Berkala Ilmiah Pendidikan
Volume 6, Number 1, March 2026

Kuras Institute
scidac plus

Analysis of Teachers' Challenges in Implementing Deep Learning in High Schools: A Qualitative Study

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Abstract

This study is driven by the imperative of 21st-century educational transformation, which necessitates deep learning approaches to foster students' critical thinking and profound comprehension. Despite its importance, applying deep learning pedagogies encounters multifaceted challenges in practice. Consequently, this research aims to analyze current deep learning implementation and identify the primary barriers educators face in schools. A descriptive qualitative methodology was employed, involving school principals and teachers as participants. Data were systematically gathered through in-depth interviews, classroom observations, and document analysis, and subsequently evaluated using data reduction, data display, and conclusion-drawing techniques. The findings reveal that while deep learning principles are being introduced through interactive discussions, reflective practices, and contextualized real-world learning, their implementation remains suboptimal. Significant constraints include inadequate information technology infrastructure, varied levels of student comprehension, overwhelming administrative burdens on teachers, and insufficient family support. Despite these hurdles, teachers demonstrate resilience by adapting innovative, context-specific instructional strategies. Ultimately, the successful institutionalization of deep learning relies heavily on educator readiness, comprehensive infrastructure support, and robust synergy among schools, families, and policymakers. This study contributes to the broader educational discourse by offering empirical insights into the pedagogical realities of deep learning and by providing actionable recommendations for stakeholders to elevate the quality of global teaching and learning environments.

Keywords: Deep Learning, Teacher Roles, Learning Constraints

INTRODUCTION

Education in schools, as a planned, directed, and integrated process of guidance in developing students' potential to master knowledge, values, and skills, plays a crucial role in shaping a nation's future. Within schools, learners with all their potential are nurtured to become high-quality human resources capable of generating creativity and contributing to the development of national culture, enabling them to survive and thrive (Chai & Kong, 2017; Berkat et al., 2025). In addition, education today emphasizes not only knowledge acquisition but also the development of 21st-century skills such as critical thinking, collaboration, and creativity. Professional development for educators has consistently been a key factor in enabling educational transformation. To enhance educators' competencies in 21st-century teaching and learning, multiple aspects must be considered, including knowledge, beliefs, and, more recently, teachers' design capacity (Tsai, 2012; Ekizer & Yıldırım, 2023). This highlights the need for continuous learning so that teachers can adapt their instructional practices to evolving educational demands. Professional development involves transforming

teachers' knowledge into practice for the benefit of their students. It has been suggested that professional learning communities provide a viable means for educators to collaboratively construct knowledge and experience the transformative changes required (Kong & Song, 2013; Salo et al., 2024). Through such collaboration, teachers can share experiences, reflect on practices, and improve the overall quality of teaching and learning.

Over the past decade, the global education landscape has undergone complex, systemic changes. Advances in technology, shifts in workforce demands, and the growing emphasis on 21st-century skills have driven fundamental changes in perspectives on the learning process (Kain et al., 2024; Mor, 2025). In Indonesia, transformations in national education policy have led to regulatory disruptions, characterized by the rapid replacement of previous policies with new ones. This dynamic context requires teachers to possess technological proficiency, 21st-century competencies, and pedagogical readiness to adopt innovative learning approaches (Sukmayadi & Yahya, 2020; Fitrah et al., 2025). Education is no longer viewed merely as a static process of information transmission, but rather as a comprehensive effort to develop students' intellectual, social, and emotional capacities. Consequently, education systems are required to move away from content-centered approaches toward learning models that are reflective, collaborative, and contextual. One pedagogical response to this shift is the emergence of deep learning pedagogy, which emphasizes transformative learning experiences through active student engagement, authentic problem-solving, and meaningful use of technology (Weng et al., 2023). Deep learning pedagogy refers to a student-centered and transformative approach to learning, distinct from the concept of deep learning in artificial intelligence. It arises from the need to engage learners in meaningful and rigorous learning activities that encourage the use of relevant cognitive strategies (Kovač et al., 2025; Chu, 2025). According to Dong & Zeng (2020), this approach not only focuses on content mastery but also on the development of critical thinking, collaboration, creativity, and communication skills. Rather than emphasizing rote memorization, students are encouraged to construct understanding, connect knowledge across disciplines, and solve real-world problems. Consequently, the role of the teacher shifts from merely delivering information to becoming a facilitator, instructional designer, and reflective leader of learning.

Deep learning is achieved when students not only master subject content but also actively engage in social interactions that enrich their learning experiences (Sugden et al., 2021; Rui et al., 2025). This is supported by a study showing that implementing deep learning (DL) can increase student learning outcomes by 91.9% (Zadeh & Ferrari, 2026). In approaches that prioritize deep learning, technology and online platforms can play a highly significant role (Wu, 2024; Leba et al., 2025). The successful implementation of deep learning requires adequate support, including continuous training, the establishment of learning communities, and the integration of innovative approaches such as digital technology and project-based learning, all of which can strengthen teachers' capacity to implement deep learning effectively (Sudirman & Pandang, 2025; Gabut et al., 2026). According to Meeks et al. (2013), deep learning is a process of acquiring knowledge that is not only understood but also applied, transferred to other contexts, and sustained in solving real-world problems. This approach emphasizes critical thinking, collaboration, creativity, and problem-solving in everyday life rather than mere memorization. The concept of deep learning goes beyond conventional education systems, as it engages learners in meaningful learning experiences relevant to the demands of the modern world (Shearer et al., 2015; John, 2026). The distinction between surface learning and deep learning was first introduced by Marton & Säljö (1976). This approach has been widely studied because

of its close relationship with levels of understanding and student learning outcomes. To better understand this concept, it is often described along a continuum ranging from deep learning to surface learning. Within this continuum, deep learning is positioned at one end and is closely associated with intrinsic motivation (Wang et al., 2025). A deep approach is characterized by learning efforts focused on seeking meaning and achieving comprehensive understanding (Greasley & Ashworth, 2007; Leenknecht et al., 2019). Students who adopt this approach tend to engage actively with the material, processing and developing information extensively in ways that support the formation of personal understanding and meaningful learning (Ellis et al., 2008; Flood & Wilson, 2008). Furthermore, students who engage in deep learning are generally driven by intrinsic motivation, namely the desire to learn due to an interest in the learning process itself or in the subject matter being studied (Otermans et al., 2026). They strive to understand the underlying structure and meaning of concepts, critically evaluate evidence, and use it carefully. They also actively connect new knowledge with prior knowledge. This process involves higher-order cognitive skills, such as identifying analogies and constructing theories (Dolmans et al., 2016). New knowledge is not only connected to prior knowledge, but also to personal experience (Kember et al., 2010; Madubun et al., 2026). In addition, students attempt to identify key patterns and processes and engage in critical reflection on what they have learned (Yumurtaci, 2023; Jamaludin et al., 2025).

The surface learning approach emphasizes the mere accumulation of information. It typically relies on memorization, avoids personal meaning-making, and involves minimal reflection on learning experiences (Turvey, 2006). In line with this, Thebe (2018) explains that surface learning is a process of repeating or reproducing knowledge rather than integrating it, with a tendency to fragment information into separate parts, categorize it rigidly, and inadequately connect facts, ideas, and theories. This approach is often found in teacher-centered learning systems, where knowledge is directly transmitted from the teacher to students. Learners who adopt this approach tend to depend on external guidance and focus more on the superficial aspects of tasks within their learning environment (Ryan & Louie, 2007; Li et al., 2022). In addition, surface learning is usually driven by extrinsic motivation, such as the desire to achieve high grades (Young & Dewey, 2018). According to Donnison & Penn-Edwards (2012), this approach is also characterized by a lack of effort to understand the information beyond the text truly, for example, merely memorizing symbols without understanding their meaning. Generally, students who adopt this approach are motivated by a desire to complete tasks or by fear of failure (Golightly & Raath, 2015; Dadiara et al., 2026). Teachers who tend to guide students toward deep learning design lessons, set tasks, and provide feedback and challenges that encourage the development of deeper cognitive processing (Smith & Colby, 2007; Geitz et al., 2016). The concept of deep learning emphasizes the efforts of both teachers and students not only to understand knowledge at a surface level but also to develop and sharpen critical thinking, reflection, and collaboration skills, enabling deep learning to be effectively implemented. However, in practice, deep learning still faces various challenges. Teachers, as the main actors in the learning process, are often not fully prepared to adapt to new models. Some teachers are still accustomed to conventional approaches that focus primarily on completing the curriculum without providing space for students to think critically and explore deeper meanings in learning. Psychological factors, such as comfort with traditional methods, become significant barriers to adopting more meaningful learning practices. In addition, limited training, lack of socialization, and insufficient supporting facilities further slow down the process of educational transformation (Palinussa et al., 2025).

On the other hand, students face various challenges that hinder their deep engagement in learning. Factors such as limited learning resources, socioeconomic conditions, and psychological pressures often affect students' motivation, concentration, and active participation in learning. Students from low socioeconomic backgrounds, for instance, often have limited access to learning resources, reducing their opportunities to engage in meaningful learning experiences. Similarly, students experiencing social or emotional pressures often struggle to adapt to learning approaches that require independence, critical thinking, and active participation. Findings from observations and interviews at SMA Negeri 1 Seram Bagian Barat further reveal that these student-related challenges are closely intertwined with institutional constraints, particularly the limited availability of information technology infrastructure and teachers' varying levels of readiness in implementing deep learning. Although some teachers have participated in training programs, their ability to integrate deep learning effectively into classroom practice remains limited. In addition, support from families and local government is not yet optimal, especially in providing adequate learning facilities and preparing students for more active learning approaches. While previous studies have highlighted the importance of deep learning in enhancing students' competencies, there remains a lack of contextual understanding of how student conditions, teacher readiness, and infrastructural support interact to influence their implementation at the school level. Therefore, this study seeks to address this gap by examining these interconnected factors to provide a more comprehensive, context-specific understanding of the challenges of implementing deep learning.

METHODS

Research Design

This study employs a qualitative, descriptive research design. A descriptive qualitative approach is a research method aimed at understanding social phenomena in depth by emphasizing meaning, processes, and interpretations of realities that occur in the field. The data collected in this study are not numerical; rather, they consist of words, narratives, and documents that describe actual conditions contextually. This approach enables researchers to gain a comprehensive understanding of the phenomenon under investigation, yielding findings that present a thorough, in-depth picture. In this study, a descriptive qualitative approach is used to examine in depth the implementation of deep learning and the various challenges teachers face in its application in the school environment. The selection of this approach is based on the consideration that the issues being studied cannot be measured quantitatively, but instead require an in-depth understanding of the experiences, perceptions, and practices of teachers and school stakeholders. This study seeks to explore how teachers understand the concept of deep learning, how they implement it in the learning process, and the factors that both support and hinder its implementation. Thus, this approach is highly relevant, as it can uncover the complex and dynamic realities in the field of education. This aligns with Lim (2025), who states that qualitative research is used to examine the natural conditions of objects, with the researcher serving as the primary instrument in data collection.

Research Sample

The subjects of this study included the principal, supervisors, and teachers, totaling 47 individuals who were directly involved in the learning process. The principal was selected as an informant due to their strategic role in policy-making and in managing instructional programs within the school. Meanwhile, teachers were chosen because they are the primary implementers of classroom instruction. The informants in this study were determined using purposive sampling, which involves selecting participants based on specific criteria

considered capable of providing relevant and in-depth information. These criteria included having teaching experience, understanding the concept of deep learning, and being directly involved in implementing this approach in the classroom. Thus, the data obtained are expected to be highly valid and credible.

Data Collection Technique

The data collection techniques used in this study included in-depth interviews, observation, and documentation. The interviews were conducted in a semi-structured manner, with the researcher preparing a set of guiding questions while allowing informants to elaborate on their responses based on their experiences and perspectives. Through these interviews, the researcher explored teachers' understanding of deep learning, the strategies they use in teaching, and the challenges they face in instructional practice. Observations were conducted directly in the school environment, particularly during the learning process. These observations aimed to obtain empirical data on how deep learning is implemented in the classroom, including teacher–student interactions, the methods used, and the level of student engagement in learning. Through observation, the researcher verified the interview data, thereby increasing the accuracy and validity of the findings. In addition, documentation techniques were used to complement the research data. The collected documents included instructional tools such as lesson plans, teaching modules, learning materials, and other relevant materials for implementing deep learning. These documents served as supporting evidence to strengthen the research findings. To ensure data validity, this study employed triangulation techniques, including both source triangulation and methodological triangulation. Source triangulation was conducted by comparing data from multiple informants, including the principal and teachers. Meanwhile, methodological triangulation was carried out by comparing data from interviews, observations, and documentation. Through triangulation, the data are expected to be highly trustworthy and scientifically rigorous.

Data Analysis

The data analysis process in this study was carried out gradually and continuously, from the initial stage of data collection to the final stage of the research. Data analysis employed an interactive model consisting of three main stages: data reduction, data display, and conclusion drawing. Data reduction is the process of selecting, simplifying, and focusing on data relevant to the research objectives. At this stage, the researcher selected important data and categorized them based on specific themes or categories. The next stage is data display, which involves organizing the data into a systematic descriptive narrative so that it can be easily understood. Data presentation may take the form of textual descriptions, tables, or matrices that illustrate relationships among the data. Through data display, the researcher can identify patterns, trends, and relationships among the variables under study. The final stage is conclusion drawing and verification. At this stage, the researcher interprets the analyzed data and draws conclusions based on the research findings. The conclusions are provisional and may evolve as additional data are obtained. Therefore, the verification process is ongoing to ensure that the data are valid and well support the conclusions. By using this descriptive qualitative approach, the study is expected to provide a comprehensive overview of the implementation of deep learning in schools, including the various dynamics involved. In addition, this research is expected to provide in-depth insights into the challenges teachers face and the strategies they employ to address them. The findings of this study are expected to contribute to the development of more innovative and meaningful teaching practices and to serve as a reference for schools, government, and other stakeholders in improving the quality of education, particularly in the implementation of deep learning.

RESULTS AND DISCUSSION

Results

Education in the 21st century requires students to possess higher-order thinking skills such as critical thinking, creativity, collaboration, and communication. This shift in the educational paradigm demands that teachers move from teacher-centered instruction to student-centered learning. Surface learning is characterized by low engagement in learning activities aimed at achieving Intended Learning Outcomes (ILOs). This approach primarily focuses on the passive reception of information and new ideas without critical evaluation, and it tends to store knowledge as isolated, disconnected pieces (Howie & Bagnall, 2013). As a result, the understanding formed is superficial, short-lived for examination purposes, and does not support deep conceptual mastery or long-term retention. This type of learning is often rigid, fragmented, and less engaging, and may foster apathy and a fixed mindset (entity theory). In contrast, deep learning involves critically analyzing new information by connecting it to previously understood concepts, principles, and theories. This approach leads to more meaningful and lasting understanding, enabling knowledge to be applied in various problem-solving situations. Therefore, deep learning plays an important role in improving both the quality of understanding and the accurate application of knowledge (Das, 2021). Thus, this approach aligns with the demands of the Merdeka Curriculum, which focuses on the holistic development of students' competencies and character.

Implementation of Deep Learning

The fundamental philosophy of the Merdeka Curriculum is to explore learning topics through higher-order thinking, greater complexity, deeper mastery, and stronger connections to real-life situations. In this process, students are expected to go beyond mere memorization and engage in mental processes at the levels of analysis, reflection, and application. Ideally, this is how learning should occur; however, in practice, it is often difficult to implement and realize effectively in the classroom. Students are expected not only to memorize, understand, and apply knowledge, but also to reflect more deeply on the learning process and integrate it with their daily lives. Therefore, the distinction between surface learning and deep learning can be illustrated in Table 1. Deep learning requires students not only to memorize material but also to understand, apply, and reflect on knowledge in relation to real-life contexts (Samuels-peretz et al., 2016). Based on field research findings, particularly interviews with one of the teachers, it was revealed:

> *"We begin the learning process by using prompting questions that connect the lesson material with students' real-life experiences, so that they become more active during learning. This aligns with the view that teachers should not merely deliver material conventionally in front of the class, but must also guide students to actively explore, engage in discussions, and reflect on knowledge based on what they have experienced, seen, heard, and lived. In this way, learning becomes more collaborative and contextual, especially in project-based activities."*

During observations, it was found that teachers had begun implementing these practices. However, there are still limitations in supporting deep learning, particularly in classroom information technology facilities and in the effective use of available technology. In addition, student readiness varies-some students are well-prepared, while others show little engagement in the learning process. These conditions make it challenging for teachers to fully implement deep learning for all students at SMA Negeri 1 Seram Bagian Barat. The findings indicate that students have not yet fully received or engaged with learning materials through a deep learning approach. Therefore, teachers need to participate in further training, particularly from academics or university lecturers who have strong expertise and experience in deep learning approaches. Such training is expected to enhance teachers' capacity so that, in the future, students will be more motivated to

participate in classroom learning using deep learning approaches. During interviews, teachers also noted that some students still do not fully understand the material. Nevertheless, given current educational demands, deep learning must still be implemented, necessitating that teachers continue to apply this approach despite existing challenges.

Table 1. The Attributes of Deep and Surface Learning

	Surface learning (SL)	Deep learning (DL)
Knowledge	SL increases information about a subject by using fewer pertinent facts and shallow integration with preexisting knowledge.	DL results in a deeper understanding of a subject, with a grasp of fundamental principles.
Application	SL leads to the application of new knowledge to specific tasks and problems, but with limited transferability.	DL leads to the application of newly understood principles in a variety of different contexts and situations.
Persistence	The information obtained through SL persists only for a short time.	The DL outcomes lead to long-lasting personal changes.
Metacognition	Inadequate prior knowledge makes students adopt SL.	Rich, relevant prior knowledge leads students to proceed with DL.

Sources: (Shearer et al., 2015).

Teachers' Challenges in Implementing Deep Learning

Teachers play a central role in implementing deep learning (DL) in schools, particularly by helping students develop a deeper understanding, as learning is not limited to mere memorization. Based on interview findings, teachers are required to implement DL in the classroom, necessitating adjustments to their lesson plans (RPPs). Previously, lesson plans were often focused on conventional approaches; however, they must now be redesigned to align with deep learning principles that emphasize collaboration, critical thinking, and reflection. Despite these efforts, various challenges persist, both in designing lesson plans based on deep learning and in implementing DL in the classroom. In addition, teachers at SMA Negeri 1 Seram Bagian Barat have begun cultivating reflective habits among students, such as asking them to write personal learning notes or to summarize the material they have studied. This effort aligns with the goals of deep learning, namely to develop critical literacy and higher-order thinking skills (Cleveland-Innes & Emes, 2005). Although teachers play a crucial role, they still face several obstacles in implementing deep learning. These challenges are summarized in Table 2:

Table 2. Challenges in Implementing Deep Learning

Challenges	Findings
Limited Supporting Facilities (Information Technology)	Not all classrooms are equipped with supporting tools such as internet access, LCD projectors, or digital learning media
Students' Lack of Understanding	Students are accustomed to conventional learning, making it difficult for them to adapt to methods that require critical thinking.
Teacher Workload	Teachers must adapt learning tools from previous lesson

	plans to deep learning formats, which increases their workload.
Environmental Support	Not all parents understand the importance of deep learning, resulting in limited support in students' home environments.

These challenges indicate that implementing deep learning (DL) is not merely a technical issue but also involves psychological, social, and structural factors. The application of DL requires teachers to design interactive learning strategies, facilitate discussions, and provide opportunities for students to construct new knowledge independently. Teachers are also expected to innovate, for example, by using project-based learning (PBL), case studies, and group discussions that encourage critical thinking. To support effective learning, it is essential to align the curriculum with instructional materials. In line with Lynch et al., the implementation of deep learning not only emphasizes knowledge transfer but also fosters students' character development and proactive attitudes in facing learning challenges. Based on interview findings, one of the main obstacles to teachers' implementation of DL is the information technology system, where supporting technological facilities remain inadequate. Therefore, it is necessary to provide sufficient technological support both in and out of the classroom. This finding is consistent with studies indicating that limited technological resources and digital readiness are major barriers to implementing exploration- and project-based learning in schools. Under such conditions, teachers are required to make adjustments, such as simplifying tasks and reducing the number of questions, to ensure that learning activities remain within the allocated time.

The findings of this study reveal that teachers experience significant challenges in implementing deep learning (DL), particularly in preparing instructional materials and conducting meaningful learning activities. These results can be interpreted through the lens of constructivist theory, which emphasizes that knowledge is actively constructed through interaction, experience, and social engagement. Deep learning aligns closely with constructivist principles, as it requires students to engage in inquiry, exploration, and reflection rather than passive learning (Darling-Hammond et al., 2020; Dahl & Mørch, 2025). Therefore, the difficulty teachers face in designing teaching modules reflects not only technical limitations but also the complexity of shifting from teacher-centered to student-centered learning approaches. Furthermore, the challenges related to student participation and the integration of various learning media are consistent with recent research on active learning. Student engagement is a critical factor in achieving meaningful learning outcomes, particularly in deep learning environments (Long et al., 2025). The present findings indicate that student participation levels significantly influence the success of DL in meeting students' needs. However, the difficulty teachers face in fostering such engagement suggests that the transition toward active, contextual learning requires both pedagogical competence and sustained practice (Zhang et al., 2024). Several studies have shown that the use of DL approaches can support the development of higher-order cognitive skills, such as critical and integrative thinking (Lee & Choi, 2017; Hobbins et al., 2020). In addition, the finding that teachers require more time and preparation to design DL-based instruction is strongly supported by recent studies. Effective deep learning implementation requires careful alignment between learning objectives, instructional strategies, and assessment, which increases teachers' workload and planning time.

This supports the current study is finding that teachers' readiness remains moderate, and that time constraints are a major barrier to implementation. The challenges identified outside the school environment, particularly limited parental understanding, can be explained through a socio-ecological perspective. Learning is influenced by interactions across multiple environments, including family and community contexts (Ajayi et al., 2022). When parents lack an understanding of deep learning approaches, students may receive limited

support at home, which can affect their readiness to engage in higher-order thinking activities. This finding is consistent with previous research emphasizing the importance of parental involvement in supporting student learning outcomes (Kantova, 2024). Despite these challenges, teachers' optimism toward deep learning aligns with self-efficacy theory, which suggests that positive beliefs about one's teaching capabilities can influence instructional innovation and persistence (Tschannen-Moran & Woolfolk, 2001). The observed increase in student engagement, questioning behavior, and reflective thinking supports previous findings that deep learning promotes higher-order thinking skills and student autonomy (Torshizi & Bahraman, 2019). However, the findings also indicate that these benefits are not yet fully realized due to contextual constraints. Moreover, the issues of limited technological facilities and time management identified in this study are widely reported in recent literature. Limited access to educational technology and the shared use of resources, such as LCD projectors, can hinder the effectiveness of innovative pedagogies. In addition, deep learning requires extended time for exploration, discussion, and reflection, which is often difficult to accommodate within standard classroom schedules. As a result, reflective activities are sometimes neglected, even though they are essential for consolidating learning.

CONCLUSION

This study concludes that the implementation of deep learning in high schools has begun to promote more meaningful, student-centered learning through activities such as discussion, reflection, and contextual problem-solving; however, its application is not yet optimal due to several persistent challenges. The findings reveal that teachers play a central role as facilitators, designers, and motivators in deep learning. However, they face constraints related to limited readiness, increased workload in preparing instructional materials, time limitations for reflective activities, inadequate technological facilities, and insufficient parental support at home. These results indicate that the success of deep learning is influenced not only by classroom pedagogical practices but also by broader environmental and institutional factors. From a theoretical perspective, this study advances educational theory by strengthening constructivist and socio-ecological frameworks, emphasizing that knowledge construction occurs through active engagement, prior knowledge, and interaction across multiple learning environments. In terms of practical implications, the findings highlight the importance of continuous teacher professional development, adequate technological infrastructure, effective time management strategies, and stronger collaboration between schools and families to support students' readiness and engagement in deep learning. Furthermore, this study suggests that future research should focus on developing and testing specific intervention models, such as structured teacher training programs, technology-supported learning designs, and school–family partnership strategies, in order to more effectively address existing challenges and enhance the sustainability of deep learning implementation across diverse educational contexts.

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