must be adapted to process qualitative data and students' character development indicators.
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Collectively, the findings highlight the pressing need to design contextual, inclusive, and needs-based deep learning models capable of functioning as pedagogical decision-support systems within the implementation of the Merdeka Curriculum in Islamic Elementary Schools.

Discussion

This discussion elaborates on the research findings by engaging them in dialogue with recent scholarly literature on deep learning-oriented instruction, learning quality, and curriculum transformation within digitally evolving educational systems. The discussion integrates theories of student-centered learning, meaningful learning experiences, and reflective pedagogy to explain how deep learning models contribute to improving instructional quality in Madrasah Ibtidaiyah. The findings confirm previous studies showing that deep learning-oriented approaches can strengthen critical thinking, collaborative learning, student engagement, and contextual understanding within the Merdeka Curriculum framework. However, this study also demonstrates that the implementation of deep learning in Islamic elementary schools is strongly influenced by institutional readiness, curriculum adaptation, leadership support, and the integration of Islamic educational values, aspects that have received limited attention in previous studies on technology-based learning.

Furthermore, this study contributes a cross-case analysis that highlights contextual differences among madrasahs in implementing deep learning-oriented instruction. The synthesis of findings indicates that successful implementation cannot rely solely on technological innovation or pedagogical reform, but also requires alignment between curriculum policy, institutional culture, teacher competence, and faith-based educational values. Therefore, the novelty of this study lies in its integrative analytical framework that combines deep learning pedagogy, curriculum transformation, and Islamic educational contexts within a multi-site research design. Scientifically, this research provides empirical contributions to technology-based learning studies by emphasizing that deep learning implementation in Islamic elementary education should be understood not only as a technical

transformation, but also as a pedagogical and cultural transformation aimed at improving learning quality.

Diverse Perspectives from Teachers and Parents

The findings reveal a spectrum of responses toward the implementation of deep learning models in Islamic Elementary Schools. Teachers with stronger digital competencies tend to perceive AI-based systems as supportive tools for differentiated instruction and formative assessment (Zhang & Zhang, 2024; Hg, et al., 2023). This aligns with Chen et al., (2020), who argue that AI-driven predictive analytics can enhance the accuracy of student performance mapping. Similarly, Holmes et al., (2022) emphasize that artificial intelligence can meaningfully contribute to personalized learning when positioned as a pedagogical decision-support system rather than merely an automation mechanism.

At the same time, concerns expressed by some teachers regarding increased administrative workload and insufficient technical readiness highlight that technological adoption extends beyond innovation- it requires systemic preparedness (Wong, et al., 2025; Almusawi & Durugbo, 2024). Bond et al. (2021) note that resistance to educational technology frequently emerges from limited institutional support and inadequate professional preparation. The present findings therefore illustrate a gap between the theoretical promise of AI and the practical realities of primary faith-based education (Papakostas, 2025; Khondoker & An, 2025).

Parental perspectives further reinforce this complexity. While some parents recognize the potential of digital innovation to enhance learning quality and future readiness, others express concerns related to data privacy and psychosocial impacts (Meng, et al., 2025; Nurhayati, et al., 2025). Current discourse on AI ethics in education underscores the importance of transparency, accountability, and robust data governance frameworks (Holmes et al., 2022; Tabaghdehi, et al., 2025). OECD (2021) similarly cautions that digital transformation must be accompanied by regulatory safeguards that ensure equity and security. Thus, community acceptance of deep learning systems depends heavily on trust and clear institutional governance (Buhmann & Fieseler, 2023; Robles & Mallinson, 2025).

From a theoretical standpoint, these dynamics can be interpreted through the lens of the Technology Acceptance Model, which posits that perceived usefulness and perceived ease of use significantly influence technology adoption (Scherer et al., 2021; Rahimi & Oh, 2025). The findings suggest that the urgency of implementing deep learning models must be accompanied by systematic digital literacy enhancement and transparent

communication strategies for all stakeholders (Singun, 2025; Arnaud, et al., 2025).

Limited Access to Teacher Professional Development

The limited availability of specialized training in learning analytics and deep learning indicates that digital transformation within the Merdeka Curriculum has not yet fully addressed teachers' technical capacities. Darling-Hammond et al., (2020) argue that instructional quality is fundamentally linked to sustained, practice-oriented professional development. Without targeted training, technological innovation is unlikely to translate into meaningful pedagogical improvement.

Ifenthaler and Yau (2020) emphasize that effective data-informed decision making requires educators to possess analytical competencies that enable them to interpret and act upon student data. The findings from Islamic Elementary Schools in Cipondoh District reveal that teachers remain primarily at the level of basic technology usage, limiting the operationalization of deep learning systems in instructional practice. This reflects a capacity gap between the adaptive demands of the Merdeka Curriculum and existing human resource readiness.

Recent research in *Computers & Education* further highlights that successful AI integration depends on collaborative, hands-on professional development models that empower teachers as co-designers of technological innovation (Ding et al., 2024). Without such structural support, AI initiatives risk becoming symbolic reforms rather than transformative practices. Consequently, the urgency of implementing deep learning models should be understood as inseparable from strategic investment in teacher capacity building. Technological transformation without parallel professional transformation is unlikely to produce sustainable improvements in learning quality.

Challenges in Integrating with the Curriculum and Madrasah System

The findings also point to structural challenges in aligning deep learning systems with the Merdeka Curriculum and the regulatory framework of madrasahs. Although the Merdeka Curriculum emphasizes differentiated learning and formative assessment, existing reporting systems remain predominantly administrative. OECD (2021) stresses that curriculum reform must be supported by aligned evaluation and accountability systems to ensure effective transformation.

Moreover, the distinctive nature of Islamic Elementary Schools, which integrate religious values and character education into instructional practices, demands a multidimensional approach to AI design. Holmes et al., (2022) caution that AI systems

should not be confined to cognitive performance metrics but must also consider social, ethical, and character dimensions of education. This becomes particularly relevant when character assessment remains largely qualitative and descriptive.

Zawacki-Richter et al. (2019) observe that most AI systems in education are designed for higher education contexts and rely heavily on large-scale quantitative data. Adapting such systems to the madrasah context requires algorithmic innovation capable of processing qualitative indicators of character development and social competence. Theoretically, these findings suggest that implementing deep learning in Islamic Elementary Schools is not merely a matter of technological adoption but involves systemic reconstruction toward contextualized, data-informed learning ecosystems. Effective integration requires alignment among policy frameworks, curriculum objectives, Islamic educational values, and adaptive analytical system design.

CONSLUSION

The findings of this study indicate that the implementation of deep learning models in Islamic Elementary Schools is a strategic necessity in supporting the Merdeka Curriculum, which emphasizes adaptive and differentiated learning. Although some teachers and parents recognize the potential of deep learning approaches to improve assessment practices and map students' abilities more accurately, there are still concerns related to infrastructure readiness, teacher competence, and the compatibility of learning systems with the characteristics of Islamic elementary education. These findings show that the acceptance of deep learning implementation is influenced not only by its pedagogical benefits, but also by institutional readiness, stakeholder trust, and the compatibility of innovation with Islamic educational values. In this context, the study offers novelty by positioning deep learning implementation not merely as a pedagogical innovation, but as an integrative transformation that includes curriculum adaptation, institutional culture, and faith-based educational contexts in Islamic Elementary Schools.

Theoretically and practically, this study emphasizes that the implementation of deep learning should be understood not only as a technical or instructional reform, but also as a sustainable pedagogical and cultural transformation toward a contextual learning ecosystem within Islamic Elementary Schools.

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