Paidea :
Jurnal Pendidikan dan Pembelajaran Indonesia
2026, 6(1), 23-35
https://doi.org/10.56393/paidea.v6i1.4705

Teachers' Methods and Challenges in Implementing Deep Learning in Senior Secondary Education: A Scoping Review

Widya Ningsih [1*], Arrafa Nayla Alfaithy [1], Ahmad Hamka [1], Udin Supriyadi [1], Indah Sari [1]
[1] Universitas Pendidikan Indonesia, Indonesia
* Author Correspondence

Article History
Received: 4 August 2026;
Revised : 20 October 2026;
Accepted: 22 November 2026.

Keywords
Teacher Challenges;
Deep Learning;
Scoping Review;
Joyful Learning;
Merdeka Curriculum.

Abstract
The enactment of Ministerial Regulation of Education, Culture, Research, and Technology (Permendikbudristek) No. 12 of 2024 and Ministerial Regulation of Primary and Secondary Education (Permendikdasmen) No. 13 of 2025 provides an essential regulatory foundation for implementing deep learning within Indonesia's Merdeka Curriculum framework. This study aims to explore the implementation processes, educational impacts, and challenges associated with the adoption of deep learning at the senior secondary education level, encompassing Senior High Schools (SMA), Vocational High Schools (SMK), and Islamic Senior High Schools (MA). Employing a scoping review methodology, this study systematically maps the scope and characteristics of existing evidence on this emerging educational approach, identifies research gaps, and synthesizes findings from studies employing diverse methodological designs. The results indicate three prominent findings. First, the Mindful, Meaningful, and Joyful (MMJ) learning principles constitute the most frequently reported pedagogical approach adopted by teachers in implementing deep learning. Second, the implementation of deep learning demonstrates positive contributions to students' cognitive and affective development, particularly in supporting meaningful learning experiences and enhancing learning engagement. Third, the Merdeka Curriculum serves as a critical regulatory and pedagogical framework that facilitates the integration of deep learning into classroom practices. Overall, these findings highlight the potential of deep learning to strengthen the quality of secondary education in Indonesia, while emphasizing the importance of institutional support, teacher readiness, and consistent pedagogical implementation to ensure its effective and sustainable adoption.

Contact : Corresponding author e-mail: raffacaniago23@upi.edu
How to Cite : Ningsih, W., Alfaithy, A. N., Hamka, A., Supriadi , U., & Sari, I. (2026). Teachers' Methods and Challenges in Implementing Deep Learning in Senior Secondary Education: A Scoping Review. *Paidea : Jurnal Pendidikan Dan Pembelajaran Indonesia*, *6*(1), 23–35. https://doi.org/10.56393/paidea.v6i1.4705

This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License. Allows readers to read, download, copy, distribute, print, search, or link to the full texts of its articles and allow readers to use them for any other lawful purpose. The journal hold the copyright.

Introduction

The transformation of the 21st-century global educational landscape demands a fundamental shift from rote-memorization paradigms toward deeper, more reflective, and contextualized understanding (Syaifulloh, 2026). Within this framework, the concept of pedagogical Deep Learning (DL) has emerged as a systematic response to the limitations of traditional instructional models in equipping students with critical thinking, creativity, collaboration, and communication skills required in the Society 5.0 era. Fullan et al. (2018) define DL as a learning process that fosters deep understanding through six global competencies: character, citizenship, collaboration, communication, creativity, and critical thinking. It collectively known as the 6Cs. In Indonesia, this momentum was formalized through Permendikbudristek No. 12 of 2024, which officially adopted pedagogical DL as a core approach within the Merdeka Curriculum, emphasizing three operational principles: *mindful*, *meaningful*, and *joyful* learning, hereafter referred to as the MMJ principles (Chotimah et al., 2025). This policy positions Indonesia as a developing nation actively adapting DL frameworks from advanced education systems, particularly Australia and Finland, to fit its unique and diverse educational context (Suwandi et al., 2024). The urgency of this transformation is underscored by Teacher Competency Test (UKG) data indicating that approximately 81% of Indonesian teachers have yet to meet the minimum competency threshold, with an average score of only 62.7 at the senior high school level, signaling a substantial pedagogical capacity gap in welcoming DL implementation (Nasrullah & Rahmanto, 2026). This condition underscores that adopting DL policies without a comprehensive understanding of field-level implementation strategies risks creating a disconnect between normative policy aspirations and actual classroom realities.

Senior secondary education encompassing General Senior High Schools (SMA), Vocational High Schools (SMK), and Islamic Senior High Schools (MA). It serves as a critical arena for DL implementation given its transitional role between basic education and higher education or the workforce. At this level, deep, competency-based learning is an urgent necessity to cultivate students capable of critical thinking, complex problem-solving, and flexible adaptation in rapidly changing environments. However, empirical realities reveal a contrasting picture. Nasrullah and Rahmanto (2026) and Serena et al. (2026) identify that DL implementation in Indonesian schools continues to face substantial barriers, including low teacher digital literacy, uneven infrastructure distribution, and weak institutional change management. More concerningly, Rahayu (as cited in Nasrullah & Rahmanto, 2026) found that many teachers still misconceive DL as a new curriculum rather than a pedagogical approach designed to transform classroom learning and interaction. This conceptual misconception directly impedes optimal DL execution at the SMA/SMK/MA level, where teachers require the deepest understanding to design mindful, meaningful, and joyful learning experiences. Existing

studies corroborate these findings by identifying teachers' pedagogical readiness, resource constraints, and resistance to change as primary obstacles hindering effective DL adoption in secondary schools. In the SMK context, these challenges are compounded by the need to align DL with specific vocational competencies, whereas in *pesantren*-based MA schools, spiritual dimensions and local wisdom must also be integrated when designing contextualized DL strategies.

Despite rapidly expanding academic discourse on pedagogical DL in Indonesia, significant research gaps persist within the existing body of literature. First, prior studies are largely fragmented, focusing on single subjects, individual schools, or isolated strategies, leaving no comprehensive evidence map of DL strategy variations across subject clusters at the SMA/SMK/MA level. Sadrah Mesak Manik et al. (2025) note that cross-national comparative studies require systematic implementation mapping, which remains unavailable for the Indonesian context. Second, teacher barriers to implementing DL have yet to be classified into a structured taxonomy distinguishing internal, structural, and policy-related obstacles. A classification vital for designing targeted interventions. Third, enabling factors (enablers) for successful DL execution in SMA/SMK/MA settings have not been systematically synthesized, despite their critical utility for policymakers and teacher professional development programs. Furthermore, most existing reviews fail to clearly distinguish between the cognitive and affective impacts of DL on students, limiting the specificity of practical implications for educators. These gaps create a knowledge void that directly constrains stakeholders, ranging from teachers and school principals to curriculum developers and policymakers, in optimizing sustainable DL implementation across Indonesian senior secondary schools (Tri Ariqoh Kholisah et al., 2025).

Building upon these gaps, this study aims to address this void through a systematic and comprehensive scoping review. A scoping review was selected due to its distinct capacity to map the breadth and nature of evidence on an emerging topic, identify research gaps, and synthesize findings across diverse study designs without restricting inclusion to a single methodology (Arksey & O'Malley, 2005). Specifically, this study addresses three research questions: (1) what are the characteristics and variations of Deep Learning implementation strategies at the senior secondary education level based on scientific literature mapping? (2) what are the primary barriers faced by teachers, and what are their implications for student learning outcomes and quality in Deep Learning implementation? (3) what enabling factors serve as key drivers for optimizing Deep Learning execution in senior secondary schools?

The novelty of this study lies in three core contributions: first, it provides the first cross-study synthesis specifically focused on DL implementation in Indonesian SMA/SMK/MA institutions covering the period 2020–2026; second, it develops a three-tier taxonomy of DL barriers (internal, structural, and policy-related) to serve as an

evidence-based reference for targeted interventions; and third, it maps enabling factors that can be directly translated into policy recommendations for Continuous Professional Development (PKB) for teachers in the Merdeka Curriculum era. Consequently, this study moves beyond mere phenomenon description to establish an empirical foundation necessary for accelerating pedagogical transformation in Indonesian senior secondary education.

Method

This study employed a scoping review methodology to map the extent, nature, and characteristics of available evidence concerning the implementation of deep learning (DL) in Indonesian senior secondary education, encompassing Senior High Schools (SMA), Vocational High Schools (SMK), and Islamic Senior High Schools (MA). This approach was selected because it enables the systematic exploration of emerging research areas, identification of knowledge gaps, and synthesis of findings from diverse research designs without imposing restrictions based on methodological approaches. The review was guided by the five-stage framework proposed by Arksey and O'Malley (2005), comprising (1) identifying the research questions, (2) identifying relevant studies, (3) selecting studies, (4) charting the data, and (5) collating, summarizing, and reporting the results. The methodological process was further informed by the updated guidance of Peters et al. (2020), particularly regarding the development of an a priori protocol, standardized data charting procedures, and consistency in study selection and evidence synthesis. In accordance with the inclusive nature of scoping reviews, formal critical appraisal of individual studies was not undertaken, as the primary objective was to map the available evidence rather than assess the effectiveness or methodological quality of individual interventions. Reporting transparency was maintained by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines developed by Tricco et al. (2018). Eligibility criteria were established to guide the selection process, as presented in Table 1, covering document type, publication period (2020–2026), indexing status (SINTA 1–5 and/or Scopus), language (Indonesian or English), educational context (SMA/SMK/MA in Indonesia), and full-text accessibility. Only peer-reviewed journal articles, including empirical studies, literature reviews, case studies, classroom action research, and community service studies, were considered eligible. Textbooks, technical reports, unpublished theses and dissertations, conference proceedings, publications outside the specified period, studies conducted beyond the target educational context, and articles without accessible full texts were excluded. Data were extracted using a structured charting approach and analyzed through descriptive numerical mapping and thematic synthesis, involving data reduction, categorization, and interpretation of recurring patterns. The synthesis focused on identifying implementation strategies, educational impacts, and challenges associated with deep learning in Indonesian senior secondary education. This methodological approach provides a transparent and systematic evidence

map to identify research trends, knowledge gaps, and implications for evidence-informed pedagogical practices.

Results and Discussion

Results

Literature searches conducted using *Publish or Perish* and *Scopus AI* with topic-relevant keywords yielded an initial pool of 400 articles. After removing 2 duplicates, 398 unique records remained for screening. Following curation based on the predefined eligibility criteria, 27 journal articles met all inclusion requirements and were included in the final synthesis, as summarized in Table 2.

Table 2. Data Curation Results Based on Established Criteria ($n = 27$)

Category / Characteristic	Frequency (n)	Percentage (%)
Publication Year		
Published in 2025–2026	24	88.9%
Published in 2024	3	11.1%
Study Design		
Qualitative design	8	29.6%
Community Service (PkM)	7	25.9%
Quantitative experimental design	4	14.8%
Classroom Action Research (PTK/CAR)	4	14.8%
Review / SLR / Meta-analysis	2	7.4%
Survey and evaluation design	2	7.4%

As shown in Table 2, 88.9% of the included articles ($n = 24$) were published between 2025 and 2026, indicating that DL implementation in SMA/SMK/MA institutions is a highly active and contemporary academic discourse. Only 3 articles (11.1%) were published in 2024, reflecting the surge in scholarly output following the enactment of Permendikbudristek No. 12 of 2024 establishing the Merdeka Curriculum as the national curriculum. Methodologically, qualitative designs predominated with 8 articles (29.6%), followed by Community Service (PkM) reports with 7 articles (25.9%), quantitative experimental studies with 4 articles (14.8%), Classroom Action Research (PTK/CAR) with 4 articles (14.8%), review/SLR/meta-analyses with 2 articles (7.4%), and survey/evaluation studies with 2 articles (7.4%). The predominance of qualitative and PkM designs reflects that field-level DL implementation remains largely in an exploratory and teacher capacity-building phase, with relatively limited large-scale empirical evidence regarding student learning outcomes.

Variations in deep learning instructional strategies. Mapping the 27 articles identified eight distinct DL implementation strategies across Indonesian SMA/SMK/MA institutions. The frequency distribution of these strategies is presented in Table 3.

Table 3. Distribution of Deep Learning Strategies/Models ($n = 27$)

Deep Learning Strategy/Model	Frequency (n)	Percentage (%)
MMJ (Mindful-Meaningful-Joyful)	7	25.9%
PjBL (Project-Based Learning)	4	14.8%
AI/Technology-based DL	4	14.8%
PBL (Problem-Based Learning)	3	11.1%
HOTS-PISA Assessment	2	7.4%
ADLX, Differentiated DL, DL-Guidance & Counseling (DL-BK) (each)	1 (each)	3.7% (each)

Table 3 demonstrates that the Mindful-Meaningful-Joyful Learning (MMJ) approach is the most dominant strategy, appearing in 7 studies (25.9%). MMJ represents the three core principles established by the Ministry of Primary and Secondary Education as the operational foundation of DL within the Merdeka Curriculum. The application of MMJ aligns closely with the dimensions of the *Profil Pelajar Pancasila* (Pancasila Student Profile), which prioritizes student-centered, flexible, and contextualized learning (Fathurrohim et al., 2026; Hardiyanti et al., 2026). This strategy has been implemented across diverse subjects—from Economics and Visual Arts to Islamic Religious Education (PAI)—highlighting its cross-disciplinary applicability. Specifically in PAI, MMJ serves as an alternative to traditional rote memorization, facilitating deeper value internalization among students (Wafa et al., 2025).

Project-Based Learning (PjBL) ranked second with 4 studies (14.8%). PjBL is widely regarded as the method most compatible with the *Projek Penguatan Profil Pelajar Pancasila* (P5) initiative embedded within the Merdeka Curriculum (Nur Hakim et al., 2024) and is recognized for fostering 21st-century competencies (Alfiah et al., 2026). Within the SMK context, PjBL facilitates learning experiences directly aligned with industry-specific workforce competencies (Serena et al., 2026). AI/Technology-based DL strategies tied for second/third place (14.8%, $n = 4$), utilizing platforms such as Google Colab, DeepSeek, and Canva AI to support deep learning. Problem-Based Learning (PBL) appeared in 3 studies (11.1%), primarily within PAI and Science (IPA) subjects to sharpen critical reasoning through contextual problem analysis. In these contexts, artificial intelligence acts as a collaborative partner for teachers in generating diverse instructional materials and personalized, memorable learning experiences tailored to individual student needs (Flora et al., 2026; Hidayati & Yudiantoro, 2025).

Three specialized, innovative strategies appeared in one study each: Active Deep Learner Experience (ADLX), which integrates direct simulations to ensure experiential and deep understanding (Azis et al., 2025); Differentiated Deep Learning, which applies adaptive content delivery at SMAN 4 Banda Aceh (Hakim & Solihah, 2026); and Guidance and

Counseling-integrated Deep Learning (DL-BK) at SMK Negeri 10 Batam (Noyita et al., 2026). This strategic diversity underscores that DL implementation in Indonesian senior secondary schools is highly contextual and adaptable to specific school conditions and student needs.

Barriers and impacts of deep learning implementation on students. Analysis of the 27 articles yielded a three-tier classification of barriers to DL implementation based on their underlying sources, as detailed in Table 4.

Table 4. Classification of Barriers to Deep Learning Implementation (n = 27 articles; 28 barrier instances identified)

Barrier Classification	Frequency (n)	Percentage (%)
Internal (teacher and student habits/competencies)	18	66.7%
Structural (time constraints, facilities, infrastructure, technology)	8	29.6%
Policy/Curriculum (administrative burden, regulations)	2	7.4%

Internal barriers predominated across 18 studies (66.7%), encompassing low teacher digital literacy, inequitable access to digital facilities across schools, and a shortage of personnel trained to implement DL for inclusive education students (Jamaludin, 2025). Eight studies (29.6%) reported structural barriers, such as insufficient instructional hours and dense curriculum content demands, which conflict with the extended time required for deep, reflective learning to achieve optimal outcomes (Khotimah & Abdan, 2025). Policy and curriculum barriers—specifically administrative burdens and regulatory complexities—were identified in 2 studies (7.4%).

Regarding student outcomes, 100% of the 27 reviewed studies reported positive cognitive and affective impacts following DL implementation. Across six identified impact categories, notable gains included a 34% improvement in cognitive and critical thinking abilities (Hadi et al., 2025). Interactive DL implementation also enhanced mathematical reasoning skills among vocational high school students (Nada & Irawan, 2026) and improved students' ability to compose negotiation texts in Indonesian language classes (Flora et al., 2026). These findings demonstrate that DL shifts the student learning experience from superficial memorization to genuine comprehension and practical application (Khotimah & Abdan, 2025). Beyond cognitive gains, the literature highlights substantial improvements in affective domains, including self-reflection, metacognition, value internalization, and learning motivation (Hakim & Solihah, 2026; Hasan et al., 2025; Wafa et al., 2025).

Enabling factors for successful deep learning implementation. Mapping the 27 articles identified six clusters of enabling factors (enablers) supporting successful DL implementation, as presented in Table 5.

Table 5. Distribution of Enabling Factors (Enablers) for Deep Learning (n = 27)

Enabling Factor (Enabler)	Frequency (n)	Percentage (%)
Merdeka Curriculum as a supportive regulatory framework	9	33.3%
Instructional media and learning technology	7	25.9%
Teacher training, workshops, and coaching	4	14.8%
University–MGMP (Subject Teacher Forum) partnerships	3	11.1%
Principal and institutional support	2	7.4%
Local wisdom and cultural context	2	7.4%

As shown in Table 5, the Merdeka Curriculum was the most frequently cited enabler (33.3%, $n = 9$), signifying that this national policy acts as a primary catalyst granting teachers the pedagogical autonomy to explore innovative DL methods. Instructional media and technology ranked second (25.9%, $n = 7$), encompassing interactive flipbooks, AI platforms, Learning Management Systems (LMS), Quizizz, and digital student worksheets (LKPD). Teacher training, workshops, and coaching appeared in 14.8% of studies ($n = 4$), underscoring the central role of continuous professional development. Partnerships between universities and Subject Teacher Forums (MGMP) were cited in 11.1% of studies ($n = 3$) as vital mechanisms for sustaining teacher capacity, followed by principal/institutional support (7.4%, $n = 2$) and the integration of local wisdom/cultural contexts (7.4%, $n = 2$).

Discussion

The predominance of the MMJ strategy (25.9%) confirms that the Mindful-Meaningful-Joyful approach has become the primary operational framework for implementing DL in Indonesian SMA/SMK/MA schools following the establishment of the Merdeka Curriculum under Permendikbudristek No. 12 of 2024. Suwandi et al. (2024) emphasize that MMJ serves as a direct pedagogical countermeasure to conventional, teacher-centered, and rote-oriented instruction. Theoretically, the *meaningful learning* component aligns with Ausubel's assimilation theory regarding the integration of new knowledge into learners' existing cognitive structures; *mindful learning* corresponds to reflective awareness and heightened curiosity during learning (Hidayati & Yudiantoro, 2025); and *joyful learning* reflects meaningful emotional engagement throughout the educational process (Fathurrohim et al., 2026).

The prominence of PjBL as the second most common strategy (14.8%) is consistent with its strong empirical foundation in Indonesian vocational education. Islamia et al. (2025) and Putra et al. (2025) demonstrate that PjBL, PBL, and inquiry-based learning are

highly effective vehicles for realizing DL by situating learning within authentic, real-world problems that stimulate critical thinking and collaborative discourse. Meanwhile, the emergence of AI/Technology-based DL (14.8%) reflects a new wave of pedagogical adaptation in the digital transformation era, wherein technology acts as an accelerator for instructional management—from designing teaching materials to generating practice assessments (Flora et al., 2026). Furthermore, AI integration has been shown to boost student motivation through engaging, visually rich content presentation (Hidayati & Yudiantoro, 2025).

The overwhelming prevalence of internal barriers (66.7%) compared to structural barriers (29.6%) carries substantial theoretical and practical significance. It indicates that the foremost obstacle to DL implementation in Indonesian senior secondary schools is not merely infrastructural deficits, but rather the challenge of shifting teachers' pedagogical paradigms. Many educators intellectually endorse DL principles yet remain practically entrenched in traditional lecture routines and one-way information transmission. Nasrullah and Rahmanto (2026) explain that this barrier manifests in teachers' difficulties designing inquiry-driven learning scenarios, compounded by resistance from students accustomed to passive learning habits.

Rogers' (2003) Diffusion of Innovations Theory offers a relevant lens for interpreting this finding, suggesting that the adoption of pedagogical innovations progresses slowly depending on perceived relative advantage, compatibility with existing values, and operational complexity. Transitioning from *teaching as telling* to *teaching as facilitating deep inquiry* entails a profound shift in professional identity that cannot be achieved through isolated, one-off workshops. As Rahayu (cited in Nasrullah & Rahmanto, 2026) noted, widespread misconceptions viewing DL as a new curriculum rather than a broader pedagogical philosophy directly contribute to the internal barriers documented across 18 of the 27 reviewed studies.

Nevertheless, the 100% consistency of positive cognitive and affective outcomes across all reviewed studies indicates that when barriers are effectively mitigated, at least within research settings—DL empirically enhances learning quality. For instance, documented increases in PAI learning mastery from 25% to 94% across two CAR cycles, alongside a 40.63% average gain in negotiation text writing proficiency, substantiate that DL translates policy aspirations into measurable student achievement (Sadrah Mesak Manik et al., 2025).

The identification of the Merdeka Curriculum as the leading enabler (33.3%) underscores the importance of national policy in cultivating an enabling environment for pedagogical innovation. Beyond granting formal legitimacy, the regulation provides structural flexibility that previously constrained instructional experimentation. However, Usman (as cited in Syaifulloh, 2026) observes that the most successful DL

implementations are driven by teachers' intrinsic pedagogical beliefs and collaborative school cultures rather than mere regulatory compliance.

Teacher training and coaching (14.8%) reinforce the argument that sustained professional development is indispensable for long-term DL success. Specifically, *coaching clinic* models have proven more effective at enhancing teachers' DL module design competencies than conventional workshops by providing individualized, contextualized feedback (Gultom, 2025; Hardiyanti et al., 2026). Sadrah Mesak Manik et al. (2025) further advocate for multi-stakeholder collaboration among educators, policymakers, and technology providers to ensure inclusive and sustainable DL execution.

Finally, partnerships between universities, Subject Teacher Forums (MGMP), and schools (11.1%) offer a scalable model for pedagogical transformation. Such collaborations facilitate the transfer of contemporary pedagogical knowledge to schools while providing universities with grounded empirical data. This aligns with Ismayati (as cited in Syaifulloh, 2026), who emphasizes that core DL bottlenecks, such as limited training and infrastructural disparities. They are most effectively resolved through coordinated multi-sector partnerships rather than isolated interventions.

This scoping review has several limitations that warrant transparent acknowledgment. First, in accordance with the Arksey and O'Malley (2005) protocol, formal quality appraisal of primary studies was not conducted, meaning studies of varying methodological rigor were weighted equally in the synthesis. Second, the heavy reliance on Google Scholar via *Publish or Perish* may have resulted in an underrepresentation of studies indexed exclusively in Scopus or Web of Science. Third, potential publication bias must be considered given that 100% of the reviewed studies reported positive DL outcomes, which may partly reflect a tendency against publishing null or negative findings. Fourth, contextual heterogeneity across general SMA, vocational SMK, and *pesantren*-based MA institutions limits the generalizability of findings across distinct school types.

Conclusion

Research on pedagogical deep learning in Indonesia continues to expand rapidly in response to national education policies enacted by the Ministry of Primary and Secondary Education (Kemendikdasmen). This scoping review demonstrates that while deep learning consistently yields positive cognitive and affective outcomes for senior secondary students, limited pedagogical readiness and uneven supporting infrastructure remain substantial obstacles across many Indonesian schools. Future scoping reviews are recommended to map deep learning implementation at the junior secondary (SMP) and primary (SD) education levels, as well as to conduct subject-specific syntheses in high-focus disciplines such as Islamic Religious Education (PAI) and Mathematics.

Acknowledgments

The authors would like to express their sincere appreciation to Universitas Pendidikan Indonesia for its institutional support and academic contribution to the completion of this research. The university's commitment to advancing education and research has provided a valuable environment for the development of this scholarly work.

Authors' Note

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

References

Alfiah, Subyantoro, Mardikantoro, H. B., & Yuniawan. (2026). Teachers' needs for collaborative project-based learning model innovation in strengthening deep learning for senior high school students in Central Java, Indonesia. *Theory and Practice in Language Studies, 16*(5), 1633–1642. https://doi.org/10.17507/tpls.1605.21

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology, 8*(1), 19–32. https://doi.org/10.1080/1364557032000119616

Azis, A., Junanto, S., & Muttaqin, Z. (2025). Implementasi pembelajaran PAI dengan pendekatan Active Deep Learner Experience (ADLX) di SMA ABBS Surakarta. *Jurnal Al Murabbi, 11*(2), 39–49.

Chotimah, S. C., Suhartono, S., & Fantofik, D. (2025). Implementasi pembelajaran mendalam: Berkesadaran (mindful), bermakna (meaningful), dan menggembirakan (joyful). *An-Nuha, 5*(4), 673–682. https://doi.org/10.24036/annuha.v5i4.758

Fathurrohim, M. F., Naziihah, H. S., Andika, K. D., & Siti, S. (2026). Review deep learning sebagai strategi inovatif pembelajaran di tiap jenjang: Efektivitas terhadap Kurikulum Merdeka. *[Nama jurnal belum tersedia, 6]*(1), 15–21.

Flora, J., Malau, I., Saragih, E. L. L., Merina, V., & Sianipar. (2026). The effect of the interactive media-based deep learning approach on the ability to write negotiation texts of grade X students of Indonesia's Private Vocational School Building 2 Medan. *[Nama jurnal belum tersedia, 7]*(4), 1944–1957.

Fullan, M., Quinn, J., & McEachen, J. (2018). *Deep learning: Engage the world, change the world*. Corwin.

Gultom, A. F. (2025a). Revitalizing Pancasila as living philosophy: Socratic-based classroom experimentation to foster critical thinking skills. *Paidea: Jurnal Pendidikan dan Pembelajaran Indonesia, 5*(2), 78–91. https://doi.org/10.56393/paidea.v5i2.4174

Gultom, A. F. (2025b). Toward a transformative multicultural pedagogy: The role of cultural empathy in university. *Didactica: Jurnal Kajian Pendidikan dan Pembelajaran, 5*(2), 60–74. https://doi.org/10.56393/didactica.v5i2.4175

Hadi, M. S., Setiawan, V., & Hidayah, P. M. (2025). The effect of implementing deep learning on improving students' cognitive abilities in the independent curriculum

at Yogyakarta high schools. *Journal of Research in Islamic Education, 7*(1), 270–282. https://doi.org/10.25217/jrie.v7i1.5637

Hakim, N., & Solihah, K. Z. (2026). Penerapan pendekatan deep learning berbasis diferensiasi untuk meningkatkan hasil belajar PAI materi dakwah pada siswa kelas XI SMA Negeri Banda Aceh. *Jurnal Edukasi, 14*(1), 201–219.

Hardiyanti, S., Anggraini, M., Saputri, M. D., & Sari, J. W. (2026). Coaching clinic model pembelajaran deep learning pada mata pelajaran PAI bagi guru di Rimbo Bujang. *[Nama jurnal belum tersedia, 4]*(4), 24497–24503.

Hasan, R., Bahsoan, A., Hasiru, R., & Maruwae, A. (2025). Implementasi Kurikulum Merdeka dengan menggunakan pendekatan deep learning pada mata pelajaran ekonomi di SMA Negeri 2 Kota Gorontalo. *[Nama jurnal belum tersedia, 5*, 2231–2240.

Hidayati, H. N., & Yudiantoro, M. N. (2025). Meningkatkan kualitas deep learning dengan pendekatan artificial intelligence. *Journal of Education Research, 6*(4), 1100–1107. https://doi.org/10.37985/jer.v6i4.2900

Islamia, U., Prayogi, A., Syaifuddin, M., & Nasrullah, R. (2025). Model problem-based learning dalam pembelajaran Pendidikan Agama Islam pada Kurikulum Merdeka: Analisis praktik pembelajaran di SMAN 3 Kota Pekalongan. *[Nama jurnal belum tersedia, 4]*(3), 221–232.

Jamaludin, M. S. (2025). Isu-isu pendidikan di Indonesia abad ke-21: Paradigma desain pembelajaran mendalam (deep learning). *Ndo-MathEdu Intellectuals Journal, 6*(7), 10636–10649.

Kholisah, T. A., Rofiqoh, H., Alia, A. N., Pramudito, B. M., & Suhardi, S. (2025). Analisis efektivitas implementasi kebijakan deep learning di sekolah. *Khatulistiwa: Jurnal Pendidikan dan Sosial Humaniora,* 5(3), 833–845. https://doi.org/10.55606/khatulistiwa.v5i3.7322

Khotimah, D. K., & Abdan, M. R. (2025). Analisis pendekatan deep learning untuk meningkatkan efektivitas pembelajaran PAI di SMKN Pringkuku. *Jurnal Pendidikan dan Pembelajaran Indonesia,* 5(2), 866–879. https://doi.org/10.53299/jppi.v5i2.1466

Manik, S. M., Ritonga, M. U., & Hadi, W. (2025). Integrating deep learning into school curriculum: Challenges, strategies, and future directions. *Jurnal Pendidikan Indonesia, 3*(1), 29–44. https://doi.org/10.62007/joupi.v3i1.415

Nada, R. Q., & Irawan, A. D. (2026). Deep learning for enhancing mathematical reasoning skills in vocational high school students. *[Nama jurnal belum tersedia, 9]*(1), 35–50. https://doi.org/10.22460/jpmi.v9i1s.30912

Nasrullah, & Rahmanto, M. A. (2026). Persepsi guru terhadap pendekatan deep learning dalam pembelajaran PAI di SMA Muhammadiyah 18. *[Nama jurnal belum tersedia, 8*(2).

Noyita, E., Saleleubaja, L., Tampubolon, N., Madala, J., & Hia, F. (2026). Penerapan pembelajaran mendalam dan bimbingan konseling guru PAK terhadap siswa di SMK Negeri 10 Batam. *Indo-MathEdu Intellectuals Journal, 4*(3), 20858–20866.

Nur Hakim, M., Zakiyatus Solihah, K., Ismail, F., Salim, A., & Prasetiyo, N. T. (2024). Optimizing the Merdeka Curriculum for developing the Pancasila student profile

through project-based learning. *Munaddhomah,* 5(4), 395–408. https://doi.org/10.31538/munaddhomah.v5i4.1396

Peters, M. D. J., Godfrey, C., McInerney, P., Munn, Z., & Tricco, A. C. (2020). Chapter 11: Scoping reviews. In *JBI manual for evidence synthesis*.

Peters, M. D. J., Marnie, C., Tricco, A. C., Pollock, D., Munn, Z., Alexander, L., McInerney, P., Godfrey, C. M., & Khalil, H. (2020). Updated methodological guidance for the conduct of scoping reviews. *JBI Evidence Synthesis, 18*(10), 2119–2126. https://doi.org/10.11124/JBIES-20-00167

Putra, R. A., Rahmawati, Y., & Halim, A. (2025). Project-based learning in the progress of deep learning. *[Nama jurnal belum tersedia, 14]*(1), 474–484.

Rogers, E. M. (2003). Diffusion of innovations. In *Encyclopedia of sport management* (2nd ed.). https://doi.org/10.4337/9781035317189.ch157

Serena, K., Hayati, N., Nugroho, L. R., Said, H. A., & Khoiron, A. M. (2026). Vocational high school teachers' readiness to implement the deep learning approach in the Merdeka Curriculum: A systematic literature review. *TOFEDU: The Future of Education Journal,* 5(2), 1775–1785.

Suwandi, Putri, R., & Sulastri. (2024). Inovasi pendidikan dengan menggunakan model deep learning di Indonesia. *Jurnal Pendidikan Kewarganegaraan dan Politik, 2*(2), 69–77. https://doi.org/10.61476/186hvh28

Syaifulloh, R. B. (2026). Transformasi pedagogis melalui deep learning dalam Kurikulum Merdeka: Studi literatur sistematis. *[Nama jurnal belum tersedia, 6]*(1), 19–28.

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine, 169*(7), 467–473. https://doi.org/10.7326/M18-0850

Wafa, A., Syarifah, S., & Nadhif, M. (2025). Transformasi pembelajaran Pendidikan Agama Islam berbasis deep learning: Dari pendekatan hafalan menuju internalisasi nilai. *Academicus: Journal of Teaching and Learning,* 4(2), 103–116. https://doi.org/10.59373/academicus.v4i2.95