

## Implementation of the Deep Learning Approach in Elementary School Mathematics Learning

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### ABSTRACT

Challenges such as limited facilities, insufficient professional training, and resistance to pedagogical innovation hinder the effective implementation of advanced learning approaches in elementary education. This study aims to analyze how the deep learning approach is implemented in mathematics instruction at the elementary school level. A qualitative research design with a case study method was employed. Participants included 29 elementary school teachers—9 from Pagerwangi I Public Elementary School and 20 from Madrasah Ibtidaiyyah Al-Haq, West Java—selected through purposive sampling. Data were collected using an observation instrument designed to assess the implementation of deep learning practices. Data analysis followed the Miles and Huberman model, involving data reduction, presentation, and conclusion drawing. The findings show that the average teacher competency score in implementing the deep learning approach was 78.06%, categorized as "good." The implementation was structured around three key stages: initial, core, and closing activities. Initial activities focused on student readiness, motivation, and contextual connections. Core activities emphasized conceptual understanding, application, and the development of higher-order thinking skills. Closing activities involved reflection, feedback, assessment, and planning for subsequent learning. The study concludes that teachers demonstrated a solid alignment between deep learning principles and instructional practice. However, achieving optimal implementation requires further development of teachers' conceptual understanding and emotional and social readiness. Enhancing these areas is essential for sustaining meaningful, mindful, and joyful learning experiences in mathematics education at the elementary level. Future professional development programs should address these dimensions to support continued pedagogical transformation.

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## 1. INTRODUCTION

The concept of deep learning in education was first introduced by Marton and Säljö (1976), who differentiated between two distinct learning approaches: surface learning and deep learning. Surface learning typically involves rote memorization and passive reception of information, whereas deep learning is characterized by the learner's active engagement in constructing meaning, connecting concepts, and applying them in various contexts (Nafi & Faruq, 2025). Subsequent theoretical development by Biggs and Collis through the SOLO (Structure of the Observed Learning Outcome) taxonomy further elucidates the continuum of understanding, ranging from unistructural to extended abstract levels. This taxonomy underlines the importance of progressing from basic knowledge acquisition to complex, integrated thinking (Biggs & Collis, 1982).

Deep learning has attracted the attention of educators and policymakers worldwide, with successful implementation reported in countries such as Norway and Finland. In Indonesia, deep learning has recently gained momentum as part of the Merdeka Curriculum, which emphasizes learning that is holistic, personalized, and meaningful (Feriyanto & Anjariyah, 2024). The deep learning approach promotes a learning environment that is mindful, meaningful, and joyful, encouraging students and teachers to engage in a holistic educational experience that integrates thought, emotion, heart, and action.

According to Fullan et al. (2018), deep learning implementation should be mindful of each student's unique background, capabilities, and interests. Teachers are not merely knowledge transmitters but are required to create rich learning environments that foster student agency and develop 21st-century skills. These skills—commonly referred to as the 6Cs: character, citizenship, collaboration, communication, creativity, and critical thinking—are central to the deep learning framework and provide a foundation for preparing learners to thrive in an increasingly complex world.

Siswanto and Susetyawati (2024) argue that deep learning places the learner at the center of the educational process by emphasizing exploration, reasoning, and reflection over memorization and passive learning. Students are guided to construct a deeper understanding of subject matter by making connections between prior knowledge and new information. Moreover, Rao and Rao (2024) highlight that deep learning requires attention not only to explicit subject content but also to the underlying thought processes, cultural dimensions, and implicit knowledge embedded within learning experiences.

In the context of Indonesia's *Kurikulum Merdeka* (Independent Curriculum), deep learning aligns with the emphasis on essential competencies and a focused curriculum. The objective is not to cover a large quantity of material but to ensure that selected competencies are mastered in depth. This principle is particularly important in elementary school mathematics education, where foundational understanding is critical. According to Andrews (2025), learning becomes meaningful when content is connected across disciplines, linked to students' real-life experiences, and taught at a pace that allows reflection and deep conceptual engagement.

The Ministry of Education has underscored the importance of shifting from surface to deep learning approaches in primary and secondary education (Nafi'ah & Faruq, 2025). This shift is supported by research indicating that students who engage in deep learning demonstrate better conceptual understanding, stronger motivation, and greater capacity to transfer knowledge (Terrenghi et al., 2019). Johnson and Gallagher (2021) further state that deep learning is not only about knowing but about doing—applying knowledge in real-life contexts, solving problems creatively, and building a habit of critical inquiry.

In mathematics education, the deep learning approach provides significant potential for enhancing students' conceptual understanding and problem-solving abilities. Deep learning encourages the use of real-world problems, exploratory learning tasks, and personalized instruction to engage students in meaningful ways (Naseer et al., 2024; Villegas-Ch et al., 2024). Research by Hattie and Donoghue (2016) confirms that instructional strategies rooted in deep learning—such as active learning, visualization, and manipulatives—significantly boost student achievement in mathematics, particularly when aligned with constructivist principles that view knowledge as actively constructed through experience.

Despite these advantages, traditional mathematics instruction in Indonesian elementary schools remains largely focused on surface learning, where students memorize formulas and procedures without understanding the underlying concepts (Depaepe et al., 2020). Teaching practices often rely on teacher-centered lectures, emphasizing uniform instruction and high-stakes assessment. This approach lacks differentiation and does not foster meaningful learning experiences. As Kohtala (2017) observes, when learning is disconnected from students' lives, it fails to inspire curiosity, engagement, or joy.

These issues emphasize the urgent need for pedagogical transformation in elementary school mathematics. Teachers must adopt more student-centered approaches that focus on deep, connected, and contextual learning. By integrating real-life problems and facilitating inquiry, teachers can help students view mathematics as a relevant and engaging discipline. Chaojing (2023) supports this view, asserting that deep learning enhances students' analytical and critical thinking abilities, especially in tasks requiring higher-order thinking.

The success of deep learning implementation depends largely on teachers' pedagogical design capacity. As Zhang and Wong (2021) argue, teachers must act as learning designers who co-create educational experiences with students, adapting curriculum objectives to suit diverse learner profiles. This includes selecting appropriate instructional strategies, creating meaningful learning activities, and modeling lifelong learning attitudes. Teachers must be equipped to cultivate curiosity, collaboration, and critical inquiry among their students.

Teachers also need to design learning that promotes exploration, problem-solving, and cognitive engagement. Q. A. Zhang (2024) emphasizes that deep learning should be meaningful, conscious, and joyful. While several studies have explored this triadic principle conceptually, there remains a need for empirical investigations on how it is practiced in classrooms, particularly in mathematics education at the elementary level.

Moreover, deep learning not only strengthens cognitive outcomes but also fosters character education and values-based learning. Hendrianty et al. (2024) argue that deep learning develops competencies required for solving contextual, real-world problems. It equips students with the ability to synthesize information, construct logical arguments, and consider diverse perspectives—skills that are essential for both academic and social success. Similarly, Dixit et al. (2021) emphasize the importance of deep learning in enhancing students' problem-solving and decision-making abilities.

At the elementary school level, the implementation of deep learning can lay the foundation for strong numeracy, literacy, and humanistic education. Anggun et al. (2025) advocate for a contextual and human-centered approach to mathematics that values student voice and experience. Deep learning in mathematics encourages students to discuss, collaborate, and explore across subjects, fostering interdisciplinary understanding and a love of learning.

Despite its promise, the literature reveals that much of the discourse surrounding deep learning remains conceptual and superficial, particularly in the Indonesian context. There is a critical need for empirical studies that examine how deep learning is implemented in specific learning domains such as mathematics, and how it translates into classroom practice. As such, further research is necessary to clarify the framework, principles, and pedagogical applications of deep learning in various educational settings.

Therefore, this study aims to analyze the implementation of the deep learning approach in elementary school mathematics instruction. Specifically, it investigates how teachers apply deep learning principles in classroom practice, what competencies are demonstrated, and what factors influence successful implementation. The study seeks to provide both theoretical insights and practical guidance to enhance the quality of mathematics instruction through a deep learning framework. Ultimately, this research contributes to the ongoing discourse on effective, equitable, and meaningful learning in Indonesia's education system.

## 2. METHODS

This study uses a qualitative approach with a descriptive case study method to analyze the implementation of the deep learning approach in elementary school mathematics learning. The case study method is a series of scientific activities carried out intensively, in detail, and in depth about a program, event, or activity to gain in-depth knowledge about the event (Rashid et al., 2019). The focus of this study is to analyze the implementation of the deep learning approach in elementary school mathematics.

The subjects in this study were selected using a purposive sampling technique. The subjects in this study involved 9 teachers of Pagerwangi I Elementary School, West Bandung Regency, and 20 teachers of Madrasah Ibtidaiyyah Al-Haq Margahayu, Bandung Regency, West Java. This research was conducted from December 2024 to April 2025. These teachers teach from grades I to VI and have at least two years of teaching experience. Furthermore, implementation at both schools is based on IHT activities. The approval procedure for the observation and mentoring of deep learning implementation was previously carried out by obtaining ethical permits from the education offices in the Bandung and West Bandung regions.

Research data were collected using a structured observation instrument designed to assess the implementation of deep learning in mathematics instruction. The data collection involved participatory observation, during which researchers directly observed teaching practices that incorporated deep learning principles. The observation focused on three core components: mindful learning, meaningful learning, and joyful learning. This approach aimed to evaluate the extent to which these principles were integrated into the learning process.

The observation instrument captured information across different stages of the lesson, including students' initial conditions, the learning process itself, and activities leading up to the conclusion of the session. Specific attention was given to the introductory, core, and closing activities carried out by teachers during peer teaching sessions. These stages were analyzed to identify how mathematical concepts were introduced, explored, and reinforced.

The instrument consisted of several assessment indicators, which were rated using a binary checklist system. Observers marked each item with a check in the "Yes" column if the indicator was observed, or in the "No" column if it was not. This format allowed for systematic documentation of teaching behaviors and instructional strategies aligned with deep learning principles, providing a clear picture of classroom practices in relation to the research objectives.

Two people conducted observations: an external facilitator and the principal, using observation instruments that had been developed, discussed, and disseminated to the target teachers. Each day after the observation, a joint reflection session with all teachers was held to discuss findings, identify causes, and plan follow-up improvements.

The instrument used in the implementation of observation and mentoring activities for the implementation of the deep learning approach for teachers is an instrument that has been developed by the resource person and activity mentor, referring to various literature, such as: academic manuscripts, Michael Fullan's book, Ian Goodfellow's book, and John D. Keleher's book. The instrument contains an identity column that mainly contains essential material components in addition to the main material and other identities. The instrument also contains a description of the findings on the condition of students before, during, and after the learning takes place. The learning activities that are the focus of observation and are relevant to the concept of deep learning consist of 25 activity items divided into preliminary activities consisting of five activity items, core activities consisting of 13 activity items, and closing activities consisting of seven activity items.

Data analysis is the process of processing, interpreting, and drawing conclusions from data that has been collected in order to answer the problem formulation or test the research hypothesis. The collected data were analyzed using the Miles and Huberman Model starting from the data reduction stage, data presentation, and conclusion drawing (Salmona & Kaczynski, 2024). This model emphasizes the relationship between collected data and contextual interpretation and meaning.

### 3. FINDINGS AND DISCUSSION

The implementation of deep learning emphasizes the creation of a mindful, meaningful, and joyful learning atmosphere. This process is carried out through holistic and integrated intellectual, ethical, aesthetic, and kinesthetic learning. The implementation of deep learning is inseparable from the role of teachers. Teachers are the frontline in determining whether the learning approach is successful or not. Therefore, this study obtained data related to teacher competency in implementing deep learning.

Data related to teacher competency maps in implementing deep learning were obtained from distributing questionnaires to collect the required data. A teacher competency map is a comprehensive description of the abilities, skills, attitudes, and knowledge possessed by a teacher. These competencies lead to carry out their professional duties effectively in accordance with national education standards. Teacher competency maps related to the implementation of the deep learning approach were obtained from teachers at Madrasah Ibtidaiyyah Al-Haq and Pagerwangi 1 Elementary School in all classes. This competency map was targeted at 20 teachers at Madrasah Ibtidaiyyah Al-Haq and nine teachers at Pagerwangi 1 Elementary School. Competency maps are obtained through a process of observation and mentoring on a scale of 100. The following is a teacher competency map related to the implementation of deep learning.

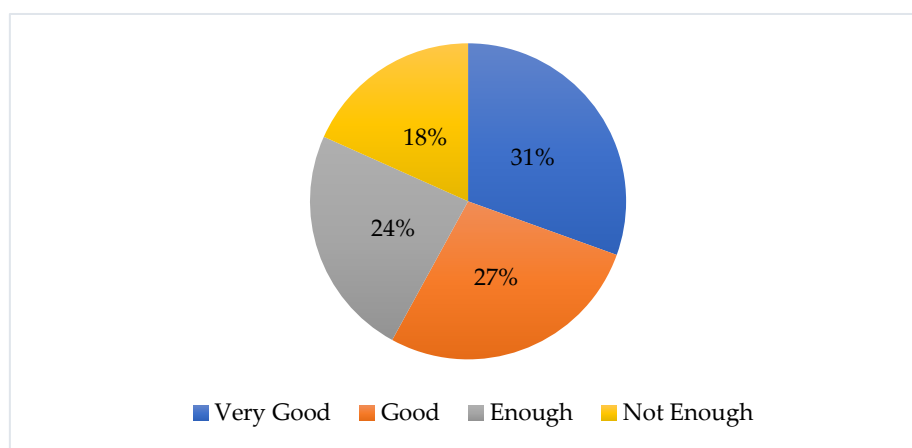
**Table 1.** Competency map of teachers related to the implementation of the deep learning approach

No.	Teacher's Name	School	Scale Score	Category
1.	T1	MI Al-Haq	76.00	Good
2.	T2	MI Al-Haq	80.00	Good
3.	T3	MI Al-Haq	88.00	Very good
4.	T4	MI Al-Haq	88.00	Very good
5.	T5	MI Al-Haq	76.00	Good
6.	T6	MI Al-Haq	88.00	Very good
7.	T7	MI Al-Haq	92.00	Very good
8.	T8	MI Al-Haq	84.00	Good
9.	T9	MI Al-Haq	72.00	Enough
10.	T10	MI Al-Haq	80.00	Good
11.	T11	MI Al-Haq	76.00	Good
12.	T12	MI Al-Haq	80.00	Good
13.	T13	MI Al-Haq	48.00	Not enough
14.	T14	MI Al-Haq	52.00	Not enough
15.	T15	MI Al-Haq	68.00	Enough
16.	T16	MI Al-Haq	60.00	Not enough
17.	T17	MI Al-Haq	56.00	Not enough
18.	T18	MI Al-Haq	84.00	Good
19.	T19	MI Al-Haq	68.00	Enough
20.	T20	MI Al-Haq	84.00	Good
21.	T21	Pagerwangi I Elementary School	92.00	Very good
22.	T22	Pagerwangi I Elementary School	92.00	Very good
23.	T23	Pagerwangi I Elementary School	92.00	Very good
24.	T24	Pagerwangi I Elementary School	80.00	Good
25.	T25	Pagerwangi I Elementary School	80.00	Good
26.	T26	Pagerwangi I Elementary School	80.00	Good
27.	T27	Pagerwangi I Elementary School	84.00	Good
28.	T28	Pagerwangi I Elementary School	84.00	Good
29.	T29	Pagerwangi I Elementary School	80.00	Good
Average			78.06	Good

Table 1 shows that the competency map results of teachers at Madrasah Ibtidaiyyah Al-Haq and Pagerwangi 1 Elementary School in West Bandung Regency regarding the implementation of the deep learning approach showed an average score of 78.06, or categorized as good. In summary, all teachers at both schools were able to implement the deep learning approach well. This finding is in line with research by Prastyo and Santos (2025), which stated that most teachers have implemented the deep learning approach well in the classroom. Teachers demonstrated readiness for the deep learning approach. Similarly, other research shows that teachers understand deep learning as an approach that emphasizes in-depth conceptual understanding (Mahardika & Jaya, 2025). Deep learning has proven to increase active student engagement. Although teachers face challenges in implementing deep learning, they demonstrate enthusiasm and readiness to adapt to it. Furthermore, 20 elementary school teachers in Surakarta demonstrated improved skills. The increase is in the form of designing and implementing deep learning strategies that focus on critical, creative, and playful thinking (Atmojo et al., 2025).

Several empirical studies and practice reviews have shown that when prospective teachers or teachers apply deep learning principles, practical assessments show improvements in teaching quality and student learning outcomes. These principles include awareness, meaning, and enjoyment (Wang et al., 2023; Weng et al., 2023). Furthermore, research on the implementation of deep learning approaches in elementary schools shows positive outcomes on students' conceptual understanding and teachers' teaching practices (Wibowo et al., 2025). Teachers who implement deep learning steps receive positive practice evaluations from observers and demonstrate improvements in discussion facilitation and authentic tasks. Further support is provided by survey results and studies on readiness to adopt deep learning pedagogy. Research by Fitrah et al. (2025) reports that training and practical supervision (coaching during real-life teaching) are strongly correlated with better practicum assessment results.

In addition to the table, these findings are detailed in a chart. The chart's specifications include the average percentage of teacher competency, categorized as very good, good, enough, and not enough. The chart is presented in Figure 1.



**Figure 1.** Teacher competency chart according to category.

From Figure 1, 24% were categorized as sufficient, and 18% as not sufficient. This indicates that some teachers are still not maximizing their implementation of deep learning. Some notes are as follows. T9 received a fair rating because the teacher was less expressive and less dynamic in teaching, and did not provide a supportive learning environment. The teacher prioritized mental activity over physical activity. Teacher T9 needed to experience teaching in a senior class with fewer male students. Furthermore, four teachers, T13, T14, T15, T17, and T18, received a low rating of inadequate. Generally, the teachers taught charismatically and expressively, but the lessons still appeared rigid, lacked dynamics, and were less engaging. The final hour of learning felt less warm, lively, and cheerful. The

teachers were unable to manage the one-hour lesson to facilitate student-centered learning. Their teaching performance generally did not align with the principles of deep learning.

This situation reflects a gap between delivery style and pedagogical substance, which are key characteristics of deep learning. Charismatic and expressive teaching styles can indeed capture students' attention, but do not necessarily guarantee deep learning. Deep learning requires teachers to foster students' conceptual understanding, rather than simply being passive recipients. In this context, teachers need to emphasize the performative aspect by implementing interactive learning strategies. This aligns with the findings of King et al. (2020), who found that teacher-centered instruction tends to produce only surface learning. This surface learning is a shallow understanding that is quickly forgotten. On the other hand, deep learning requires student engagement in the process of connecting, interpreting, and reflecting on concepts.

Furthermore, in the implementation of deep learning, findings of poor teacher practice are also evident in less dynamic classes, particularly during the final learning period. Research findings indicate that some teachers are unable to optimally manage student learning energy and motivation. According to Deci and Ryan (2000), students' intrinsic motivation can be maintained if they feel they have autonomy, competence, and connectedness in the learning process (Self-Determination Theory). When learning remains instructional and teacher-centered, students lose opportunities for active participation, dialogue, and creativity. A "lack of warmth and cheerfulness in the classroom" can also reflect a lack of a positive emotional climate in learning. According to Hamre and Pianta (2006), a positive emotional connection between teachers and students plays a crucial role in creating a productive and sustainable learning environment. Therefore, teachers need to balance cognitive and affective aspects through strategies that enliven the classroom atmosphere.

Furthermore, teacher beliefs also influence the success of in-depth learning implementation. Their role is crucial in time management (Isnaeni et al., 2025; Shi & Lan, 2024). First, teachers who believe that learning is an active, constructive process tend to position students as active learners. They are more open to reflective and participatory approaches. Teacher beliefs are a strong determinant of teaching practices because they influence how teachers interpret experiences and make pedagogical decisions. In this context, teachers who have positive beliefs about students' potential for critical thinking will be more successful in consistently implementing deep learning.

Second, time constraints remain a major obstacle to optimal learning implementation. The deep learning approach requires sufficient time to allow space for the exploration of ideas, reflection, and in-depth dialogue. However, the reality in schools shows that teachers are forced to shorten the reflective learning process. This pressure is evident in the administrative burden, the tight curriculum targets, and the rigid allocation of class hours (Mabunda, 2023). As a result, the potential of deep learning is sometimes reduced to learning that merely "appears active" but fails to address the essence of critical thinking. In addition to time constraints, curriculum pressures also have a significant impact on the quality of deep learning implementation. Many teachers feel bound by administrative demands and the need to complete all basic competencies. So, pedagogical innovation is often hampered.

Although some teachers experience mistakes related to deep learning, the majority of teachers have mastered the main components of deep learning. The mastery of deep learning demonstrated by the scores in Table 1 is part of the teacher competency map. The teacher competency map demonstrates the teachers' commitment to implementing deep learning, as it yields robust data. The high scores are attributed to the teachers' thorough implementation of each stage of deep learning, particularly its core components. The core components of learning consist of preparatory/initial activities, core activities, and final activities. These core components are the core of educational activities, aligning with the Minister of Education and Culture Regulation Number 22 of 2016 concerning standards for elementary and secondary education processes. These activities form a unified whole, creating meaningful learning experiences for students. Each learning stage implemented by teachers at Madrasah Ibtidaiyyah Al Haq and Pagerwangi I Public Elementary School is outlined in Tables 1, 2, and 3.

**Table 2.** Activities with a deep learning approach in preliminary activities.

No	Learning Activities
1.	Preparing students physically and mentally (praying, checking attendance, learning equipment, ice breaking, etc.)
2.	Motivate learning contextually by presenting current and future issues, crises, or problems of the universe.
3.	Asking questions to connect the learning material to be studied with previous material and students' daily experiences
4.	Conveying learning objectives and the focus of learning materials (essential materials)
5.	Delivering learning activity plans (e.g., individual, group work, conducting observations, etc.)

The learning activities as shown in Table 2 show the preliminary activity process that has been carried out by the teacher in implementing deep learning. These activities include preparing students physically and psychologically, providing instruction, asking guiding questions, communicating learning objectives, and planning learning activities. Preliminary activities prioritize preparing students mentally, emotionally, and physically for the learning process. These findings align with general theories about initial learning activities. Previous theories have discussed preliminary activities focused on developing students' motivation and enthusiasm for learning. Furthermore, teachers need to connect prior knowledge with the material to be learned. They must also convey the objectives and benefits of the learning process. Furthermore, they need to explain the learning and assessment steps. This research aligns with other findings that teachers focus more on students' mental and physical preparation when preparing for learning. Teachers also need to motivate and raise students' awareness of the importance of the lessons they are learning (Indrawan & Alim, 2022).

Other findings support this study, which found that opening activities typically begin with preparing and ensuring students are ready to learn and receive material from the teacher. In addition, other researchers added that the spark can focus students, motivate them, and convey learning objectives (Oktary et al., 2023). The initial stage of learning also connects the material to students' previous experiences (apperception). Apperception is carried out so that students can fully understand the material (Badelah, 2021). Further support is obtained from the relevance of previous research to this study. Opening activities simultaneously and significantly influence student learning quality and achievement, making them more disciplined and motivated to continue learning (Adinoto, 2019).

In addition to discussing initial activities, core activities in learning are a long process that must be carried out by both teachers and students. This process involves many activities according to the initial plan. The findings of this study are presented in a table of learning activities within the core activities.

**Table 3.** Activities with a deep learning approach to core activities

No	Learning Activities
1.	Stimulate each student to ask questions to arouse their curiosity
2.	Asking exploratory questions about the essential material that is the focus of the learning material.
3.	Creating a learning environment that "invites" the involvement of educators and students (multi-perspective and multi-perception)
4.	Creating a learning environment that is full of collaboration about the focus of the learning material being studied
5.	Facilitating students to learn information or knowledge slowly and in greater depth
6.	Building bridges or bridging student learning activities so that they remain in line with learning objectives or the focus of the learning material
7.	Linking learning materials in one subject with other subjects (cross-disciplinary)
8.	Respond to students' learning needs by approaching them, recording learning findings, and providing constructive feedback.
9.	Appreciate the process, results, student excellence, and provide motivation to students during the learning process with motivating actions or words.

10. Involving ICT as a learning medium and learning resource to obtain diverse information about learning materials.
11. Creating procedures, routines, learning methods that allow for learning flexibility
12. Linking the focus of learning material with kauniyah verses to recite together and kauniyah verses to recite together
13. Facilitating the development of each student's talents during free time during learning.

Core activities reflect a pre-planned learning process. Core activities include activities that utilize learning methods, models, and media. The core learning process is tailored to students' needs. Core learning activities play an important role in creating learning conditions without memorizing facts but understanding concepts, applying them, and developing higher-order thinking skills. Core activities also serve as a form of exploration and elaboration in learning. Students are actively involved in this exploration process, observing phenomena, asking questions, experimenting, or seeking information on their own. This aligns with the characteristics of deep learning, which prioritizes active student involvement and the activation of initial cognitive schemas. Literature studies show that when students are given the opportunity to explore in meaningful contexts, motivation and cognitive engagement increase (Apriliyana, 2025).

Another equally important stage is elaborating on the knowledge acquired during learning. This stage is essential for deep learning because it enables students to think at a higher level, synthesizing and evaluating information. A study of Design-Based Learning (DBL) has shown that methods incorporating this active stage can enhance critical thinking and problem-solving skills as part of deep learning (Weng et al., 2023). By designing core learning activities through engaging stages, teachers create an environment that supports deep learning. For example, students are active, concepts are deeply understood, and reflection and knowledge transfer occur. Initial activities can arouse curiosity; allow students to "process" the material, and ensure that understanding does not stop at a superficial level. Research by Miller and Krajcik (2019) shows that the use of Project-Based Learning (which includes exploration and elaboration stages) significantly supports deep knowledge in use. That is, the model helps students to solve problems in real life.

After the core activities, the next process is the closing activity. This activity is the final stage of the learning process. Its function is to conclude the learning process systematically. This is done by providing reinforcement, reflection, and ensuring the achievement of learning objectives. According to the Minister of Education and Culture Regulation No. 22 of 2016 concerning the Standards for Elementary and Secondary Education Processes, the closing activity is an activity carried out to "Close learning activities by reflecting, providing feedback on the learning process and outcomes, and planning follow-up activities." The results of the closing activities in this study are displayed in Table 4.

**Table 4.** Activities with a deep learning approach in closing activities

No	Learning Activities
1.	Facilitate and guide students to conclude the lesson material to gain a shared understanding and ensure new knowledge as a development of old knowledge.
2.	Facilitate and guide students to reflect on the learning process and results and conduct self-assessments
3.	Provide feedback to all students based on findings during the learning process and learning outcomes that have been achieved
4.	Conduct a final formative assessment to obtain initial information as a basis for the next meeting and a summative assessment to determine whether learning objectives have been achieved.
5.	Giving literature reading assignments to strengthen understanding of the material that has been studied and to practice the learning material in real life.
6.	Convey the focus of the learning material that will be studied at the next meeting
7.	Closing the lesson by conveying words of wisdom or pearls of advice that are meaningful to students (power closing)

Based on Table 4, the closing activity has several important components: reflection, assessment and feedback, conclusions, follow-up, and closing with a positive impression. This research is supported by previous research, which explains that closing activities include learning reflection, conclusions, and planning follow-up actions (Rini & Rahmawati, 2025). In the context of deep learning, closing activities are crucial because they support students' metacognitive reflection, strengthen knowledge transfer, and provide space for conceptual reinforcement. Closing activities are not just a formality at the end of learning, but a crucial phase to ensure understanding, build reflection, and strengthen deep learning.

Through reflection, shared conclusions, and appropriate follow-up, closing activities help students internalize the meaning of learning and prepare for the next lesson. This study's findings align with previous research that suggests that reflection as part of the closing phase can strengthen deep learning (Arvatz et al., 2025). Other research shows that final comments from lesson study frameworks provide in-depth feedback to teachers and that the "closing" process in post-lesson discussions plays a crucial role (Seino & Foster, 2021). Kropp (2024) discusses reflection as part of the closing phase, and that reflection strategies at the end of the learning process can provide feedback for teachers and students while improving learning effectiveness.

These findings indicate that teacher competency develops not only technically but also through school culture, leadership style, and access to effective training and professional development. Teachers' ability to prepare students demonstrates that they operate within a school culture that supports reflection, empathy, and active participation. According to Stoll et al. (2006), a collaborative school culture plays a significant role in developing deep learning-based pedagogical competencies. Schools with this culture typically emphasize not only academic achievement but also value the learning process and emotional experiences of students. A positive, supportive, and respectful school climate allows teachers to experiment with student-centered approaches without excessive administrative pressure (Hargreaves & Fullan, 2012).

Consistent implementation of deep learning is also closely linked to the leadership role of the principal. Instructional leadership creates a climate that fosters teachers' courage to try innovative strategies, engage in open reflection, and center the learning process on students (Hallinger, 2011). Teachers who are able to systematically are more likely to work under visionary and supportive leadership. Principals not only assess teacher performance but also mentor, facilitate, and provide a professional discussion space for teachers to understand the philosophy of deep learning (Leithwood & Jantzi, 2006).

A teacher's ability to integrate cognitive, affective, and reflective aspects into learning also indicates exposure to quality professional training. According to Darling-Hammond et al. (2020), teacher training is not just a short workshop-style training, but rather a long-term professional learning experience that is contextual, collaborative, and based on real-life classroom practice. Teachers who participate in training typically develop reflective skills, understand the relationship between learning theory and teaching practice, and adapt methods to student characteristics. In other words, teacher success is not solely the result of individual abilities, but the cumulative outcome of the professional learning process.

This interpretation also suggests that the implementation of deep learning is effective when there is alignment between institutional policies and classroom learning practices. If schools have adopted reflective, evaluative, and character-based policies, it will be easier for teachers to consistently implement in-depth learning strategies (OECD, 2018). In this context, teachers are not merely implementers of the curriculum, but key actors in pedagogical transformation. Deep learning is not just a learning strategy, but a manifestation of a culture that upholds the values of humanity, collaboration, and sustainable growth. Overall, this research demonstrates that teachers' success in deep learning is not solely a result of personal abilities, but a product of a supportive educational ecosystem.

#### 4. CONCLUSION

Based on the findings, this study concludes that elementary school teachers have demonstrated the ability to implement a deep learning approach effectively, as seen in structured learning phases – from initial activities that prepare students mentally, emotionally, and physically, to core activities emphasizing conceptual understanding, application, and higher-order thinking, and finally, to closing activities focused on reflection, assessment, and feedback. These practices indicate a shift toward more meaningful, student-centered learning that fosters critical and reflective thinking. The results suggest that deep learning not only enhances classroom engagement and cognitive development but also supports teacher professional growth and curriculum advancement aligned with the Independent Curriculum. However, the study has several limitations. It involved only two schools, limiting the generalizability of the findings, and was conducted over a short period, which may not fully reflect the long-term impact of deep learning on student outcomes. Variability in teacher pedagogical competence and a limited ability of the observation instrument to capture students' internalization of concepts may have affected the consistency and depth of the results. Therefore, future research is encouraged to adopt a quantitative or mixed-methods approach to examine the measurable impact of deep learning on student achievement and critical thinking across diverse educational settings. Additionally, further qualitative studies could explore how teachers and students engage in reflective practices within deep learning environments to provide deeper insights into the pedagogical processes involved.

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