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DEEP LEARNING APPROACH ENHANCES EDUCATIONAL QUALITY IN ELEMENTARY SCHOOLS

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ABSTRACT

This study is driven by the need for elementary schools to enhance educational quality through learning that goes beyond content mastery, fostering deep understanding, critical thinking, character development, and relevance to students' real lives. The aim is to analyse the integration of deep learning to improve outcomes at SDN 01 Batunyala and SDN 02 Semayan. Using a qualitative approach with a multisite case study design, data were gathered through classroom observation, interviews with principals and teachers, document analysis, and learning activity documentation. Analysis employed the interactive model of data condensation, data display, and conclusion drawing. Findings reveal that deep learning can be integrated through three dimensions: mindful learning, meaningful learning, and joyful learning. These dimensions guide teachers in designing objectives, contextual activities, reflective questions, formative assessments, and feedback aligned with student needs. Integration of deep learning enhances cognitive, affective, social, and metacognitive outcomes. The study concludes that deep learning is a strategic pedagogical approach to strengthen elementary education when supported by teacher readiness, school leadership, contextual resources, and continuous academic supervision.

Keyword: Deep Learning, Educational Outputs, Elementary School, Case Study, Meaningful Learning

INTRODUCTION

Elementary education plays a pivotal role in establishing the foundation of students' knowledge, character, and lifelong learning competencies. At this educational level, learning outcomes should not be viewed solely in terms of academic achievement or examination scores (Fafurida et al., 2022; Vermunt et al., 2023). Rather, they encompass students' ability to understand concepts, think critically, communicate ideas effectively, collaborate with others, demonstrate self-discipline, and apply acquired knowledge to real-life situations. Consequently, improving educational outcomes requires learning approaches that are holistic, contextual, reflective, and oriented toward the comprehensive development of students' cognitive, social, and affective capacities (Anwar, 2017; Saragih & Subroto, 2023).

Within the current direction of Indonesian educational policy, deep learning refers to a pedagogical approach rather than the application of artificial intelligence technologies. It emphasises meaningful learning experiences that enable students to construct conceptual understanding, connect knowledge with authentic contexts, and develop critical, creative, collaborative, and reflective thinking skills (Herkama et al., 2022, 2024). In elementary

education, this approach should be implemented through developmentally appropriate learning activities that are concrete, engaging, meaningful, and enjoyable for young learners.

Despite ongoing educational reforms, classroom instruction in many elementary schools remains predominantly teacher-centred, offering limited opportunities for dialogue, reflection, collaboration, and the construction of meaningful knowledge. Although many teachers have begun incorporating diverse instructional methods, learning media, and assessment strategies (Susilawati et al., 2025; Wedi Iswandi & Hendry, 2025), these practices are often implemented independently rather than within a coherent pedagogical framework to improve educational outcomes. As a result, students may actively participate in classroom activities without developing deep conceptual understanding or demonstrating substantial improvements in learning attitudes, self-confidence, communication abilities, and social competencies.

SDN 01 Batunyala and SDN 02 Semayan were selected as the case study sites because both are public elementary schools operating within similar local socio-cultural contexts while facing comparable challenges in improving instructional quality and educational outcomes. Examining these two schools enables a comparative analysis of how deep learning is integrated into lesson planning, classroom implementation, assessment practices, and the institutional factors that facilitate or constrain its implementation. This comparative context is particularly significant because improving the quality of elementary education depends not only on instructional practices but also on teacher competence, school culture, leadership support, and the availability of educational resources.

Recent studies have demonstrated that technology-supported, student-centred, contextual, and inquiry-based learning approaches can significantly enhance students' conceptual understanding, motivation to learn, classroom participation, and higher-order thinking skills. Furthermore, international research consistently emphasizes that artificial intelligence and deep-learning-based educational technologies should function as pedagogical support tools rather than substitutes for teachers' professional judgment and instructional decision-making (Adiguzel et al., 2023; Crompton & Burke, 2023; Haleem et al., 2022; Holmes & Tuomi, 2022; Kasneci et al., 2023; Molenaar, 2022; Ng et al., 2021; Ouyang & Jiao, 2021; Seo et al., 2021). Similarly, recent studies published in SINTA-accredited Indonesian journals highlight the importance of contextual teaching materials, differentiated instruction, inquiry-based learning, local wisdom integration, formative assessment, and project-based learning in improving elementary students' learning outcomes (Dewi & Agustika, 2021; Iriawan et al., 2025; Nafi'ah & Faruq, 2025; Ramlawati et al., 2025; Regi et al., 2025; Saputra et al., 2025).

The novelty of this study lies in its comprehensive examination of deep learning as a strategic framework for improving educational outcomes in elementary schools through a comparative case study of two public elementary schools. While previous studies have primarily examined deep learning from a conceptual perspective or within specific subject areas, this study investigates its integration across instructional planning, classroom implementation, assessment practices, and multidimensional indicators of educational outcomes. By adopting a holistic perspective, the study provides a more comprehensive understanding of how deep learning can enhance the overall quality of elementary education.

Based on the foregoing discussion, this study addresses the following research questions: **(1)** How is deep learning integrated into instructional planning, classroom implementation, and assessment at SDN 01 Batunyala and SDN 02 Semayan? **(2)** How does the integration of deep learning contribute to improving the quality of educational outcomes in these schools? **(3)** What factors support or hinder the implementation of deep learning in both educational settings? Accordingly, this study aims to describe and analyse the integration of deep learning as a strategy to enhance educational outcomes at SDN 01 Batunyala and SDN 02 Semayan.

LITERATURE REVIEW

The Concept of Deep Learning in Elementary Education

Deep learning in education is a pedagogical approach that encourages students to understand concepts thoroughly, connect new information to prior experiences, and apply knowledge in new situations. This concept differs from surface learning, which tends to emphasise memorisation, repetition, and task completion without substantial meaning-making. Deep learning requires teachers to design learning activities that enable students to ask questions, investigate, explain, compare, draw conclusions, and reflect on the learning process. Recent educational literature further stresses that deep learning should be aligned with learner agency, feedback, data-informed reflection, and ethical use of educational technologies (Bond et al., 2024; Chiu, 2023; Janiesch et al., 2021; Khosravi et al., 2022; Tlili et al., 2023; Zhai et al., 2021).

At the elementary school level, deep learning must be translated into learning experiences that are appropriate to children's cognitive, social, and emotional development. Teachers cannot directly demand high-level abstraction without first building concrete contexts, dialogue, visualisation, practice, and simple reflection. Therefore, integrating deep

learning in elementary schools requires a gradual strategy that begins with students' real experiences, familiar learning objects, and relevant problems in the surrounding environment.

Mindful Learning, Meaningful Learning, And Joyful Learning

Mindful learning emphasises students' awareness of their learning goals, thinking processes, emotions, and learning strategies. In elementary classrooms, mindful learning can be realised by opening lessons with clear objectives, reflective questions, simple concentration activities, and opportunities for students to express what they already know and what they want to learn. Through this process, students are not only physically present in the classroom but also mentally and emotionally engaged in learning activities.

Meaningful learning is grounded in the idea that knowledge becomes stronger when students can connect new concepts with prior knowledge, life experiences, local culture, and real-world problems. At SDN 01 Batunyala and SDN 02 Semayan, learning materials can be contextualised through the school environment, family life, village activities, natural phenomena, and social issues that are close to students' everyday experiences. Meaningful learning helps students understand why a subject is important and how it can be used in life.

Joyful learning emphasises positive emotional experiences in the learning process. Joyful learning does not mean that learning loses its depth; rather, it builds a safe, appreciative, challenging, and curiosity-driven atmosphere. Recent studies on gamification, project-based learning, digital game-based learning, and formative feedback show that enjoyment contributes to learning when it remains connected to clear objectives, active reasoning, assessment, and reflection (Christopoulos & Mystakidis, 2023; Hattie, 2023; Panadero et al., 2023; Wang et al., 2022; Yan & Carless, 2022; Zhang & Ma, 2023). Thus, joyful learning needs to be integrated with clear objectives, meaningful activities, and assessment that encourages students' growth.

Elementary Educational Outputs

In this study, elementary educational outputs are understood as the direct and indirect results of the learning process, including knowledge, skills, attitudes, and learning habits. Cognitive outputs include conceptual understanding, the ability to explain ideas, and the ability to apply knowledge. Skill-related outputs include communication, collaboration, problem-solving, and creativity. Affective outputs include learning responsibility, confidence, curiosity, and respect for others. Metacognitive outputs include students' ability to recognise learning difficulties, select strategies, and reflect on their progress.

Within the Merdeka Curriculum and the policy direction of deep learning, the development of meaningful educational outputs requires teachers to design diverse forms of assessment. Formative assessment, portfolios, performance assessment, project rubrics, anecdotal records, and student reflection can complement written tests. Through varied assessment, teachers can obtain a more complete picture of student development and can provide feedback that is relevant to students' needs.

Case Study In Elementary Education Research

A case study is used to understand a phenomenon in depth within its real-life context. In this study, a multisite case study enables the researcher to describe how teachers in two elementary schools understand, plan, implement, and evaluate deep learning. Qualitative case study logic is appropriate because the research focuses on meanings, practices, school-context dynamics, and cross-site patterns rather than experimental control (Braun & Clarke, 2021; Creswell & Creswell, 2023).

Qualitative case study research also requires triangulation to ensure the credibility of findings. Classroom observation data must be connected with teacher interviews, lesson module documents, student assessment results, and activity documentation. Through triangulation, researchers can avoid relying solely on a single source of information and better understand the dynamics of implementation.

Framework For Deep Learning Integration

The framework for integrating deep learning in this study consists of five components. First, analysis of students' needs and school context. Second, formulation of learning objectives that emphasise understanding, skills, and character. Third, design of mindful, meaningful, and joyful learning activities. Fourth, the implementation of formative assessment and constructive feedback. Fifth, reflection and follow-up for the improvement of subsequent learning. This framework serves as the analytical basis for examining deep learning practices at SDN 01 Batunyala and SDN 02 Semayan.

METHODOLOGY

This study adopted a qualitative approach employing a multisite case study design. A qualitative approach was considered appropriate because the study sought to gain an in-depth understanding of how deep learning is integrated into classroom practice, how teachers and students construct meaning through the learning process, and how school contexts shape educational outcomes. A multisite case study design was selected because the research was

conducted in two public elementary schools, namely SDN 01 Batunyala and SDN 02 Semayan, enabling comparisons across different educational settings while exploring a common phenomenon.

The participants consisted of school principals, classroom teachers, subject teachers, and students involved in classrooms implementing deep-learning-oriented instruction. Participants were selected through purposive sampling based on their direct involvement in instructional planning, classroom implementation, and learning assessment. The two research sites were chosen because they shared similar educational contexts while providing relevant settings for investigating instructional practices, assessment processes, and educational outcomes associated with the implementation of deep learning.

Data were collected through classroom observations, semi-structured interviews, document analysis, and documentation. Classroom observations focused on the opening, core, and closing phases of instruction, with particular attention to how teachers promoted student engagement, connected learning materials to authentic contexts, facilitated collaborative discussions, encouraged critical reflection, and provided formative feedback. Semi-structured interviews were conducted to explore participants' understanding of deep learning, instructional planning strategies, classroom implementation, assessment practices, and their perceptions of changes in educational outcomes. Document analysis included examining lesson plans, teaching modules, assessment instruments, student work samples, and school policy documents related to improving instructional quality.

The research instruments comprised observation protocols, interview protocols, document analysis checklists, and an educational outcomes analysis matrix. The observation protocol was developed based on indicators of mindful, meaningful, and joyful learning, as well as principles of formative assessment. The interview protocol included questions addressing instructional planning, classroom implementation, challenges encountered during practice, teachers' professional support needs, and strategies for improving educational outcomes. The document analysis checklist was used to examine the alignment between learning objectives, instructional activities, assessment strategies, and follow-up actions designed to support student learning.

Data were analysed using data condensation, thematic coding, data display, conclusion drawing, and verification, following an iterative qualitative analysis process. Data from each school were initially analysed independently through thematic coding, then compared using cross-case analysis to identify similarities, differences, and recurring patterns in the integration of deep learning across the two schools. To enhance the trustworthiness of the findings, the

study employed source triangulation, methodological triangulation, member checking, and peer debriefing with academic supervisors and fellow researchers (Braun & Clarke, 2021; Creswell & Creswell, 2023; Panadero et al., 2023).

RESULTS AND DISCUSSION

The findings indicate that the successful integration of deep learning begins with systematic instructional planning. Rather than functioning merely as administrative documents, lesson plans should serve as pedagogical frameworks that align learning objectives, classroom activities, assessment strategies, and expected educational outcomes. This finding suggests that the effectiveness of deep learning depends not only on innovative classroom practices but also on teachers' ability to design coherent learning experiences that encourage students to actively construct knowledge. Such an approach is consistent with constructivist learning theory, which emphasises that knowledge is developed through interaction, inquiry, and reflection rather than passive information transfer (Bransford et al., 2000; Vermunt et al., 2023).

The study also demonstrates that planning for deep learning requires teachers to formulate authentic learning objectives and higher-order guiding questions. Questions that encourage students to explain, compare, justify, predict, and evaluate enable learners to develop conceptual understanding rather than memorising isolated facts. These findings support Herkama et al. (2024), who argue that deep learning is characterised by meaningful cognitive engagement that encourages learners to establish conceptual relationships and transfer knowledge to unfamiliar situations. Similarly, Hattie (2023) emphasises that students achieve higher learning outcomes when classroom questioning promotes reasoning rather than factual recall.

Another important finding concerns the implementation of mindful, meaningful, and joyful learning. Mindful learning was reflected in teachers' efforts to focus students' attention, communicate learning objectives explicitly, and encourage students to monitor their own learning progress. These practices align with metacognitive learning theories, which suggest that students learn more effectively when they understand learning goals and regulate their cognitive processes (Panadero et al., 2023). Developing metacognitive awareness from the elementary level is particularly important because it encourages independent learning habits that extend beyond classroom instruction.

Meaningful learning emerged when teachers connected instructional content with authentic situations drawn from students' daily experiences and local environments.

Vol. 18 No. 2 Agustus 2026
p. 410-425
email: elmidadpgmi@uinmataram.ac.id

Contextual examples, environmental observations, and community-based learning activities enabled students to recognise the relevance of school knowledge to real-life situations. This finding supports the principles of contextual learning proposed by Johnson (2002). It aligns with experiential learning theory, which argues that meaningful understanding develops through direct experience, reflection, conceptualisation, and active experimentation (Kolb, 2015). In elementary education, contextual learning is particularly effective because children generally develop conceptual understanding more successfully through concrete experiences than through abstract explanations.

Table 1. Matrix of Deep Learning Integration and Educational Outputs

Component	Deep Learning Integration Practice	Educational Output Indicators
Mindful learning	Learning objectives are written clearly; apperception is based on experience; initial and final learning reflections are conducted.	Students stay focused, understand the learning objectives, and can identify their progress and difficulties.
Meaningful learning	Learning materials are connected to the local environment, real problems, and family or community experiences.	Students can provide examples, explain conceptual relationships, and apply knowledge.
Joyful learning	Activities are varied and include educational games, group work, appreciation, and a safe atmosphere for experimentation.	Students are active, confident, willing to ask questions, and motivated to learn.
Formative assessment	Performance rubrics, portfolios, oral questions, written reflection, and continuous feedback are used.	Teachers obtain evidence of students' cognitive, skill, attitudinal, and metacognitive development.

The findings further reveal that joyful learning contributes positively to classroom participation and student motivation. However, joyful learning should not be interpreted simply as entertaining classroom activities. Instead, enjoyment should function as a pedagogical condition that supports deeper cognitive engagement, collaboration, and reflective thinking. This interpretation is consistent with Fredrickson's (2001) broaden-and-build theory, which suggests that positive emotions expand learners' cognitive flexibility, creativity, and willingness to engage in challenging learning tasks. Therefore, enjoyable learning environments should always align with meaningful instructional objectives rather than emphasising entertainment alone.

The implementation of differentiated instruction and Teaching at the Right Level (TaRL) also emerged as an important strategy for accommodating differences in students' learning readiness. Teachers who adjusted instructional support, learning materials, and task complexity according to students' needs created more inclusive learning environments. These findings correspond with Tomlinson's (2017) differentiated instruction framework, which emphasises adapting content, process, products, and learning environments to maximise each

student's learning potential. Recent studies similarly demonstrate that differentiated instruction significantly improves learning achievement, engagement, and equity in elementary classrooms (Regi et al., 2025; Saputra et al., 2025).

The following table summarises the strategic factors to consider for strengthening deep learning integration at SDN 01 Batunyala and SDN 02 Semayan.

Table 2. Supporting Factors, Obstacles, And Strengthening Strategies

Factor	Strengthening Opportunities	Risks/Obstacles	Follow-Up Strategies
Teacher readiness	Teachers know varied methods and media.	Understanding of deep learning is uneven; assessment still emphasises final scores.	Teacher learning communities, academic supervision, and rubric training.
School support	Principals can build a culture of quality and teacher collaboration.	Time for joint planning is limited.	Lesson study, sharing good practices, and routine review of teaching documents.
Local learning resources	Village environments and local culture support meaningful learning.	Contextual resources are not yet mapped in lesson modules.	Map local assets and develop a cross-subject contextual learning bank.
Student participation	Students respond well to concrete and collaborative tasks.	Ability differences make some students passive.	Differentiate tasks, use peer tutoring, and apply group-based formative assessment.

The study indicates that integrating deep learning contributes to educational outcomes across multiple domains, including cognitive, psychomotor, affective, and metacognitive development. Improvements were evident not only in students' conceptual understanding but also in their communication skills, collaborative abilities, confidence, responsibility, curiosity, and capacity for self-reflection. These findings reinforce the argument that educational quality should not be evaluated solely by standardised examination scores but by multidimensional indicators that reflect students' overall development (OECD, 2023; Vermunt et al., 2023). Such a perspective aligns with contemporary educational paradigms that emphasise competency-based education and holistic student development.

An important contribution of this study is its demonstration that educational outputs can be identified through observable changes in classroom interaction rather than solely through numerical achievement scores. Increased student participation, more frequent questioning, improved reasoning, collaborative problem-solving, and richer teacher feedback all represent meaningful indicators of educational improvement. These findings support Black and Wiliam's (2018) assertion that formative assessment provides stronger evidence of learning progress than summative assessment alone. Consequently, schools should incorporate formative evidence into their systems for evaluating instructional quality.

The findings further indicate that successful implementation of deep learning depends on multiple institutional factors beyond teachers' classroom practices. Teacher commitment, supportive school leadership, collaborative professional culture, and the availability of contextual learning resources all facilitate successful implementation. Conversely, limited understanding of deep learning, insufficient time for collaborative planning, assessment traditions that emphasise final examination scores, and variations in students' readiness pose significant challenges. These findings are consistent with Fullan's (2020) theory of educational change, which argues that sustainable instructional improvement requires simultaneous changes in teacher capacity, school leadership, organisational culture, and professional collaboration.

The comparison between SDN 01 Batunyala and SDN 02 Semayan suggests that schools do not require extensive structural reforms before implementing deep learning. Instead, sustainable improvement can begin with small-scale instructional innovations, such as redesigning selected lessons to align with mindful, meaningful, and joyful learning principles, followed by systematic teacher reflection and collaborative evaluation. Such incremental improvement reflects continuous school improvement models, which emphasise gradual, evidence-based changes rather than large-scale reforms (Hopkins, 2023). This finding provides practical guidance for elementary schools with limited resources seeking to improve educational quality through pedagogical innovation.

From a theoretical perspective, this study extends existing literature by positioning deep learning as a comprehensive pedagogical framework rather than merely a classroom strategy or a technology-related concept. While previous studies have frequently examined deep learning within specific subject areas or associated it with artificial intelligence applications (Kasneci et al., 2023; Rudolph et al., 2023; Su & Yang, 2023), the present study demonstrates that deep learning encompasses instructional planning, classroom implementation, formative assessment, and multidimensional educational outcomes. Consequently, this study contributes to a broader understanding of deep learning as a holistic approach to improving elementary education.

Practically, the findings suggest that schools should develop institutional guidelines to support the implementation of deep learning. Such guidelines may include examples of higher-order questioning techniques, contextual learning activities, formative assessment rubrics, student reflection templates, and locally relevant project-based learning models. These resources can promote consistency across classrooms while strengthening teachers' pedagogical competence and shared professional understanding. Establishing professional

learning communities and conducting regular lesson study activities would further facilitate continuous improvement in instructional practice.

Despite these contributions, this study has several limitations. The research was conducted in only two public elementary schools, limiting the transferability of the findings to other educational contexts. Furthermore, the qualitative design focused primarily on understanding implementation processes rather than quantitatively measuring improvements in educational outcomes. Future studies could adopt mixed-methods or longitudinal designs to examine the long-term effects of deep learning on students' academic achievement, critical thinking, communication skills, collaborative competencies, and metacognitive development across diverse educational settings.

CONCLUSION

The integration of deep learning at SDN 01 Batunyala and SDN 02 Semayan represents a strategic effort to enhance the quality of elementary education. This approach frames learning as mindful, meaningful, and joyful, enabling students not only to master content but also to develop understanding, critical thinking, confidence, collaboration, and positive learning character. Deep learning can be implemented through instructional planning, guiding questions, contextual activities, formative assessment, feedback, and continuous reflection. Teachers act as designers of learning experiences, managing classrooms that are safe, focused, and active, while connecting lessons to real life. Improved outcomes are evident in conceptual understanding, questioning skills, reasoning ability, social competence, responsibility, and metacognitive awareness. The study recommends establishing teacher learning communities, internal guidelines, coaching-based supervision, and diverse assessments. Future research may extend this work by quantitatively measuring changes in educational outputs or by developing deep learning models tailored to local elementary school contexts.

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