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Application of Deep Learning Approaches in Mathematics Learning

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ABSTRACT:
Indonesia is experiencing a learning crisis that has occurred over the past five years. The results of the 2022 PISA test show that Indonesia has experienced a decline in the aspects of mathematics, reading, and science. The decline in education quality is influenced by students' low interest in learning. Meanwhile, the low interest in learning among students is a result of the increasingly widespread technological development. The deep learning approach has emerged as an alternative formulated by the Minister of Basic and Secondary Education for the need for more effective and quality learning. In this regard, this study aims to describe the application of a deep learning approach in mathematics learning. This study uses a literature review method that examines several articles. The results of this study indicate that mathematics learning with a deep learning approach requires careful preparation, starting from the planning, implementation, and assessment stages. The learning carried out still adheres to the principles of deep learning, namely mindful learning, meaningful learning, and joyful learning. Mathematics learning with a deep learning approach adopts the Bloom's Taxonomy and SOLO Taxonomy syntax with the aim of creating deep and meaningful learning.

Key words: *Deep Learning, Learning Mathematics, Mindful, Meaningful, Joyful.*

INTRODUCTION

Indonesia is facing a learning crisis that has occurred over the past five years. The quality of education has declined, students' interest in learning has decreased, and there has been a rise in student behavior that does not reflect that of a learner. This is evidenced by the results of PISA 2022 (OECD 2022), which show that Indonesia's average performance has declined in mathematics, reading, and science. Indonesian students' performance in mathematics and science ranks 71st out of 80 participants, while their reading ability ranks 72nd. This stems from the lack of effective teaching practices in schools, where teachers do not prioritize critical and creative thinking in problem-solving. Most teachers in educational institutions still rely on traditional teaching methods, dominated by lecturing (Rahmandani et al. 2025). This situation is further exacerbated by students' low interest in learning, especially in mathematics.

The low interest of students in learning mathematics is a result of the increasingly widespread and unlimited use of gadgets. The advancement of sophisticated technology has a significant impact on various aspects of real life, including the implementation of learning (Mutmainnah, Adrias, and Zulkarnaini 2025). This creates the urgency for the development of the independent

curriculum as a guideline for learning in Indonesia. The learning model in the independent curriculum is student-centered learning, where teachers are free to use learning strategies that match the characteristics of their students and act as facilitators in the learning activities. Teachers are not only faced with the learning process itself but also with various 21st-century educational challenges, which are expected to equip students with critical, creative, and collaborative thinking skills (Syafi'i 2023). However, in practice, the existing curriculum often fails to accommodate these needs.

Transforming the learning paradigm has become a necessity to face the challenges of the 21st century. Educational innovation must be implemented as a solution to the evaluation of the existing learning processes. For this reason, the Minister of Primary and Secondary Education (Mendikdasmen), Mr. Abdul Mu'ti, has developed a deep learning approach to be integrated into the implementation of the independent curriculum. He emphasized the need for education that focuses on deep understanding, where students not only comprehend but also critically analyze the knowledge they possess in a clear and concise manner (Nurul et al. 2025). The goal of the deep learning approach is to transform conventional teaching paradigms into more profound learning experiences. This aligns with research (Suwandi, Putri, and Sulastri 2024) indicating that the deep learning approach not only involves understanding concepts theoretically but also connecting them to real-life experiences. This approach gives students the opportunity to explore more deeply and contextually according to their individual interests and abilities.

In several countries, the deep learning approach has been successfully implemented and has shown significant improvements in student understanding and engagement in creating enjoyable learning (Nurhakim, Rojibillah, and Zakiah 2025). In Indonesia, the deep learning approach has become a relevant alternative, as it emphasizes meaningful, conscious, and enjoyable learning. Several studies indicate that employing the deep learning approach can enhance learning effectiveness, boost student motivation, and help teachers accurately analyze learning outcomes. Research findings (Khotimah and Abdan 2025) show that the application of the deep learning approach in Islamic Religious Education can increase students' active participation in conceptual understanding. Similar research by (Mandasari, Puri, and Hapsari 2025) shows that the implementation of a deep learning approach in Science and Social Studies (IPAS) learning in Elementary Schools can improve students' overall learning outcomes. Through problem-based projects, group discussions, environmental observations, and self-reflection, students become more active, critical, and able to relate concepts to real life.

In the application of a deep learning approach in the learning process, it does not stop at the implementation stage, but from the planning stage, implementation, and assessment also use the

principles of deep learning. The principles used are mindful, meaningful, and joyful. Mindful means full awareness and active engagement in the learning process. Meaningful refers to students' deep and comprehensive understanding of the context of the material. Meanwhile, joyful refers to a pleasant atmosphere in the learning process that can stimulate activeness, creativity, and effectiveness in learning activities (Fitriani and Santiyani 2025). Integrating the three principles of deep learning requires careful planning and a deep understanding of students' characteristics. Thus, it not only creates effective learning, but also meaningful and enjoyable learning for students.

In this regard, this study aims to explain how deep learning approaches can be applied in mathematics education. Considering the challenges teachers face in creating deep learning in the 21st century, careful preparation and planning are necessary. Therefore, it is hoped that this research can provide an important contribution to the implementation of deep learning approaches in education, particularly in mathematics education.

METHODS

The method used in this study is a literature review method by conducting a series of literature studies, namely collecting data from several related articles. The selection of references is based on the relevance of the content to the research topic, the credibility of the publication, and the publication year, which is still current, namely between 2021 and 2025. Data collection is carried out through literature searches using keywords that match the research focus. Data collection is conducted through platforms such as Google Scholar, Crossref, Sinta, Rumah Jurnal, and other relevant sources. Once found, the obtained data is compiled, analyzed, and studied in depth to draw conclusions on the topic being discussed. This study is conducted with the aim of examining, analyzing, and integrating deep learning approaches in mathematics learning from various references obtained.

RESULT AND DISCUSSION

Deep Learning Approach

A review of several references shows that the deep learning approach is a learning method focused on a thorough understanding of concepts, deep information processing, and application of knowledge in new situations. In this approach, students are not only required to engage in rote learning, but are also expected to understand the context, analyze information critically, and create innovative solutions based on strong conceptual understanding. As explained by (Rosiyati et al. 2025), the deep learning approach is a profound way to understand material concepts by emphasizing a meaningful, student-centered learning process, thereby creating an enjoyable learning experience. With a solid conceptual understanding, students can connect various acquired

ideas and integrate the learned material into real-life contexts. Thus, the deep learning approach becomes an important foundation in developing students' characters to be critical, creative, collaborative, and communicative in the learning process (Nurul et al. 2025).

According to (Agyeman 2024), the deep learning approach is an in-depth learning method that promotes better understanding through student engagement in discussions, presentations, and projects, aiming to foster critical thinking, creativity, and problem-solving skills. Unlike conventional learning, which focuses primarily on memorizing and repeating information, deep learning encourages students to actively participate in more complex thinking processes such as applying, analyzing, evaluating, and creating (Mandasari, Puri, and Hapsari 2025). Moreover, the deep learning approach can cultivate student independence while also developing collaborative skills. Students have the opportunity to build self-confidence and reflect on what they have accomplished. Thus, this can improve students' competence in learning and the previously planned learning outcomes can be achieved (Adnyana 2024).

The deep learning approach integrates three main principles in the learning process, namely mindful, meaningful, and joyful. This approach offers a new paradigm in education that is more humanistic and contextual. It is therefore not only applied to cognitive aspects but also takes into account the affective and social aspects of students, which can create a more meaningful and enjoyable learning experience (Sari and Arta 2025). Mindful learning is a form of learning that emphasizes full awareness, where students are encouraged to be consciously present, focused, and reflective throughout the learning process. When the mind is fully present, students connect authentically with the material and the learning process. Focus in the learning process is key to achieving deeper and more meaningful understanding, where students actively observe and become aware of their thoughts, feelings, and sensations that arise during the learning process.

In practice, mindful learning is characterized by learners feeling comfortable in the learning process, maintaining focused concentration, being open to new perspectives, and having a curiosity for the knowledge and experiences to be explored. Mindful learning helps learners process information more effectively, acquire accurate and comprehensive knowledge, and discover the most effective learning strategies (Syafi'i and Darnaningsih 2025). The implementation of mindful learning in education can not only improve academic learning outcomes but also equip learners with life skills and hands-on experiences.

Meaningful learning is a learning approach that integrates the principles of meaningfulness and emphasizes the abilities of connection, integration, and application. This process involves integrating new information with the knowledge structures that learners already have and connecting across disciplines. In this case, the material being learned is linked to real and relevant

contexts to build stronger and deeper cognitive structures. With meaningful learning, learning is connected to the learner's environment, which can help them understand who they are, how to position themselves, and how they can contribute back (Suyanto 2025). The implementation of meaningful learning involves the roles of parents, society, or the community as sources of practical knowledge, as well as fostering a sense of responsibility and social care.

Joyful learning is an enjoyable form of learning designed to be as engaging as possible according to the students' learning styles. Joyful learning aims to create student involvement, curiosity, and feelings of happiness, not just academic demands (Gifari, Gunadi, and Dewi 2025). The implementation of joyful learning involves designing learning activities that integrate elements of play, creativity, and exploration. As a result, students will feel more comfortable and motivated to learn. Furthermore, students will also see and experience the learning process as something enjoyable and beneficial.

The integration of the three principles of the deep learning approach in education can create a holistic and effective learning experience. This approach not only enhances students' cognitive understanding but also takes into account emotional and social aspects. As a result, the learning that takes place becomes more meaningful and enjoyable. This aligns with the previous definition of the deep learning approach, which emphasizes a deeper understanding of the subject matter and the development of critical thinking skills, such as analysis and evaluation (Nurul et al. 2025).

Deep Learning Approach in Mathematics Education

The integration of deep learning approaches in mathematics education is highly relevant to be applied in 21st-century learning while still adhering to the three principles of the deep learning approach, namely learning with full awareness, meaningful learning, and enjoyable learning. Mathematics as a field of study combines various thinking skills, ranging from conceptual understanding, procedural skills, critical thinking, creative thinking, reflective thinking, problem-solving, etc., where these thinking skills are applied in solving problems in real-life experiences. The deep learning approach in mathematics education is not only applied to learning methods and media but also to the process of planning and assessing the learning process. As stated by (Munawar et al. 2025), the assessment process with a deep learning approach can enhance the effectiveness of learning and the measurement of student competencies in the independent curriculum.

Considering that the deep learning approach is an advanced approach and a further development of the Merdeka curriculum, theoretically, the concepts, principles, objectives, and learning paradigms are not much different from the Merdeka curriculum (Akmal, Maelasari, and Lusiana 2025). This aligns with the research (Rosiyati et al. 2025) which states that the

implementation of the deep learning approach in education serves as both a refinement and a solution for the evaluation and reflection of the Merdeka curriculum's implementation. Therefore, the implementation of the deep learning approach in education emphasizes deep, conscious, and enjoyable learning, guided by Bloom's Taxonomy and SOLO Taxonomy thinking processes, with the hope of improving students' thinking skills and academic performance (Natsir 2025).

The thinking process in the deep learning approach begins with the aspect of understanding, which is relevant to the unistructural and multistructural levels in the SOLO Taxonomy, and the stages of remembering and understanding (C1 and C2) in Bloom's Taxonomy. At this stage, learners recall previously acquired knowledge and start thinking of new ideas that will develop more complexly. In the aspect of applying and reflecting, which is relevant to the relational and extended abstract stages in the SOLO Taxonomy, and the stages of applying, analyzing, evaluating, and creating (C3 – C6) in Bloom's Taxonomy, learners correlate various ideas they have learned, expand their understanding, and apply their knowledge in real contexts. Thus, the deep learning approach is able to encourage learners to construct understanding in a holistic, reflective, and applicable manner.

Table 1. Deep Learning Approach Learning Syntax (Suyanto 2025)

Deep Learning Stages	**SOLO Taxonomy Levels**	**Bloom's Taxonomy Levels**	**Description**
-	*Prastructural*	-	Has not understood the concept
Understanding	*Unistructural, Multistructural*	Considering, understanding	Reflecting on and developing new knowledge from experience
Applying	*Relational*	Analyzing, applying	Connecting knowledge and using it to solve problems
Reflecting	*Extended Abstract*	Evaluating, creating	Evaluating learning, refining understanding, broadening perspectives

In practice, learning with a deep learning approach trains students to learn in a way and at a pace that suits themselves. Student-centered learning means that teachers are no longer the sole source of knowledge, but rather act as companions who build dialogue, provide reflective feedback, and create a learning environment that supports exploration (Mujtahid, Assidiqi, and Sadiyah 2025). Teachers play the role of facilitators in creating a learning environment rich in experiences and intellectual challenges. Thus, the deep learning approach in mathematics learning is not solely focused on achieving cognitive learning outcomes, but also on developing life skills and shaping students' character.

Most teachers who have tried to adopt a deep learning approach tend to still understand and implement it in a limited way, namely just in the execution of physical projects or activities that

result in an end product. The application of this approach is not accompanied by a deep learning process, such as concept mapping, critical analysis, personal reflection, or open discussions that connect the project with real-life experiences (Handayani et al. 2025). Thus, it does not touch the main essence of the deep learning approach. In general, the steps that teachers should take in teaching with a deep learning approach are as follows:

Table 2. Steps for Implementing a Deep Learning Approach

No.	Stages	Work Steps
1.	Planning	a) The teacher designs learning experiences that refer to the principles of deep learning, which demand students' conceptual understanding. b) Teachers choose learning strategies or methods, such as project-based, problem-based, game-based, or contextual approaches that can enhance students' thinking skills..
2.	Implementation	a) Teachers act as facilitators for students in the learning process. b) The teacher guides students to explore, participate, and collaborate to create a deep learning experience.
3.	Assessment	a) Teachers assess students' thinking processes and engagement in the learning process using holistic assessment instruments. b) Teachers conduct diagnostic assessments to determine the appropriate and effective strategies according to the characteristics of the students. c) The teacher conducts ongoing formative assessments, such as quizzes, reflections, class discussions, etc. d) Teachers conduct summative assessments, such as projects, portfolios, and presentations.

The implementation of a deep learning approach in mathematics education across various learning achievement elements can be observed from the results of research conducted by several researchers. According to the study by (Mutmainnah, Adrias, and Zulkarnaini 2025), simulations were used to understand the concept of fractions, where the teacher demonstrated the concept of fractions by dividing a cake to clarify the material. Students were required to divide it fairly according to the prepared scenario. Mindful learning was demonstrated by observing the shape and size of the cake, considering different ways of dividing it, and connecting it to the fraction concepts they had learned. Some students quickly grasped the concept, while others needed further guidance. Meaningful learning was demonstrated when students related the concept of fractions to their real-life experiences of sharing food. Meanwhile, the joyful learning demonstrated is through direct simulations by students, involving social interaction and enjoyable activities. The approach makes it easier for students to understand the concept of fractions compared to explanations given through lectures on the blackboard.

In addition to gamification-based learning, learning using the problem-based learning (PBL) method can also be implemented to create deep learning. By integrating PBL into the deep learning approach, students are not only more active and enthusiastic in learning but also able to effectively connect theory with real-world practice (Rahayu 2024). Thus, the implementation of PBL in deep learning can strengthen students' ability to analyze and evaluate information deeply, facilitate collaborative development, and enhance critical thinking skills and interpersonal abilities. Here is an example of its application in ratio/comparison material:

Table 3. Problem-Based Learning Method with a Deep Learning Approach

PBL Stage	**Activity**	***Deep Learning* Stage**
Problem Orientation	1) Students are introduced to a real problem, namely the school canteen wants to sell orange juice with an orange to water ratio of 2:5. 2) The teacher provides a prompt, and the students help design the size of the cup given. For example: if the cup size is 350 ml, how do you determine the amount of orange and water so that the ratio remains 2:5? Or if the customer wants a stronger orange flavor, what should be done?	*Meaningful, Joyful*
Organizing a group	1) The students are divided into several small groups 2) The teacher explains the group targets that must be achieved, such as calculating the ratio for each different glass size, determining the composition of the drinks, and presenting the results with mathematical reasoning.	*Mindful, Joyful*
Investigation	1) Students deepen their understanding of the concept of ratios through exploration, discussion, and proof 2) The student writes down why their steps are like that 3) Students see firsthand how ratios are used in recipes and food preparation	*Mindful, Meaningful*
Development and Presentation	1) Students create authentic solution products, such as tables of orange and water compositions for various given glass sizes, mathematical reasons why the ratio remains constant, and recommendations for the school cafeteria 2) Students present the results they obtained, and other students ask questions and provide feedback 3) The teacher assesses the clarity of concepts and accuracy in calculations	*Meaningful, Joyful*
Reflection	1) The teacher reinforces students' conceptual understanding through self-reflection	*Mindful, Joyful*

In addition to the PBL and gamification methods, there are other methods that can be used in mathematics learning with a deep learning approach, such as project-based learning (PjBL), inquiry-based learning, and other learning methods. The implementation of a deep learning

approach in mathematics learning is not only limited to the learning process but also to the assessments used during learning. The assessments used in the deep learning approach can be diagnostic, formative, and summative, in accordance with the assessments outlined in the Merdeka Curriculum. Diagnostic assessments are used to evaluate students at the beginning, formative assessments provide feedback during the learning process, and summative assessments are used to measure overall learning outcomes. Assessments in the deep learning approach must meet the eight Dimensions of Graduate Profile (DPL), namely citizenship, critical reasoning, creativity, collaboration, independence, and communication (Rosardi and Widiastuti 2025). These eight DPLs are used as benchmarks for developing assessments in mathematics learning.

Table 4. Learning Assessment with a Deep Learning Approach

	Mindful	**Meaningful**	**Joyful**
As Learning (Input)	Diagnostic Assessment		
For Learning (Proses)	Reflection Journal, Observation, and Feedback	Reflection, observation, and feedback journal	Surveys and interviews, class participation and enthusiasm
Of Learning (Output)	Mindfulness practices, critical thinking test/non-test	Written test and performance test	Creative output and positive experience

To implement deep learning effectively, teachers need to pay attention to aspects that influence lesson planning with a deep learning approach, such as: 1) Pedagogical Practice, which is teaching methods that encourage exploration and open dialogue; 2) Learning Partnerships, which are collaborations between teachers, students, parents, and the community; 3) Learning Environment, which is a classroom atmosphere that is safe, open, and supportive of student growth; 4) Digital Utilization, which is the proper use of technology to enrich the learning process (Fikriyatii 2025).

However, the implementation of a deep learning approach in mathematics education does not automatically proceed according to existing theories. This is evidenced by the reality in the field, which shows that its implementation is still far from expectations. There are several obstacles and challenges that need to be reevaluated and real solutions found. Many teachers are still confused, awkward, and even hesitant in preparing for the deep learning approach. This confusion among teachers is not without reason, as there are still quite a number of problems that hinder the implementation of this approach, ranging from a lack of intensive training that provides practical guidance, limited understanding of the concepts and techniques of deep learning, limited technological skills, to insufficient support from adequate learning infrastructure (Rohmatun

2025). In many cases, teachers feel as if they are left alone to face major changes without sufficient preparation and tools. In fact, deep learning is not an instant method that can be applied just like that; it requires a strong philosophical understanding as well as technical skills honed through experience and guidance.

One of the fundamental issues that often arises is the weak conceptual understanding of teachers. Teachers do not understand that deep learning is not synonymous with advanced technology or expensive devices, but rather with approaches that stimulate students' reasoning and curiosity. In addition, the lack of specific and practical training is also a challenge, as many teacher competency improvement activities (such as seminars or general workshops) take place without guidance in real classrooms, making it difficult for teachers to translate them into actual teaching practice. Another equally important problem is the limitation of facilities and infrastructure. Challenges also come from the still traditional school culture. Teachers, principals, and even parents often view new methods with skepticism. Exam scores are still the main benchmark of success, and authentic assessments such as portfolios or projects are not yet fully recognized as valid measurement tools.(Handayani et al. 2025)

Therefore, it is necessary to openly socialize with parents and the community regarding the paradigm shift for the success of the deep learning approach. The government and educational institutions also play a role in providing practical modules and examples of good practices. Training sessions should also include real simulations, case studies, and direct mentoring that allow teachers to experience and evaluate the implementation of deep learning in their own classrooms. Collaboration between classroom teachers and teachers from other institutions on integrative projects based on deep learning is also important as it serves as a learning platform that enriches both teachers and students. If all these steps are carried out consistently and in an integrated manner, the expected results will no longer be merely a possibility but an inevitability. Thus, the paradigm shift being promoted does not stop at the administrative and symbolic level, but also brings significant changes to the quality of learning and the characteristics of students.

CONCLUSION

Research shows that the deep learning approach in mathematics education has several aspects that need to be considered. It continues to adhere to the principles of deep learning, namely mindful learning (learning with full awareness), meaningful learning (in-depth learning), and joyful learning (enjoyable learning). The steps that need to be prepared in implementing the deep learning approach in teaching are the planning, implementation, and assessment stages. Mathematics learning using the deep learning approach adopts the syntax from Bloom's Taxonomy (remembering, understanding, applying, analyzing, evaluating, and creating) and the SOLO Taxonomy (pre-structural, uni-structural, multi-structural, relational, extended abstract). This is still adjusted according to the planned learning outcomes and learning objectives. Meanwhile, the

learning methods that can be applied in mathematics learning using a deep learning approach are very varied, such as game-based learning, problem-based learning, project-based learning, role-playing, etc. In addition, the deep learning approach is also applied to the assessment and evaluation of students in mathematics learning.

Regardless of the implementation steps, field facts show that there are many challenges in applying the deep learning approach in mathematics education. These range from teachers' understanding of the deep learning approach not being complete, limited resources, and an unsynchronized assessment system. Therefore, the application of the deep learning approach must continue to be developed and reflections conducted for further improvement. The deep learning approach in mathematics education will not run smoothly or in accordance with existing theory if there is no collaboration between schools, subject teachers, students, and parents.

Research results show that the implementation of a deep learning approach in mathematics learning must continue to be developed and subject to reflection and evaluation. Therefore, it is highly recommended that future researchers conduct research and development on learning strategies, learning media and methods, as well as assessment rubrics that can enhance students' conceptual understanding and mathematical thinking skills. Of course, the developments carried out must continue to consider the main concepts of the deep learning approach and also the independent curriculum.

BIBLIOGRAPHY

Adnyana, I Ketut Suar. 2024. "Implementasi Pendekatan Deep Learning dalam Pembelajaran Bahasa Indonesia." *Jurnal Retorika* 5 (1).

Agyeman, Nana Yaw Brenya. 2024. "Deep Learning in High Schools: Exploring Pedagogical Approaches for Transformative Education." *Humanika: Kajian Ilmiah Mata Kuliah Umum* 24 (2): 2. https://doi.org/10.21831/hum.v24i2.71350.

Akmal, Aria Nur, Nur Maelasari, and Lusiana. 2025. "Pemahaman Deep Learning dalam Pendidikan: Analisis Literatur melalui Metode Systematic Literature Review (SLR)." *Jurnal Ilmiah Ilmu Pendidikan* 8 (3): 3229–36.

Fikriyatii, Amiq. 2025. "Pembelajaran Mendalam (Deep Learning): Menghidupkan Proses Belajar yang Berkesadaran, Bermakna, dan Menggembirakan di Kelas." S1 Pendidikan Kimia FMIPA Universitas Negeri Surabaya. https://pendidikan-kimia.fmipa.unesa.ac.id/post/pembelajaran-mendalam-deep-learning-menghidupkan-proses-belajar-yang-berkesadaran-bermakna-dan-menggembirakan-di-kelas.

Fitriani, Alya and Santiyani. 2025. "Analisis Literatur: Pendekatan Pembelajaran Deep Learning dalam Pendidikan." *Kampus Akademik Publising Jurnal Ilmiah Nusantara (JINU)* 2 (3). https://doi.org/10.61722/jinu.v2i3.4357.

Gifari, Muhamad Kosim, Rustian Akbar Gunadi, and Ratna Dewi. 2025. "Mindful, Meaningful, Dan Joyful Learning Di PAUD: Sebuah Tinjauan Literatur Sistematis." *Prosiding Seminar Nasional Pendidikan FKIP Universitas Lampung*, March 25, 2025, 284–96.

Handayani, Eka Selvi, Ferry Fernando, Sherly Gaspersz, Ridwan, Ahmadin, and Euis Kusumarini. 2025. "Implementasi Pembelajaran Mendalam (Deep Learning) dalam Meningkatkan Efektivitas Kurikulum Berdampak Di Sekolah." *EDU RESEARCH* 6 (2): 1522–35. https://doi.org/10.47827/jer.v6i2.975.

Khotimah, Deny Khusnul, and Muhammad Rohmad Abdan. 2025. "Analisis Pendekatan Deep Learning Untuk Meningkatkan Efektivitas Pembelajaran PAI Di SMKN Pringkuku." *Jurnal Pendidikan Dan Pembelajaran Indonesia (JPPI)* 5 (2): 866–79. https://doi.org/10.53299/jppi.v5i2.1466.

Mandasari, Natasya Alifia, Agnia Puri, and Anita Dwi Hapsari. 2025. "Pendekatan Pembelajaran Deep Learning Sebagai Upaya Peningkatan Hasil Belajar IPAS Di Sekolah Dasar." *Jurnal Riset Pendidikan Dasar* 8 (2). https://doi.org/10.26618/35q86e33.

Mujtahid, Hasan Ali Assidiqi, and Dini Sadiyah. 2025. "Implementasi Pembelajaran Mendalam (Deep Learning) Di Sekolah Dasar Sebagai Penguatan Kurikulum Merdeka." *PEDASUD : Jurnal Ilmu Pendidikan Guru Sekolah Dasar Dan Usia Dini* 2 (2).

Munawar, Mumtaz Ali Ridha Al, Nayla Ikhsani Azyan, Stephanie Aurelia, Sulis Indriani, and Angga Hadiapurwa. 2025. "Teachers' Views on Optimizing Kurikulum Merdeka in SMK Kencana Accounting Department." *Hipkin Journal of Educational Research* 2 (1): 1.

Mutmainnah, Nurul, Adrias Adrias, and Aissy Putri Zulkarnaini. 2025. "Implementasi Pendekatan Deep Learning Terhadap Pembelajaran Matematika Di Sekolah Dasar." *Pendas : Jurnal Ilmiah Pendidikan Dasar* 10 (01): 848–71. https://doi.org/10.23969/jp.v10i01.23781.

Natsir, Siti Rahmalia. 2025. "Implementasi Kurikulum Merdeka Dalam Pembelajaran Matematika di Sekolah Dasar: Studi Deskriptif Pendekatan Deep Learning Dalam Kerangka Kurikulum Merdeka Belajar." *Journal of Innovation Research and Knowledge* 4 (9): 7263–74.

Nurhakim, Haditsa Qur'ani, Isnan Rojibillah, and Qiqi Yuliati Zakiah. 2025. "Inovasi Kurikulum dan Teknologi Pembelajaran (Deep Learning)." *Jurnal Edukasi dan Teknologi Pembelajaran* 6 (2).

Nurul, Aulia, Sofyan Iskandar, Mutiah Amalia, and Putri Fasya Naziha. 2025. "Konsep dan Implementasi Pendekatan Deep Learning di Sekolah Dasar." *Pendas: Jurnal Ilmiah Pendidikan Dasar* 10 (2). https://doi.org/10.23969/jp.v10i2.25562.

OECD, Education GPS. 2022. "OECD Education GPS." https://gpseducation.oecd.org/.

Rahayu, Puji. 2024. "Implementasi Model Pembelajaran PBL Untuk Meningkatkan Keterampilan Berpikir Kritis pada Pembelajaran Matematika Kelas III Sekolah Dasar." *Pendas: Jurnal Ilmiah Pendidikan Dasar* 9 (04): 435–43.

Rahmandani, Fahdian, Mohamad Rifqi Hamzah, Trisakti Handayani, and Moh Wahyu. 2025. "Integrasi Pembelajaran Mendalam (Deep Learning) dalam Mewujudkan Pembelajaran yang Bermutu dan Bermakna bagi Peserta Didik." *Inovasi: Jurnal Sosial Humaniora dan Pendidikan* 4 (3). https://doi.org/10.55606/inovasi.v4i2.4896.

Rohmatun, Siti. 2025. "Mengatasi Kendala Guru dalam Menerapkan Pendekatan Deep Learning." Ardan Sirodjuddin. https://ardansirodjuddin.com/.

Rosardi, Raras Gistha, and Anik Widiastuti. 2025. "Asesmen Pembelajaran IPS Dalam Pendekatan Deep Learning: Tinjauan Konsep Dan Implementatif." *Prosiding Seminar Nasional Fakultas Ilmu Tarbiyah Dan Keguruan UIN Syarif Hidayatullah Jakarta* 2 (1): 67–73. https://doi.org/10.64277/fc1z2n84.

Rosiyati, Diana, Risa Erviana, Anisa'ul Fadilla, Ummu Sholihah, and Musrikah. 2025. "Pendekatan Deep Learning dalam Kurikulum Merdeka." *Al-Irsyad Journal of Mathematics Education* 4 (2): 131–43. https://doi.org/10.58917/ijme.v4i2.270.

Sari, Ambar Wulan, and Dewi Juni Arta. 2025. "Implementasi Deep Learning: Suatu Inovasi Pendidikan." *Jurnal Wawasan Pengembangan Pendidikan* 13 (01).

Suwandi, Riska Putri, and Sulastri. 2024. "Inovasi Pendidikan Dengan Menggunakan Model Deep Learning Di Indonesia." *Jurnal Pendidikan Kewarganegaraan Dan Politik* 2 (2): 69–77. https://doi.org/10.61476/186hvh28.

Suyanto. 2025. "Pembelajaran Mendalam: Menuju Pendidikan Bermutu Untuk Semua." Pusat Kurikulum dan Pembelajaran, Kementerian Pendidikan Dasar dan Menengah Republik Indonesia.

Syafi'i, Ahmad. 2023. "Analisis Kesiapan Guru Dalam Mengimplementasikan Kurikulum Merdeka Belajar Di MTs As'adiyah Uloe." *Az-Zakiy: Journal of Islamic Studies* 1 (01): 9–14. https://doi.org/10.35706/azzakiy.v1i01.9965.

Syafi'i, Ahmad and Darnaningsih. 2025. "Pendekatan Pembelajaran Berbasis Deep Learning: Mindful Learning, Meaningful Learning, Dan Joyful Learning." *Al- Mumtaz: Jurnal Manajemen Pendidikan Islam* 2 (1).