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Implementation of Learning Management with the Deep Learning Approach: A Multi-Site Study in Sidoarjo toward SDG 4

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ABSTRACT

Objective: *To describe, analyze, and construct propositions regarding a conceptual model of learning management with the Deep Learning approach at State Junior High School 1 Gedangan and State Junior High School 4 Sidoarjo.* ***Method:*** *Using a descriptive qualitative design with a multi-site case study approach. Data were analyzed to explore the role of school principals, teachers, curriculum integration, infrastructure, digital technology, and stakeholder collaboration in supporting the implementation of Deep Learning-based learning management.* ***Results:*** *The findings show that school principals do not only perform managerial functions but also strengthen their role as transformational leaders. They facilitate teacher professional development through coaching, mentoring, and supportive clinical discussions. The principal's transformational leadership becomes a determining factor in translating the curriculum vision into real action through the principles of mindful, meaningful, and joyful learning. The implementation of learning management with the Deep Learning approach requires the strengthening of human resources, especially teachers, as well as the improvement of principals' managerial competencies, curriculum integration, optimization of facilities and digital technology, and collaboration with stakeholders.* ***Novelty:*** *Offering a conceptual model of learning management based on the Deep Learning approach by emphasizing the strategic role of transformational school leadership in aligning policy commitment, teacher and student mindset transformation, and managerial strategies in educational units. The proposed model contributes to SDG 4 by promoting inclusive, equitable, and quality education through meaningful, mindful, and joyful learning practices.*

INTRODUCTION

The government, through the Ministry of Primary and Secondary Education, has launched a deep learning approach to strengthen the Independent Curriculum, which will be widely implemented starting in the 2025/2026 academic year. This approach aims to enable students to develop their understanding of fundamental elements and apply that knowledge to both familiar and unfamiliar contexts. Deep learning addresses the need for 21st-century skills because it enables students to build competencies to create a positive impact in their world, not simply to succeed on exams (Baihaqi et al., 2025; Patrinos, 2020; Zebua, 2025). Education, as an active and social process aligned with the constructivist approach (Vygotsky, 1978), learning strategies that encourage reflection, discovery, and integration of information have been shown to create deeper and more lasting understanding (Ramadhan et al., 2023). The integration of cognitive, affective, and social aspects in deep learning is also directly proportional to learning outcomes, where this approach produces high-quality learning outcomes, while less in-depth methods result in lower outcomes (Gao, 2025; Jiao et al., 2020; Peng & Chen, 2019). This concept is described as an approach that emphasizes creating a mindful, meaningful, and joyful learning environment through the holistic development of intellectual, ethical, aesthetic, and kinesthetic aspects (Alim et al., 2025; Andayanie et al., 2025; Feriyanto & Anjariyah, 2024).

Based on the statement above, schools must prepare themselves for the implementation of Deep Learning (Isnaeni et al., 2025; Miles et al., 2014; Riani & Sujarwati, 2025). Teachers must possess the ability to teach using a deep learning approach (Gao, 2025; Liu et al., 2022; Weng et al., 2023). Field evidence indicates that teachers have not yet fully mastered Mindful, Meaningful, and Joyful Learning (B2M) (Hanh & Weare, 2017; Nafi'ah & Faruq, 2025). They appear to still use lecture methods, which are boring and theoretical, often late to class, create sub-conducive classroom environments, and assign a large amount of homework without providing learning projects. The objective evidence above shows that project-based learning in deep learning presents numerous problems in several junior high schools in Sidoarjo Regency, but not at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo.

This phenomenon is interesting to examine through a multi-site case study to compare and synergize patterns of success and obstacles that arise in each school. A multi-site case study allows researchers to gain a more comprehensive picture of how district-level policies translate into real-world classroom practices (Euker, 2019; Newman, 2020; Schmidt, 2025). The differences in students' socioeconomic backgrounds and school cultures at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo provide a rich perspective on the adaptability of deep learning implementation.

Based on this context, this study aims to further explore the planning, implementation, evaluation, inhibiting and supporting factors, and principals' strategies for implementing deep learning in Sidoarjo Regency. This study aims to explore the implementation of learning management using a deep learning approach at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, Sidoarjo Regency. The results of this study are expected to serve as a reference for other schools in the Sidoarjo region in optimizing the implementation of deep learning. By understanding best practices at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, it is hoped that the quality standards of deep learning at the junior high school level can be improved equitably and sustainably.

THEORITICAL REVIEW

Deep learning concept

Deep learning in education is a learning approach that emphasizes a comprehensive understanding of concepts, rather than merely memorizing them superficially (Bishop & Bishop, 2023; McTighe & Silver, 2020; Mehta & Fine, 2019; Vasile, 2024). This approach encourages students to think critically, connect ideas, and apply knowledge in real-world contexts, in accordance with the requirements of their respective school curriculum. Deep learning encompasses the understanding and interconnectedness of conceptual and procedural knowledge and the ability to apply conceptual knowledge in new contexts (Boyle & Ravenscroft, 2012; McPhail, 2021; Taye, 2023). This concept is being developed by the Ministry of Primary and Secondary Education to transform learning from a mechanical approach to a more mindful, meaningful, and joyful one.

Deep learning is a pedagogical approach that emphasizes active student engagement in understanding meaning, building connections between ideas, and applying knowledge in various real-world contexts (Afifatun, 2025; Peltier et al., 2022; Singh, 2025). Unlike surface approaches, which focus solely on short-term factual reproduction and memorization, deep learning encourages students to explore concepts comprehensively, enabling them to answer questions about "why" and "how" a phenomenon occurs (Al Mamun & Lawrie, 2024; Lim,

2025). The main characteristics of this approach include a solid conceptual understanding, metacognitive skills to reflect on thought processes, and the ability to connect new knowledge with pre-existing cognitive schemas (Dessie et al., 2023; Drigas & Mitsea, 2021; Sreelohor et al., 2025; Talanquer & Kelly, 2024).

Theoretically, the implementation of deep learning is firmly rooted in the constructivist theory proposed by Vygotsky (1978), which states that knowledge is independently constructed by students through interaction with the environment and direct experience (Dahl & Mørch, 2025; Gunawardena et al., 2025). In this context, effective learning occurs when students are not merely passive recipients of information, but act as active subjects constructing their own understanding (Fullan & Langworthy, 2014). The integration of strategies such as project-based learning and inquiry approaches is a crucial instrument in supporting this constructivist ecosystem, as it can increase students' active engagement and long-term retention.

Management of the deep learning approach

Deep learning planning is a crucial transformational step oriented toward character development and meaningful understanding in students through systematic and structured thought processes (Sumarto & Harahap, 2025). Within the PAET (Planning, Application, Evaluation, and Follow-up)-based curriculum management framework, this planning must be directed toward stimulating higher-order thinking skills (HOTS), encompassing aspects of analysis, evaluation, and creativity (Evelin et al., 2026). To achieve this, teachers must integrate exploratory scenarios into Teaching Modules or Lesson Plans (RPP) by implementing innovative models such as Project-Based Learning (PjBL) to boost students' conceptual activity (Syarifah et al., 2021). The entire design must also align with a meaningful, mindful, and joyful learning environment, utilize STEAM-based digital technology (Zainal et al., 2025), and prepare process-oriented diagnostic and formative assessment instruments.

During the implementation stage, the deep learning approach becomes a form of paradigm transformation that encourages students to connect new concepts with prior knowledge so that the essence of the material can be fully internalized (Saputra et al., 2025). This principle aligns closely with the flexible spirit of the Independent Curriculum, which focuses on developing students' essential competencies (Mujtahid et al., 2025). In classroom practice, the learning ecosystem must facilitate emotional and cognitive engagement to achieve students' metacognitive levels (Hadyan et al., 2025). The success of this shift in the role of teachers to transformational facilitators is greatly influenced by their pedagogical competency and technical skills in classroom management (Nurjanah & Suryadi, 2025). Furthermore, this implementation requires the support of a conducive environment, extensive learning partnerships, and the use of digital technology to enable students to analyze problems independently (Rifayanti & Kaliwanovia, 2025). Therefore, several opinions from related education experts can be summarized as follows: learning transformation will make students emotionally and cognitively engaged in learning activities due to teachers who are competent both pedagogically and professionally.

However, the implementation of deep learning approaches in the field often faces various internal and external obstacles. Internally, the main obstacles stem from teacher resistance, reluctance to step out of their comfort zones, conventional memorization-based methods, limited digital competency in integrating technology, and weak student learning independence and intrinsic motivation (Anwar & Sodik, 2025). Externally, challenges include

limited technological infrastructure in schools (Evelin et al., 2026) and the high quantitative administrative burden of the curriculum, which forces teachers to focus on mastering the material rather than on in-depth understanding (Mujtahid et al., 2025). Family environments that are less supportive of children's independent learning at home also weaken the internalization of the deep learning values established in schools (Suhartono et al., 2024). Therefore, the greatest challenge today is how to build the capacity of capable and competent teachers in meaningful learning activities.

Behind these obstacles, there are internal and external supporting factors that can be optimized as driving forces for transformation. The most dominant internal strength is teachers' pedagogical readiness to design in-depth classroom interactions, such as through a discourse-based teaching approach (Susanto et al., 2025). This competency can be continuously accelerated through a culture of collaboration and the sharing of good practices within learning communities such as MGMP. Externally, the autonomy afforded by the Independent Curriculum allows teachers the freedom to focus on essential material without being burdened by administrative matters. This flexibility is further strengthened by the availability of digital infrastructure for student independent research and consistent partnerships with parents to support children's character development (Evelin et al., 2026). Based on the references above, it is hoped that support from school principals will provide opportunities for teachers to participate in professional development activities oriented toward learning strategies and digital skills.

As a final stage, evaluation in deep learning acts as a quality control tool and a strategic reflection instrument, shifting the focus from numerical grades to process assessment and conceptual depth. This evaluation is aimed at measuring students' emotional and cognitive engagement through the pillars of meaningful, mindful, and joyful (Hadyan et al., 2025). By relying on immediate feedback from formative assessments. Authentic assignments such as projects and portfolios are used to capture students' true collaborative abilities and creativity Zainal et al., (2025), whose data can be precisely integrated through digital activities. Ultimately, self-reflection mechanisms Sumarto & Harahap (2025) supported by the principal's academic supervision will produce strong managerial recommendations for continuously improving the quality of education in an era of disruption. Thus, the principal's involvement as one of the determinants of learning success is highly prioritized because with supervision and mentoring,

Principal strategy in monitoring learning with the deep learning approach

The principal's strategy is a determining factor in the success of educational transformation, particularly in implementing the deep learning approach. As a transformational leader, the principal is responsible for creating a curriculum vision that aligns with the Ministry of Education's policy, which promotes deep learning as a solution to the learning crisis. Anwar and Sodik (2025) emphasized that implementing this approach in educational units requires a strong conceptual framework orchestrated by school leadership to effectively realize the principles of mindfulness, meaningfulness, and joy.

One crucial strategy for the principal is to conduct educational planning oriented toward character development and future competencies. Sumarto and Harahap (2025) stated that the principal's role in developing the deep learning curriculum is crucial to ensure that every school policy is directed at strengthening student character. This planning includes a clear division of roles and alignment of school programs with the profile of Pancasila students, the primary target of current national education.

The principal's evaluation and clinical supervision strategies serve as a mechanism for teacher quality control of the implementation of the deep learning approach. Hadyan et al. (2025) stated that evaluation of deep learning approaches must be able to identify the extent of student engagement in critical thinking. Through mentoring supervision, principals can provide constructive feedback to teachers on how to improve the depth of material and the effectiveness of teaching methods in the classroom.

In conclusion, a comprehensive principal strategy encompasses aspects of planning, teacher competency development, facility provision, and ongoing evaluation. Tsuraya et al., (2025) concluded that the role of deep learning in improving the effectiveness of the education system depends heavily on how school leaders are able to translate national policies into relevant, transformational learning practices in the field. With transformative leadership, the implementation of deep learning in Sidoarjo Regency can serve as a reference for improving the quality of education more broadly.

RESEARCH METHOD

Research design

This research employed a descriptive qualitative design with a multi-site study, with two schools as the research sites. According to Moleong (2013), research using a qualitative approach aims to comprehensively understand and explore various phenomena experienced by research subjects, such as behavior, perceptions, motivations, and other actions. Creswell (2012) detailed that multi-site case study research can be conducted through several activities, such as collecting data from original sources using interviews, observations, recordings, or documentation.

Research objects

The research objects in this study were Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo. The informants were the principal, vice principal, and teachers. Field observations and other supporting documents, including photographs, activity reports, products, and other supporting activities, were collected.

Research techniques

This study utilized three data collection techniques: participant observation, in-depth interviews, and document study. Participant observation was conducted to observe and record all phenomena occurring in the classrooms of SMPN 1 Gedangan and SMPN 4 Sidoarjo. In-depth interviews were used to obtain concrete information and data from informants such as the principal, vice principal, and teachers. School documents related to the implementation of deep learning were obtained from teaching modules, learning preparation documents, and learning evaluation documents. Moleong (2007) stated that a qualitative approach was used to holistically understand the experiences of the research subjects, encompassing observation, interviews, and documentation.

Data analysis techniques

The data analysis technique in this study employed descriptive analysis techniques with more descriptive details. The results of interviews and documentation studies were analyzed qualitatively and described in descriptive form to obtain data related to the implementation of learning management using a deep learning approach. According to Miles et al., (2014),

there are three qualitative data analysis techniques: data condensation, data presentation, and conclusion drawing.

RESULTS AND DISCUSSION

Results

This research focuses on the implementation of learning management using a deep learning approach. The research results can be summarized for each competency as following.

Learning planning with a deep learning approach

Educational planning within the context of deep learning is a crucial step that functions as a strategic transformational design to shape systematic thought processes, meaningful understanding, and student character. Integrating this approach into planning documents such as Teaching Modules and PPM documents is essential for achieving high-quality learning. In its implementation, teachers are required to design scenarios that facilitate active student engagement through innovative models such as Project-Based Learning (PjBL), which has been proven effective in significantly increasing activity and conceptual understanding. The success of this process is no longer viewed as a mere administrative formality, but rather requires the collaboration and involvement of all stakeholders within the learning community to ensure the curriculum is implemented in accordance with the school's vision.

At the operational level at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, planning is realized through the alignment of the national curriculum or the adaptive Merdeka Curriculum by integrating eight dimensions of the graduate profile: Faith and Piety, Citizenship, Critical Reasoning, Creativity, Collaboration, Independence, Health, and Communication. This process focuses on creating a conscious, meaningful, and enjoyable learning experience (the "B2M" principle) through contextual competency mapping, strengthening literacy-numeracy aspects, and implementing a flexible block schedule. Managerially, school leaders adopt strategic policies by allocating dedicated coordination time, allocating supporting resources, and establishing minimum standards for teaching materials that must be met. This step is reinforced by a systematic strategy for improving teacher competency through In-House Training (IHT) and optimizing collaborative platforms such as the School Subject Teachers' Conference (MGMPS) and the "KRIDA" Learning Community to ensure a robust framework for producing critical, adaptive, and metacognitive graduates.

Implementing learning with a deep learning approach

The implementation of deep learning is a transformational paradigm that shifts the focus of learning from mere memorization to substantive conceptual understanding and critical thinking skills (Saputra et al., 2025). The success of this approach in practice depends heavily on teacher readiness through conceptual understanding and technical skills (Nurjanah & Suryadi, 2025), as well as the support of a conducive learning ecosystem, extensive partnerships, and the use of digital technology (Rifayanti & Kaliwanovia, 2025). In its implementation, the learning ecosystem must be able to encompass meaningful, mindful, and joyful aspects to foster students' curiosity and self-awareness (Hadyan et al., 2025). This is reinforced by the implementation of innovative models such as project-based learning and digital media to support students' independent investigations (Prakoso et al., 2026).

At the operational level at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, the implementation of deep learning is realized through the transformation of the role of teachers as activators, motivators, and facilitators of learning. Both schools managerially strengthen teacher competencies through workshops, In-House Training (IHT), and optimization of internal learning communities such as MGMPS and the Creative Innovative Teacher Learning Community Spenivda, abbreviated as "KRIDA". Technically in the classroom, teachers apply active learning strategies such as trigger questions, contextual learning, scaffolding techniques, and differentiated learning that is inclusive for all students, including those with disabilities. The success of this implementation is also supported by the integration of student programs (such as OSIS and literacy movements), the use of AI-based digital tools and coding, digital laboratories, and intensive collaboration with parents through character journals to ensure the internalization of character values in students' daily lives.

Inhibitors of deep learning

The implementation of deep learning approaches in educational institutions faces systemic and multidimensional challenges that hinder the alignment of the policy's conceptual framework with the realities on the ground (Anwar & Sodik, 2025). Internally, psychological barriers arise from the low learning independence of students who are still bound by a culture of rote learning, making it difficult for them to follow the intense cognitive flow that demands understanding, application, and reflection (Anwar & Sodik, 2025). On the other hand, external factors such as limited digital infrastructure and inadequate physical environments are negative determinants that complicate the implementation of project-based learning (Prakoso et al., 2026). Without adequate support, in-depth exploration of concepts is hampered, and the learning process tends to be stuck in the limited use of standard textbooks.

At the operational level at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, the main obstacles stem from resistance to changing the mindset of educators who have not yet fully shifted from conventional methods to strategies that stimulate critical thinking, as well as limited mastery of various assessment techniques. Technically and managerially, teachers also face challenges in managing strict lesson durations to balance the depth of material with personalized feedback. Furthermore, non-technical issues such as low intrinsic motivation and bullying disrupt students' psychological well-being and concentration. To mitigate these challenges, both schools implemented integrated strategic measures through periodic managerial evaluations, principal supervision, regular discussions in the MGMP/MGMPS forums, and cross-sector collaboration with external parties such as the DP3AKB and the police to create a safe, conducive, and meaningful school ecosystem.

Supporting factors for learning with a deep learning approach

The implementation of deep learning serves as a pillar of a quality education strategy that demands students' active involvement in the exploration and analysis of knowledge in real-world contexts (Kadarismanto & Sari, 2025). The most important internal supporting factor lies in teachers' pedagogical competence in implementing innovative learning models, such as discourse-based teaching, which is a key driving force in secondary schools (Susanto et al., 2025). When students are actively involved in analyzing and applying this knowledge, they tend to exhibit greater enthusiasm and intrinsic motivation (Kadarismanto & Sari, 2025).

Through a mindful, meaningful, and joyful learning process design, this ecosystem has proven effective in encouraging students to become independent learners capable of achieving high levels of metacognition.

At the operational level at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, the success of this approach is driven by the synergy of visionary Transformational leadership, adaptive principal regulations, and adequate allocation of the RKAS budget. Internally, teacher competency is continuously strengthened through innovation spaces and learning communities such as MGMPS and the "KRIDA" (Guru Belajar) Learning Community, which allows for the sharing of best practices. External support in the form of conducive policies from the Sidoarjo Regency Education and Culture Office, active parental involvement, and strategic partnerships with professional institutions and local MSMEs further enhance the relevance of the material to real life. The combination of digitalization of teaching materials, utilization of digital technologies (such as AI and coding), administrative flexibility, and Adiwiyata and inclusive school status collectively accelerated the transformation of the transformative education ecosystem in both schools.

Discussion

Principal evaluation in monitoring learning using the deep learning approach

Evaluation in the context of deep learning is a critical stage that serves as a quality control tool and strategic reflection instrument to ensure activity alignment with the goal of developing students' higher-order thinking skills (HOTS) (Prakoso et al., 2026). Unlike conventional models that focus on outcomes, this approach emphasizes process assessment, depth of conceptual understanding, and meaningful, mindful, and joyful aspects to measure students' emotional and cognitive engagement in problem-solving (Hadyan et al., 2025). This evaluation aspect is strengthened through a collaborative reflection mechanism to shape student character (Sumarto & Harahap, 2023) and continuous formative assessment that provides immediate feedback. Furthermore, integrating data from various student digital activities is essential to provide a comprehensive, high-quality, and transparent picture of competency achievement (Zainal et al., 2025).

At the operational level at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, evaluations conducted by the principals focused on students' achievement of holistic competencies, encompassing knowledge, skills, and character building. With the primary success indicator being the fulfillment of the "B2M" (conscious, meaningful, and joyful) principles, this evaluation process was systematically recorded in student progress reports. The evaluation results, followed up with a collaborative reflection mechanism, were proven to have a significant positive impact on transforming student learning behaviors, such as increased independence, a strong sense of curiosity, and the courage to reason critically and argue. Through this structured and ongoing evaluation management, both schools were able to maintain a balance between students' intellectual intelligence and spiritual integrity while laying a strong foundation for future curriculum quality improvements.

Principal strategy in monitoring learning with a deep learning approach

The principal's strategy is a determining factor in the success of educational transformation, particularly in implementing a deep learning approach. As a transformational leader, the principal is responsible for orchestrating a strong conceptual framework vision so that mindful, meaningful, and joyful principles can be concretely realized in daily classroom

practice (Anwar & Sodik, 2025). In addition to organizing digital resources and infrastructure to support project-based learning (Prakoso et al., 2026), the principal must also provide teachers with training in facilitation and problem-solving techniques to foster student leadership character. Within the quality control function, evaluations must identify the extent of student engagement in critical thinking (Hadyan et al., 2025) and be aligned with effective communication support with the family environment to strengthen student learning independence at home (Suhartono et al., 2024 in Prakoso et al., 2026).

At the operational level, at Public Junior High School 1 Gedangan and Public Junior High School 4 Sidoarjo, monitoring strategies are systematically implemented through a structured, data-driven academic supervision system. The principal uses specific supervisory instruments that include regular classroom observations and analysis of teaching materials or modules to ensure alignment between planning and active student engagement. In its implementation, the principal also collaborates with the supervisor of the School Subject Teachers' Conference (MGMPS) to ensure the objectivity of the evaluation. Beyond merely a managerial control function, monitoring results are proactively followed up by providing constructive feedback in the form of clinical discussions, coaching, and mentoring for educators, and encouraging a culture of dissemination of good practices among colleagues to achieve collective and sustainable improvement in teaching quality.

Beyond its implications for educational management, the findings of this study also contribute to the achievement of Sustainable Development Goal (SDG) 4, which emphasizes inclusive and equitable quality education and the promotion of lifelong learning opportunities for all. The implementation of Deep Learning-based learning management fosters critical thinking, creativity, collaboration, metacognitive skills, and student independence through meaningful, mindful, and joyful learning experiences. In addition, the active involvement of principals, teachers, parents, and external stakeholders reflects the importance of collaborative partnerships in educational transformation, aligning with the spirit of SDG 17. Therefore, the proposed learning management model not only strengthens instructional quality at the school level but also supports broader efforts toward sustainable educational development.

CONCLUSION

Fundamental Finding: The implementation of learning management with the Deep Learning approach is carried out through six main aspects: planning, implementation, inhibiting factors, supporting factors, evaluation, and the principal's monitoring strategy. The findings show that Deep Learning requires strategic and transformational learning design, teacher competency strengthening, curriculum integration, digital technology optimization, and a learning ecosystem that is mindful, meaningful, and joyful. The principal plays a key role as a transformational leader who translates curriculum vision into concrete learning practices through supervision, coaching, mentoring, and clinical discussions. **Implication:** This study implies that schools need to strengthen the role of principals and teachers in managing Deep Learning-based instruction. School principals should not only function as administrative managers but also as instructional leaders who guide teachers, build collaborative learning communities, and ensure that learning activities develop students' critical thinking, independence, character, and metacognitive skills. These efforts contribute to the achievement of SDG 4 (Quality Education) through the promotion of inclusive and quality learning, while collaboration among schools, families, and external stakeholders reflects the importance of partnerships in sustaining educational transformation. **Limitation:** This study

is limited to two research sites, namely State Junior High School 1 Gedangan and State Junior High School 4 Sidoarjo. Therefore, the findings may not fully represent the implementation of Deep Learning-based learning management in other schools with different contexts, resources, and institutional cultures. **Future Research:** Future studies are recommended to involve more schools with diverse characteristics and educational levels. Further research may also examine the effectiveness of Deep Learning implementation using mixed methods or quantitative approaches to measure its impact on students' learning outcomes, character development, critical thinking skills, and teacher professional growth.

AUTHOR CONTRIBUTIONS

Aris Setiawan contributed to the conceptualization of the study, research design, data collection, data analysis, and drafting of the manuscript on the implementation of learning management with the Deep Learning approach. **Yatim Riyanto** contributed to methodology development, academic supervision, validation of research findings, and critical review of the manuscript. **Nunuk Hariyati** contributed to the development of the theoretical framework, research validation, supervision, and manuscript revision. All authors have reviewed, provided input, and approved the final version of this article for submission.

CONFLICT OF INTEREST STATEMENT

The authors state that no financial or personal conflicts of interest exist that may have affected the content or findings of this research.

STATEMENT ON THE USE OF AI OR DIGITAL TOOLS IN WRITING

The authors declare that no artificial intelligence (AI) tools or other digital writing assistants were used in the preparation, analysis, or writing of this manuscript. All stages of the research process, including data analysis, interpretation, and manuscript writing, were conducted solely by the authors. The authors take full responsibility for the originality, accuracy, and integrity of the content presented in this article.

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