

TEACHERS' UNDERSTANDING OF DEEP LEARNING IN THE INTEGRATION OF MORAL MESSAGES IN MATHEMATICS LEARNING

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ABSTRACT

This study investigates teachers' conceptual understanding of deep learning and its integration with moral values in mathematics instruction at SDN 221 Babakan Sentral. The research is framed by 21st-century educational demands that require learning to be both academically meaningful and character-building. A gap remains in empirical studies that explain how teachers interpret deep learning reflectively and how moral values are systematically embedded in mathematics classrooms. A qualitative case study design was adopted with a sixth-grade teacher as the primary participant, supported by the school principal and two students. Data were collected through semi-structured interviews, participatory observations, and document analysis, and were analyzed using Miles and Huberman's interactive model. The results show that the teacher's understanding of deep learning is still limited to basic conceptual and cognitive aspects. Classroom implementation remains focused on surface-level activities, while reflective and ethical components key features of deep learning have not been fully applied. Although values such as honesty, responsibility, and cooperation are introduced, they are not consistently integrated into the instructional design. The study concludes that teachers need strengthened reflective pedagogical competence and structured value-based learning designs. It recommends continuous professional development programs emphasizing reflective pedagogy to support the integration of academic and moral goals in mathematics learning.

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INTRODUCTIONS

Teachers' understanding of deep learning principles is a fundamental component in ensuring the effectiveness of mathematics instruction at the elementary level. In contemporary pedagogy, teachers do not merely transmit information but act as facilitators who guide students to construct knowledge through reflective, critical, and meaningful processes (Pujawati et al., 2025). Within the demands of 21st-century education, learning is expected to

strengthen academic performance while simultaneously fostering advanced thinking skills, value awareness, and the development of moral character (Kemendikbudristek, 2022; Ozmantar et al., 2025). Deep learning becomes a relevant approach because it emphasizes meaningful understanding, reflective processes, and conceptual connections (Backfisch, Schilling, et al., 2024), allowing teachers to embed moral values applicable in daily life (Everett, 2024; Seah, 2020).

Despite this potential, mathematics learning in many educational systems remains mechanistic and outcome-oriented. Students are frequently directed toward memorizing formulas rather than engaging in conceptual reasoning, limiting opportunities for reflective thinking and moral development (Sølvik & Glenna, 2022a). Field observations at SDN 221 Babakan Sentral, Bandung, indicate similar patterns: learning is dominated by conventional strategies prioritizing exam completion and practice tasks, while values such as honesty, responsibility, and cooperation are not explicitly integrated (Seah, 2020). This situation demonstrates a clear discrepancy between national policy directions especially the Pancasila Student Profile and actual classroom practice.

Theoretically, deep learning is rooted in Ausubel's constructivism and meaningful learning theory, which underscores the integration of new information with existing cognitive structures. This approach requires teachers to create a learning environment that is challenging, relevant, and personally valuable for students (Dimopoulos & Koutsampelas, 2024). By integrating cognitive, social, and moral dimensions, deep learning supports a holistic and equitable educational process aligned with the vision of the Merdeka Curriculum, which promotes balanced development of competence and character.

The implementation of deep learning depends significantly on teachers' ability to design reflective, collaborative, and value-based learning while maintaining ethical awareness to balance pedagogical innovation and moral responsibility (Kovač et al., 2025; Radzi & Mahmud, 2025). Teacher morality serves as an essential mediator between technological competence and readiness for the Industrial Revolution 4.0 era, ensuring that pedagogical innovation does not undermine ethical foundations (Zulnaidi et al., 2024).

However, several elementary teachers still perceive deep learning merely as an effort to master technical content, without acknowledging its affective and moral dimensions. Mathematics, in fact, has strong potential as a medium for internalizing values such as honesty, responsibility, and perseverance through reflective and contextual learning experiences (Cui & Teo, 2023; Lawson et al., 2023). Previous research predominantly focuses on deep learning to enhance academic mastery and critical thinking (Admiraal & Kittelsen Røberg, 2023; Konstantinidou & Kyriakides, 2022), but there are still few who explore teachers' understanding of implementing deep learning as a moral-pedagogical approach.

Existing research focuses on deep learning for cognitive competence, yet limited studies explore its moral integration in mathematics education, especially at the elementary level in Indonesia. Thus, meaningful mathematics learning can only be realized when teachers possess both a deep understanding of deep learning principles and a moral commitment to implement them meaningfully (Kovač et al., 2025; Ozmantar et al., 2025). Based on this rationale, this study aims to analyze teachers' understanding of deep learning and identify the forms of moral integration in mathematics learning at SDN 221 Babakan Sentral. The findings are expected to contribute conceptually to the development of pedagogical competence and teacher character in the 21st century and serve as a foundation for designing contextual, value-oriented professional development programs so that learning becomes not only intellectually rigorous but also humanizing (Asif, 2020; Radzi & Mahmud, 2025; Zulnaidi et al., 2024).

RESEARCH METHODS

This research is applied with a qualitative method through a case study approach. Based on the opinion (Creswell, 2012), case study enables in-depth exploration of a bounded system in this case, a teacher's understanding of deep learning and the integration of moral messages in mathematics instruction at SDN 221 Babakan Sentral. The phenomenon was examined within its real-life context through prolonged engagement and multiple data sources, allowing for a holistic understanding of instructional values and reflective practice.

The research was conducted at SDN 221 Babakan Sentral, Bandung City, in October 2025. The site was

intentionally selected because the school has actively promoted value-based pedagogy and innovations aligned with deep learning principles. The primary participant was one Grade VI teacher, selected through purposive sampling based on her direct role in mathematics instruction and her consistent practice of embedding moral values. The decision to focus on a single teacher is methodologically appropriate in case study research, as it allows for analytic depth, contextual richness, and a nuanced understanding of reflective meaning-making (Yin, 2018). To strengthen data triangulation, the principal and two students were included as supporting informants.

Data were collected through (1) in-depth semi-structured interviews, (2) participatory classroom observations, and (3) document analysis of lesson plans, teacher reflection notes, and student work. Data analysis followed a thematic coding strategy adapted from Braun and Clarke (2006), involving familiarization, initial coding, theme development, and refinement. Analytical rigor was ensured through member checking, triangulation across data sources, and the maintenance of an audit trail throughout the research process.

RESULT AND DISCUSSION

The results of the study show that the understanding of grade VI teachers on the principles of deep learning in mathematics learning has developed, but its application is still limited. Teachers understand deep learning as a process that focuses on active engagement and mastery of concepts, but the reflective and affective aspects have not been fully realized in learning activities. This condition is in line with the findings of Pujawati et al. (2025) who explain that the success of deep learning is greatly influenced by teacher readiness, institutional support, and the ability to adapt learning approaches to student needs.

In practice in the classroom, some teachers are still oriented towards academic learning outcomes. This phenomenon is in line with Sølvik & Glenna (2022) who affirm that deep learning is achieved when teachers are able to create reflective interactions and provide space for students to relate mathematical concepts to everyday experiences. Observations at SDN 221 Babakan Sentral show that teachers are still focusing on achieving exam scores and have not consistently encouraged reflection on students' thinking processes.

The barriers to the application of deep learning can be explained through insights (Fauskanger & Bjuland, 2020). They stated that time constraints, administrative demands, and large numbers of students often reduce teachers' opportunities to carry out in-depth reflective activities. In fact, reflection is at the core of deep learning because it helps students connect learning experiences with conceptual understanding (Everett, 2024). Increasing teachers' reflective awareness is needed so that mathematics learning can take place in a more meaningful way.

In addition to the reflection aspect, moral values such as honesty, responsibility, and cooperation have begun to be applied in learning activities, although they are still implicit. These results reinforce the view of Zulnaidi et al. (2024) that morality acts as a link between teachers' professional abilities and the effectiveness of learning involving technology and social values. Morality helps teachers consider ethical decisions in learning management, especially when facing the demands of efficiency and technological change.

The relationship between teachers' understanding of deep learning and the ability to integrate moral values is also strengthened by (Radzi & Mahmud, 2025). They show that inclusive pedagogy requires teachers to have the capacity to be innovative, empathetic, and sensitive to student diversity. In this study, grade VI teachers tried to cultivate moral values through group work and process-based evaluation, but did not have a systematic approach to associate these values with mastery of mathematical concepts. The need to strengthen teachers' ethical competence was also conveyed by Ozmantar et al. (2025), who highlighted the importance of moral agency, which is the ability of teachers to weigh and account for ethical decisions in teaching activities.

According to Kovač et al. (2025), deep learning will lose its humanistic meaning if it is carried out without a basis for moral responsibility. Asif (2020) added that moral education becomes effective when adjusted to the local social and cultural context. In the Indonesian elementary school environment, the application of moral values can be directed to strengthening character in accordance with Pancasila and the culture of mutual cooperation. Teachers who understand the moral dimension of deep learning find it easier to adapt learning to the character and needs of students.

The professional aspect of teachers is a determining factor in the success of the implementation of deep learning, as the balance between work demands, professional resources, and teacher satisfaction levels affects their motivation to adopt complex and reflective learning strategies. Admiraal & Kittelsen Røberg (2023) assert that teachers who feel supported by principals and peers tend to be more motivated to try new approaches, such as Problem-Based Learning. In contrast, teachers who are burdened with administrative demands and lack professional support tend to maintain conventional methods.

Teachers' professional experience and career stage also affect the ability to understand and implement deep learning. Early career teachers need intensive guidance to understand the reflective, integrative, and moral dimensions, while experienced teachers find it easier to relate academic concepts to the context of values (Admiraal & Kittelsen Røberg, 2023). In addition, teachers' motivation in maintaining their profession and job satisfaction also has an effect, Al'Abri et al. (2022) show that teachers who have high motivation to leave the profession tend to have low job satisfaction, so the adoption of complex learning strategies is limited.

Teachers' cross-cultural exposure and pre-service global experience has been shown to enrich their pedagogical skills as well as critical awareness. Huang et al. (2023) state that study abroad programs enhance teachers' cross-cultural competence, while Wu & Li (2023) emphasize global engagement helps pre-service teachers critique human capital narratives and broaden pedagogical perspectives. Awareness of gender bias in assessment is also important, as Doornkamp et al. (2022) found that gender stereotyped beliefs can influence academic evaluation, so reflective understanding and cross-cultural experiences strengthen teachers' ability to design equitable and inclusive math learning.

The development of reflective dialogue between teachers and students has been proven to improve students' critical thinking skills and ethical awareness, because through discussion students can evaluate not only how to solve problems, but also the moral and social values contained in the thinking process (Cui & Teo, 2023). The integration of moral values requires teachers to have high ethical sensitivity and social awareness, which is reinforced by the practice at SDN 221 Babakan Sentral (E. Cownie et al., 2023; F. Cownie et al., 2023). A collaborative culture through the Professional Learning Community (PLC) strengthens teachers' ability to adapt learning strategies that foster deep understanding and moral integrity (Konstantinidou & Kyriakides, 2022; Lawson et al., 2023). By strengthening teachers' professionals through reflection, metacognitive awareness, and pedagogical collaboration, mathematics learning can improve conceptual understanding while shaping students' character and ethical awareness (Backfisch et al., 2024; Hermawan & Kusniasari, 2023; Tak et al., 2025; Zhang, 2021).

CONCLUSION

The study demonstrates that the Grade VI teacher possesses a foundational understanding of deep learning, particularly its emphasis on conceptual mastery and the avoidance of rote memorization. However, the reflective, integrative, and moral dimensions of deep learning have not yet been fully internalized in instructional practice. Moral values such as honesty, responsibility, cooperation, and perseverance were introduced during mathematics learning but remained at an external behavioral level without systematic integration into conceptual reasoning. The effectiveness of deep learning with moral content is shaped by teacher professionalism, organizational support, and reflective awareness. Teachers with higher metacognitive awareness and strong involvement in the school's collaborative culture demonstrate a more coherent connection between mathematical reasoning and character formation.

These findings reinforce theoretical perspectives that position deep learning as a multidimensional construct encompassing cognitive, reflective, and moral domains. The results extend existing literature by illustrating how moral values function not merely as supplementary components but as integral elements that influence students' reasoning processes in mathematics. The study also highlights the importance of teacher metacognition and moral agency as theoretical anchors for understanding how educators interpret and enact deep learning-oriented pedagogy. Additionally, the findings emphasize that deep learning is most effective when supported by a school culture that values reflective dialogue, ethical sensitivity, and professional collaboration.

The study underscores the need to strengthen teacher professional development through structured reflective training that integrates deep learning principles with moral and character-based education. Schools may benefit from

developing Professional Learning Communities (PLCs) that facilitate ongoing dialogue, peer mentoring, and collaborative lesson study. Curriculum designers are encouraged to balance academic achievement with moral formation by embedding ethical reasoning within mathematical tasks and reflective activities. Moreover, teachers should be supported in designing contextual learning that connects mathematical concepts to real-life moral and social situations, thereby promoting meaningful and character oriented learning.

This study involved a single teacher within one school context, which limits the generalizability of the findings. Future research should include a broader range of participants across multiple schools to explore variations in reflective practice, moral integration, and deep learning implementation. Further studies can also focus on developing and testing a structured teacher training model that systematically integrates deep learning with ethical and character education in mathematics. Longitudinal research is recommended to examine how sustained reflective engagement and school-level support influence the evolution of teachers' deep learning competencies over time.

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