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# Deep Learning in Elementary School: Systematic Literature Review

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**Abstract**: The challenges of 21st-century education require learning approaches that go beyond factual mastery and emphasize deep conceptual understanding and higher-order thinking skills in elementary school students. This study aims to analyze research trends, implementation characteristics, and the impact of the deep learning approach in elementary school learning through the Systematic Literature Review (SLR) method. The literature review process follows the PRISMA protocol, including identification, screening, and eligibility stages. Articles were identified using Publish or Perish software from Google Scholar, Semantic Scholar, and Scopus databases with the keywords "deep learning" and "elementary school" within the publication period of 2020–2025. The initial search yielded 528 articles, which were then filtered using inclusion and exclusion criteria, resulting in 17 empirical research articles indexed by SINTA 1–4 and Scopus for the final analysis. The synthesis shows three main characteristics of deep learning implementation: constructive learning through discussions, projects, and contextual exploration; fun and recreational learning that enhances motivation through educational games and digital media; and reflective learning that develops metacognitive awareness through reflection and evaluation. This approach improves learning outcomes, strengthens critical thinking, creativity, collaboration, communication, and supports metacognitive development in elementary education.

**Keywords:** Elementary School; Deep Learning; Deep Learning Approach.

## Introduction

The rapid development of technology and the increasing complexity of global challenges in the 21st century require individuals to possess not only factual knowledge but also higher-order thinking skills such as critical thinking, analytical reasoning, creativity, and adaptability. In the era of automation and artificial intelligence (AI), many routine and repetitive tasks are increasingly performed by machines, reducing the relevance of learning approaches that rely solely on memorization. Consequently, education systems are required to design learning processes that develop deeper understanding and cognitive flexibility, so that learners can respond effectively to complex and unpredictable real-world problems (Irawan, 2025; Subro & Fawaid, 2025) .

In this context, elementary education plays a crucial role in building the intellectual, emotional, and social foundations of learners. At this stage, students begin to develop fundamental thinking skills, learning habits, and character traits that influence their future academic development and social participation (Hermawan Prasetyo, Roemintoyo, 2023) . Therefore, learning at the elementary school level should not merely emphasize the acquisition of factual knowledge but also foster 21st-century competencies such as critical thinking, creativity, collaboration, and communication (Nurdiana, 2025). Effective learning processes at this level are expected to stimulate students' curiosity, reasoning abilities, and conceptual understanding.

However, many elementary school classrooms still rely heavily on conventional teacher-centered instruction, particularly on lecture-based learning that

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emphasizes the transmission of information. Such practices tend to limit students' opportunities to construct knowledge actively, thereby hindering the development of critical thinking and scientific understanding (Putri et al., 2024 ; Ni Putu Manik Candra Dewi et al., 2025; Suyit Ratno, Fenny Rizky Amelia et al., 2024). This situation highlights the need for innovative pedagogical approaches that encourage active learning, conceptual exploration, and deeper engagement with learning content.

One approach that has gained increasing attention in educational discourse is *deep learning.* In the pedagogical context, deep learning refers to a learning orientation that emphasizes meaningful understanding, integration of knowledge, reflective thinking, and the application of concepts to real-life situations (Feriyanto & Anjariyah, 2024; Mubarok et al., 2025) . Through learning activities such as inquiry, discussion, experimentation, and contextual exploration, students are encouraged to construct knowledge rather than passively receive information. This approach is particularly relevant for elementary school students at the stage of developing logical reasoning and conceptual understanding (Muhammad Muchsin Afriyadi, M. Luthfi Oktarianto, 2022) .

It is important to distinguish this pedagogical concept of deep learning from the term *deep learning in artificial intelligence.* In the field of AI, deep learning is a computational method in machine learning that uses multilayer neural networks to process large datasets and perform complex pattern recognition. In contrast, deep learning in education focuses on meaningful learning experiences that enable students to develop deep conceptual understanding, reflective thinking, and the ability to apply knowledge in authentic contexts. Therefore, although the two concepts share the same terminology, they differ fundamentally in purpose, theoretical foundation, and application domain.

Despite the growing discussion of deep learning in education, previous studies on this topic remain fragmented and often focus on specific classroom implementations rather than providing a comprehensive synthesis of research trends and implementation characteristics. In addition, the similarity of terminology to that of artificial intelligence has led to conceptual ambiguity, particularly in the interpretation of deep learning in educational research. Consequently, there is still limited systematic evidence that maps research developments, identifies the characteristics of its implementation, and examines its educational impact in the context of elementary schools.

Based on these considerations, this study conducts a *Systematic Literature Review (SLR)* to examine the development of research on the deep learning approach in elementary schools over the past five years. Specifically, this study aims to answer the following research questions:

1. How are research trends on *the deep learning* approach in elementary schools distributed in terms of publication year, country, and journal?
2. What are the main characteristics of implementing *the deep learning* approach in elementary schools?
3. What impacts does *the deep learning* approach have on elementary school students?

## Method

This study employed the *Systematic Literature Review (SLR)* method to systematically examine the development of research on the *deep learning* approach in elementary school learning. The SLR method was chosen because it enables researchers to identify, evaluate, and synthesize relevant empirical research findings to obtain a comprehensive understanding of research trends, implementation characteristics, and the impact of the *deep learning* approach in the context of elementary education. (Hidayat et al., 2023) .

To ensure that the literature selection process was conducted transparently and systematically, this study adopted the PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses)* protocol. The PRISMA protocol provides a systematic framework for the literature selection process through several main stages, namely identification, screening, eligibility, and inclusion (Rusyati et al., 2025) .

*Identification Stage*

At the identification stage, the researchers conducted a literature search using the Publish or Perish software connected to several academic databases, namely Google Scholar, Semantic Scholar, and Scopus. The article search was carried out using the keywords "*deep learning*" and "*elementary school*", as well as their Indonesian equivalents such as "*pembelajaran mendalam*" and "*sekolah dasar*". The publication year range was limited to 2020–2025 to obtain recent, relevant empirical research on the topic under investigation. Based on the initial search results, 528 articles were identified, consisting of:

- 500 articles from the Google Scholar database
- 22 articles from Semantic Scholar
- 6 articles from Scopus

All identified articles were then compiled for further screening.

*Screening Stage*

During the screening stage, the identified articles were first examined based on their titles and abstracts to determine their relevance to the research focus. Articles retrieved from Google Scholar were exported in RIS

format and processed using the Covidence software to facilitate duplicate detection and article screening. Meanwhile, articles from Semantic Scholar and Scopus were screened manually due to the limitations of the Covidence free version.

At this stage, several articles were eliminated for various reasons, including:

- Duplication across databases
- Research topics not relevant to the pedagogical context of *deep learning*
- Studies not focusing on the elementary school education level
- Publication types not classified as empirical research articles

Based on this screening process, 421 articles were excluded, leaving 107 articles that met the initial criteria for further analysis.

*Eligibility Stage*

At the eligibility stage, the researchers conducted a full-text review of the remaining 107 articles to ensure their compliance with the predetermined inclusion and exclusion criteria. This process aimed to ensure that the analyzed articles were truly relevant to the research topic and possessed adequate methodological quality.

**Table 1.** Criteria Inclusion And Exclusion

| Criteria | Inclusion | Exclusion |
|---|---|---|
| Year of Publication | Published in the last five years (2020-2025) | Published before 2020 |
| Article Title and Content | Relevant topics regarding deep learning in the context of pedagogical approaches and practices in elementary schools. | Irrelevant topics or using deep learning terms outside the context of the pedagogical approach, and practices outside the basic education level. |
| Publication Type | Empirical research articles published in Sinta 1-4 or Scopus accredited journals | Apart from journal articles (books, papers, theses, proceedings, etc.), they are not empirical articles (literature reviews), and are not accredited by Sinta 1-4 or Scopus. |
| Language | Using Indonesian or English | Do not use Indonesian or English |
| Accessibility | Full text and articles are freely accessible. | Incomplete text such as only the abstract appears after being obtained with maximum effort |

After evaluating the articles based on these criteria, 83 articles were excluded because they did not meet the inclusion criteria. Consequently, 17 empirical research articles fulfilled all requirements and were used as the sources for analysis in this study.

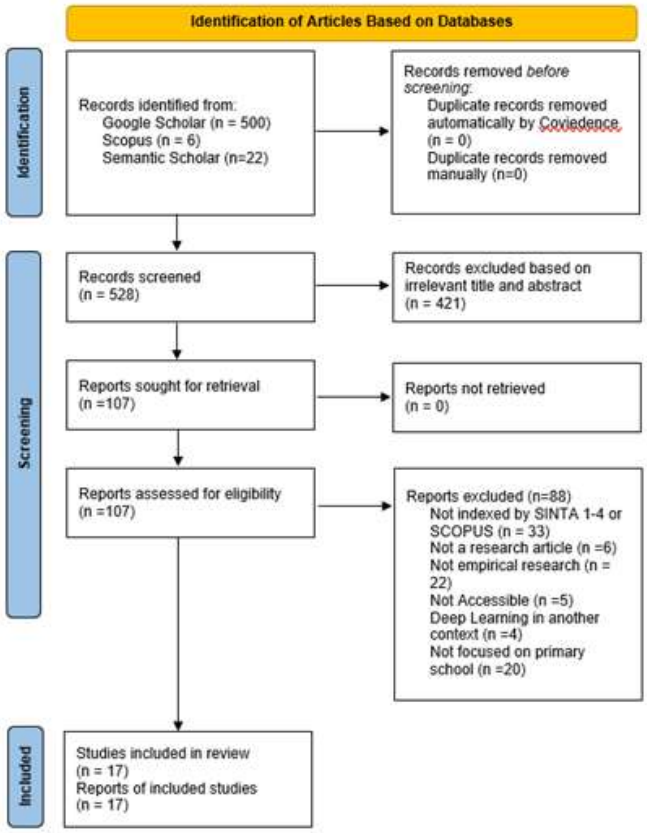


**Figure 1.** PRISMA flow diagram

*Data Analysis Stage*

The selected articles were then analyzed using a thematic content analysis approach. This approach was employed to identify patterns, themes, and characteristics of the implementation of the *deep learning* approach in elementary school learning.

The analysis process was conducted through several stages, namely:

- Coding, which involved identifying key concepts, research objectives, research methods, and the main findings of each analyzed article.
- Data categorization, which involved grouping research findings into thematic categories based on similarities in the characteristics of deep learning implementation.
- Thematic synthesis, which involved integrating the various research findings to identify patterns of *deep learning* implementation and its impact on elementary school learning.

**Table 2.** Characteristics of Selected Articles

| Article Code | Year | Country | Research Method |
|---|---|---|---|
| A1 | 2022 | Norway | Qualitative |
| A2 | 2023 | Hong Kong | Content Analysis |
| A3 | 2025 | Norway | Qualitative |
| A4 | 2025 | Indonesia | Qualitative |
| A5 | 2025 | Indonesia | Qualitative Case Study |
| A6 | 2025 | Indonesia | Research and Development (R&D) |
| A7 | 2025 | Indonesia | Classroom Action Research |
| A8 | 2025 | Indonesia | Qualitative |
| A9 | 2025 | Indonesia | Qualitative |
| A10 | 2025 | Indonesia | Quasi-Experimental |
| A11 | 2025 | Indonesia | Quantitative |
| A12 | 2025 | Indonesia | Qualitative |
| A13 | 2025 | Indonesia | Phenomenology |
| A14 | 2025 | Indonesia | Qualitative |
| A15 | 2025 | Indonesia | Qualitative Case Study |
| A16 | 2025 | Indonesia | Research and Development (R&D) |
| A17 | 2025 | Indonesia | Experimental |

Through this analysis process, the study was able to identify various characteristics of the implementation of the *deep learning* approach and its contribution to the development of critical thinking, creativity, collaboration, and communication skills among elementary school students. The article selection process in this study is visualized in the PRISMA flow diagram, which illustrates the article selection process from the identification stage to the final articles included in the analysis.

## Result and Discussion

A total of 17 empirical articles that met the inclusion criteria were analyzed to identify research characteristics and key findings related to the implementation of the *deep learning* approach in elementary schools. The analysis was conducted using content analysis techniques by examining research objectives, research methods, and the main findings of each selected article. The results of the analysis and synthesis of the selected articles are presented in Table 3.

**Table 3.** Results of Analysis and Synthesis of Selected Articles

| Title (And The Publisher) | Author | Year | Result of Discussion |
|---|---|---|---|
| Teachers' potential to promote students' deeper learning in whole-class teaching: An observation study in Norwegian classrooms (Journal of Educational Change) | Randi M. Solvik & Anne EH Glenna. | 2022 | This research shows that deep learning is not tied to a particular learning model as an approach but is reflected in teachers' pedagogical strategies such as meaningful discussions, literacy activities that encourage reasoning and interpretation of meaning, and so on. The results of the study revealed that the success of deep learning implementation is highly dependent on teachers' conceptual understanding of the approach, so that variations in classroom practices reflect differences in teachers' levels of understanding of *deep learning* itself. |
| Mobile Learning as Deep Learning: Content Analysis of in-Service Primary School Music Teachers' Lesson Plans in Mobile Music Creation (International Society For Music Education) | Jason Chi Wai Chen. | 2023 | Mobile learning facilitates creativity, collaboration, reflection, and musical problem-solving. Students are more active, motivated, and able to connect music learning to real-life experiences. Teachers use a variety of strategies in the mobile learning process. All of this data shows that even mobile learning can adopt a deep learning approach. |
| Deep Learning in The Primary School English Classroom in Norway (Nordic Journal of Comparative And International Education) | Tony Burner & Delia Schipor | 2025 | Results from study This is some language teachers English not enough know the concept of deep learning, but practices carried out Already in harmony with deep learning principles with through implementation learning Language English cross eye Lessons , facilitating comparison Language English Also Norway For strengthen acquisition vocabulary , and so on. |
| Implementation of Deep Learning in Elementary School Improving the Effectiveness and Quality of IPAS Learning. (Elementary School Education Journal (ELSE)) | Hullatul Luthfiyah , Toto Nusantara, Siti Faizah , Shirly Rizki Kusumaningrum , | 2025 | Deep learning, with its three learning principles (known in the Merdeka curriculum), can be integrated with science subjects, such as meaningful learning, which involves observing the school environment to connect material concepts with real-life experiences; mindful learning, which involves written reflection and discussion to foster metacognitive awareness; and joyful learning, which involves integrating local culture, such as traditional games, to enhance learning. The results of this implementation include improved critical |

| Title (And The Publisher) | Author | Year | Result of Discussion |
|---|---|---|---|
| | Mardhatillah . | | thinking, social skills, learning motivation, and active involvement of both teachers and students in science learning. |
| The Effectiveness of Implementing the Deep Learning Approach to Improve Student Learning Outcomes in the Science Subject of Class V of Sd Negeri 2 Ambon (PENDAS: Scientific Journal of Elementary Education) | Rofika Azzahra Rahaningmas, Ode Abdurrachman, Leonid Ritiauw. | 2025 | The deep learning approach, with its three learning principles (meaningful, mindful, and joyful), can be implemented through a problem-based learning model. The end result is more active, critical, and reflective students, resulting in improved science learning outcomes. |
| Analysis of the Implementation of Deep Learning in the Curriculum at SD Negeri 125 Ogan Komering Ulu, South Sumatra (Journal of Education and Learning Indonesia (JPPI)) | Faris Irfanuddin, Congratulations, Hendro Widodo. | 2025 | The deep learning approach in the independent curriculum has three learning phases: Understanding, Applying , and Reflecting and can be implemented well in Islamic Religious Education (PAI) subjects (based on the distribution of alerts and post-activity distribution data) through open-ended questions, the use of simple digital media, and reflective discussions. The results obtained are that the principle of mindful learning is evident in reflection activities, meaningful learning emerges when students connect religious concepts with the realities around them, and joyful learning is reflected in the warm and pleasant classroom atmosphere. |
| Analysis of the Needs for Deep Learning Design in Mathematics Based on Congklak Games in Elementary Schools (Journal of Educational Research (JPP)) | Ade Dalia, Heri Yusuf Muslihin , Lutfi Nur. | 2025 | Deep learning was implemented in a fun way in mathematics through the traditional game of congklak, which emphasizes the principles of joyful learning. The findings of this study indicate that congklak-assisted mathematics learning can improve conceptual understanding of mathematics, particularly multiplication, in elementary school. |
| The Effectiveness of Using the Pjbl Learning Model Based on Deep Learning & Ict to Improve Creative Thinking Skills of Students at Sdn 3 Glodogan (Didaktika Dwija Indria) | Tri Wulandari & Sutrisna Wibawa. | 2025 | The deep learning approach is implemented by involving students in real-life projects, assisted by the use of digital media for information exploration, collaborative communication, and project-supporting technology (ICT implementation). Qualitatively, students are more active, able to design projects, convey ideas, collaborate, and reflect on their ideas. |
| Implementation of Deep Learning Approach in Improving Students' Conceptual Understanding in Elementary Schools (PENDAS: Scientific Journal of Elementary Education) | Gandhi Wibowo , Deni Gunawan , Dinny Mardiana. | 2025 | The deep learning approach is reflected in the indicators of mind, meaningfulness, and joyful learning. These three aspects can support deeper conceptual understanding through how students pay attention to the material, re-explain concepts, and feel comfortable and happy during the learning process. |
| Deep Learning Approach to Science Learning at State Elementary School 58 Mojo Sragen (PENDAS: Scientific Journal of Elementary Education) | Septyana Candra Puspita, Sri Wardani, Adinda Nova Permatasari. | 2025 | The implementation of the deep learning approach through active learning strategies such as project-based learning and problem-based learning. The results obtained are that the application of the deep learning approach encourages students to understand science concepts in depth and contextually, thereby deepening their understanding of science concepts, fostering the development of advanced thinking skills, and fostering active student engagement. |
| The Influence of the Deep Learning Approach and Interactive Media Based on the Canva Digital Platform on Learning Outcomes of Area Measurement in Elementary Schools (DIDAKTIKA DWIJA INDRIA) | Yuni Karsih Asmi & Zaimnur Wijayanto. | 2024 | A deep learning approach is applied to mathematics instruction, emphasizing in-depth understanding through engaging digital learning tools like Canva. As a result, mathematics learning becomes more engaging, students become more engaged and critical, and the automated feedback provided by the tools can increase motivation to learn. |
| The Effect of Implementing Deep Learning on the Social | Arviana Ayu Gift Dewi & | 2025 | Deep learning encourages students to go beyond memorization to deeply understand concepts, connect new knowledge to previous |

| Title (And The Publisher) | Author | Year | Result of Discussion |
|---|---|---|---|
| Sciences Learning Outcomes of Fifth Grade Students of Muhammadiyah Karangturi Elementary School (PENDAS: Scientific Journal of Elementary Education) | Ani Rusilowati. | | experiences or existing realities, and cultivate critical and reflective thinking. The teacher's role is crucial in designing learning strategies that achieve deep understanding. As a result, deep learning can improve science learning outcomes. |
| Development of Digital-Based Comic Media with a Deep Learning Approach to Improve Elementary School Student Learning Outcomes (PENDAS: Scientific Journal of Elementary Education) | Muhammad Fathul Fuadi, Panca Dewi Purwati, Agus Yuwono. | 2025 | Comic media combines visuals, animations, and interactive tests that encourage learning interest as well as deep learning integration to encourage in-depth understanding, critical thinking, and active student engagement so that the combination of the two can improve their learning outcomes. |
| Improving Literacy Skills Through Deep Learning in Grade IV Students of UPT SDN 8 Pinrang ( Cokroaminoto Journal of Primary Education) | Yusnita Epik, Elihami, Dedi Setiawan. | 2025 | The deep learning approach is implemented through meaningful reading strategies, reflective question and answer sessions, and group discussions that encourage students to understand, interpret, and reflect on the reading content to support literacy skills. The research results show that deep learning contributes positively to improving elementary school students' literacy when applied systematically and reflectively. |
| Teachers' Perceptions of the Implementation of Deep Learning in a Deep Learning Framework. Edukasiana : Journal Innovation Education (Journal of Educational Innovation) | Yoyon Mahardika & Christian Arief Jaya. | 2025 | Results study This is teachers at SDN 02 Patemon understand deep learning as learning based understanding deep conceptual Also involvement active student. |
| Deep Learning Strategy through Co-curricular Activities in Elementary Schools (DIDAKTIKA: Journal of Education) | Siti Lestari Wahyuningsih, Sutama, Yulia Maftuhah Hidayati, Fitri Puji Rahmawati, Minsih. | 2025 | The deep learning approach is implemented in the teaching of mind, meaning, and joy in co-curricular activities such as scouting, dance, and science clubs. Co-curricular activities and deep learning foster each other through active and meaningful activities. |
| Integration of Deep Learning Approach in Civics Learning: Teacher Strategy to Develop Critical and Reflective Character of Elementary School Students (Raudhah Proud To Be Professionals: Jurnal Tarbiyah Islamiyah) | Wanur Khadillah. | 2025 | The deep learning approach is represented through the PBL learning model and inquiry-based learning. Field implementation results show that teachers who choose a deep learning-based learning strategy are proven to encourage students to understand, apply, and reflect on the civic values in Civics lessons. |

Based on the synthesis of the selected studies presented in Table 3, several patterns regarding the implementation of the *deep learning* approach in elementary schools can be identified. The findings show that the deep learning approach is implemented in various learning contexts and subject areas, including science learning, mathematics, English, civic education, music education, and literacy learning.

In general, the reviewed studies demonstrate that deep learning is not limited to a single instructional model but rather represents a pedagogical orientation that emphasizes meaningful engagement, conceptual understanding, and reflective learning processes. The implementation of deep learning also varies depending on teachers' pedagogical understanding, classroom context, and the learning strategies used. To provide a clearer conceptual synthesis, the findings from the selected studies were further categorized into several thematic patterns.

**Table 4.** Thematic Synthesis of Deep Learning Implementation in Elementary Schools

| Thematic Category | Key Characteristics | Supporting Studies |
|---|---|---|
| Conceptual characteristics of deep learning | Learning emphasizes meaningful learning, mindful learning, and joyful learning which promote conceptual understanding and metacognitive reflection | Solvik & Glenna (2022); Wibowo et al. (2025); Luthfiyah et al. (2025); Irfanuddin et al. (2025) |
| Pedagogical implementation strategies | Deep learning is implemented through instructional strategies such as project-based learning, inquiry learning, collaborative learning, mobile learning, and contextual learning | Chen (2023); Wulandari & Wibawa (2025); Khadillah (2025); Puspita et al. (2025) |
| Educational outcomes | Implementation contributes to improved conceptual understanding, literacy skills, critical thinking, creativity, and student engagement | Epik et al. (2025); Fuadi et al. (2025); Rahaningmas et al. (2025); Asmi & Wijayanto (2024) |

**RQ 1.** How level growth trend publication related approach deep learning at school base reviewed on element distribution time, between country, and journal?

To examine the development of research related to the deep learning approach in elementary education, the selected studies were analyzed using several bibliometric indicators, including publication year, country distribution, and journal sources. These indicators provide an overview of the temporal development, geographical concentration, and disciplinary dissemination of studies discussing the implementation of the deep learning approach in elementary school contexts.

**Table 5.** Distribution of Publications by Year

| Year | Number of Articles | Percentage |
|---|---|---|
| 2022 | 1 | 5.9% |
| 2023 | 1 | 5.9% |
| 2024 | 1 | 5.9% |
| 2025 | 14 | 82.3% |
| Total | 17 | 100% |

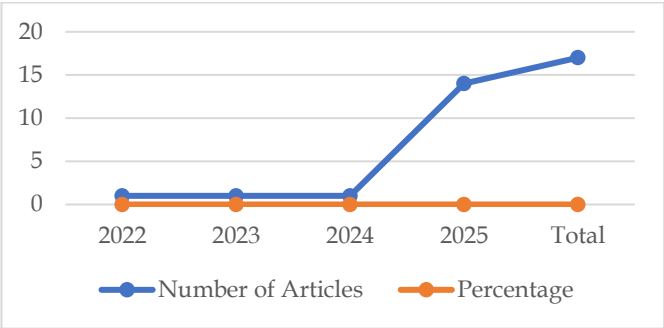


**Figure 2.** Time Growth Diagram of Deep Learning Approach Research

The distribution of publications by year shows a significant increase in research on the deep learning approach in elementary education in recent years. In 2022, only one study was identified, representing 5.9% of the total publications. A similar number of studies was found in 2023 and 2024, each contributing 5.9% of the overall publications. A substantial increase occurred in 2025, with 14 articles published, accounting for 82.3% of the selected studies. This pattern indicates that research interest in the deep learning approach within elementary education has grown considerably in the most recent year. The sharp rise in publications in 2025 reflects the increasing attention of scholars to innovative learning approaches that promote deeper conceptual understanding and support the development of essential 21st-century skills among elementary school students.

This upward trajectory suggests that the deep learning approach has become an increasingly important topic within contemporary educational research, particularly in discussions concerning innovative pedagogical strategies aimed at fostering deeper conceptual understanding, critical thinking, and meaningful learning experiences in elementary education. However, the concentration of publications in recent years should be interpreted with caution, as the distribution may also be influenced by the selection criteria applied in this systematic literature review, including publication year limitations (2020–2025), journal indexing requirements (SINTA 1–4 and Scopus), and the inclusion of empirical studies specifically addressing elementary education settings.

**Table 6.** Distribution of Publications by Country

| Country | Number of Articles | Percentage |
|---|---|---|
| Indonesia | 14 | 82.4% |
| Norway | 2 | 11.8% |
| Hong Kong | 1 | 5.8% |
| Total | 17 | 100% |

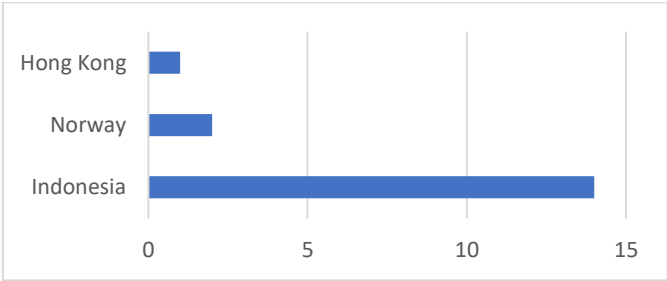


**Figure 3.** Time Growth Diagram of Deep Learning Approach Research

The findings demonstrate that Indonesia contributes the largest proportion of publications, accounting for 82.4% of the total studies included in this review. In comparison, Norway contributes 11.8% of the publications, while Hong Kong accounts for 5.8%.

The strong dominance of Indonesian publications suggests that the topic of deep learning in elementary education has gained significant attention among scholars within the Indonesian educational research community. This trend may be associated with ongoing efforts to improve instructional quality and promote student-centered learning approaches within the national education system. At the same time, studies originating from Norway and Hong Kong provide important international perspectives that contribute to a broader understanding of how the deep learning approach is conceptualized and implemented across different educational contexts and sociocultural environments.

In addition to temporal and geographical analysis, this review also examines the distribution of publications based on journal sources. This analysis is important to identify the disciplinary contexts in which research on the deep learning approach in elementary education is disseminated.

**Table 7.** Distribution of Publications by Journal Source

| Journal Source | Number of Articles | Percentage |
|---|---|---|
| PENDAS: Jurnal Ilmiah Pendidikan Dasar | 5 | 29.4% |
| Jurnal Pendidikan Dasar Indonesia | 3 | 17.6% |
| Jurnal Pendidikan Guru Sekolah Dasar | 2 | 11.8% |
| International Journal of Education Studies | 2 | 11.8% |
| Journal of Music Education | 1 | 5.9% |
| Journal of Curriculum and Instruction | 1 | 5.9% |
| Journal of Educational Research | 1 | 5.9% |
| Journal of Learning Innovation | 1 | 5.9% |
| Journal of Educational Practice | 1 | 5.9% |
| Total | 17 | 100% |

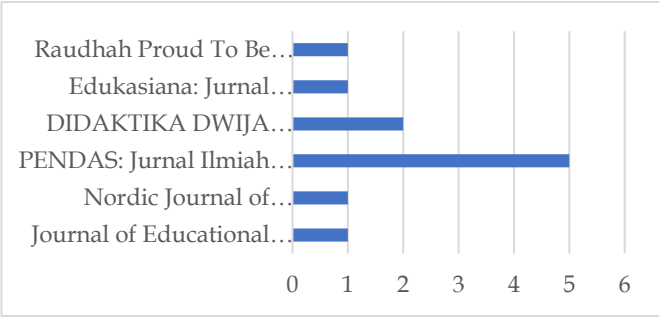


**Figure 4.** Time Growth Diagram of Deep Learning Approach Research

The analysis indicates that research on the deep learning approach in elementary education is disseminated across a diverse range of academic journals representing different educational disciplines. The largest proportion of publications appears in *PENDAS: Jurnal Ilmiah Pendidikan Dasar*, which accounts for 29.4% of the total studies. Several other studies were published in journals focusing specifically on elementary education and teacher education, such as *Jurnal Pendidikan Dasar Indonesia* and *Jurnal Pendidikan Guru Sekolah Dasar*.

In addition to journals specializing in elementary education, several studies were also published in broader educational journals and interdisciplinary academic outlets, including journals related to curriculum studies, educational research, and music education. This pattern suggests that the deep learning approach is not limited to a specific academic discipline but is instead discussed across multiple domains within the field of education.

The diversity of journal sources reflects the interdisciplinary nature of the deep learning approach, which can be applied in various subject areas and instructional contexts. Consequently, research on this topic continues to expand beyond traditional boundaries of elementary education scholarship, indicating its growing relevance in contemporary discussions on innovative pedagogical practices.

**RQ 2.** What are the characteristics of the application of *the deep learning* approach in elementary schools?

*Constructive Learning*

In the 21st century, all jobs that rely solely on memorizing mechanical routines will be easily replaced by machine development (Sølvik & Glenna, 2022) . Therefore, the ideal education today is learning that does not only rely on memorization for students, but trains advanced thinking skills (Rahaningmas et al., 2025) . This is in line with the application of the *deep learning approach* based on previous studies where deep learning has a variety of activities that welcome in-depth understanding for elementary school students (Siti Lestari Wahyuningsih et al., 2025) . The many varieties of active learning activities in the *deep learning approach* in elementary schools have the same characteristic pattern, namely constructive learning where knowledge is obtained through activities to build understanding, not just being given.

Constructive learning is reflected in learning activities with a *deep learning approach* through the process of active involvement of elementary school students in building their own understanding so that the position of educators shifts from the most dominant role to a facilitator in learning (Luthfiyah et al., 2025) . Constructive learning in this approach is carried out

through various strategies and methods such as discussions, project implementation, observation, and various other active activities (Wulandari & Wibawa, 2025) . Although there are variations in constructive learning activities in *deep learning* , there is the same core learning scheme, namely linking knowledge that elementary school students already have with new knowledge and/or applying existing knowledge to real and contextual life for elementary school students (Epik & Setiawan, 2025). In fact, the statement that the characteristics of constructive learning are closely related to the application of the deep learning approach is supported by one of the principles of *deep learning* introduced by the Indonesian education curriculum, the Merdeka curriculum, that meaningful education for students is a learning process that links new knowledge with old knowledge and this is the principle of Meaningful learning *(* Irfanuddin et al., 2025).

As a pedagogical approach that prioritizes constructive learning, *deep learning* is not only bound by various familiar learning models such as problem-based learning and project-based learning (Irfanuddin et al., 2025) , but is reflected in how an educator applies learning to construct deep understanding for students even though it is packaged through conventional learning strategies (Burner & Schipor, 2025) . However, educators who understand the concept of the *deep learning approach* will make a full effort to apply constructive learning with various active activities rather than those who only accidentally apply it without fully understanding the concept of this learning approach (Irfanuddin et al., 2025) . This shows that the *deep learning approach* is flexible to be applied with various teaching methods and the term *deep learning* is not only seen as a product of a pedagogical approach to improve learning quality, but as a goal where learning quality is measured through students' deep understanding.

The striking strategy in the application of constructive learning in the *deep learning approach* in elementary schools is presented in a way that is contextual to the lives of its students (Septyana Candra Puspita, Sri Wardani, 2025) . This is to make it easier for students to understand abstract teaching materials for them by linking patterns or characteristics of abstract teaching materials with real experiences or their previous understanding (Irfanuddin et al., 2025) , both packaged through group discussions to discuss issues around and how to solve them, making joint projects in learning, observing the school environment, and other forms of contextual learning in achieving learning constructivism with a *deep learning approach.*

*Fun and Recreational Learning*

Based on the results of the synthesis of articles categorized as suitable for discussing this topic, it was found that the implementation of learning oriented towards the *deep learning approach* places great importance on the emotional condition and learning motivation of elementary school students. This is because their emotional condition and learning motivation play an important role in the success of achieving a deep understanding of learning (Khadillah, 2025) . Meanwhile, elementary school students really like to play and are active, so if these two elements are accommodated into the learning system, their enthusiasm and learning motivation will increase (Dalia et al., 2025) . Therefore, the *deep learning approach* is implemented in elementary schools through the characteristics of fun and recreational learning activity patterns (Luthfiyah et al., 2025).

There are many ways to apply the characteristics of fun and recreational learning in the deep learning approach, for example by using a *game-based learning model* that not only emphasizes learning success but also student enthusiasm through meaningful and contextual educational games (Dalia et al., 2025), the use of interactive and fun teaching media that can be easily accessed and used by students, for example, Canva interactive slides and so on (Asmi & Wijayanto, 2025) , or even implemented simply through constructive and contextual learning through direct practice activities, discussions, and the implementation of real projects (Luthfiyah et al., 2025).

*Reflective Learning*

Similar to the characteristics of the implementation pattern of the *deep learning approach* in elementary schools previously, the results of the researcher's analysis from the synthesis of previous studies found that there are characteristics of reflective learning in the patterns of various learning practices with the *deep learning approach.* Reflective learning is a learning characteristic that develops students' metacognition, where they are directed to think and ask questions related to what is learned so that it can be seen by educators and themselves (Sølvik & Glenna, 2022) . The goal is to understand the urgency of the learning they are undergoing and reflect it on real life. As well as knowing and evaluating their difficulties during learning so that they can find the right learning strategy (Luthfiyah et al., 2025) .

As for the application of learning with a *deep learning approach* , the characteristics of reflective learning appear to intersect with the mechanism of constructive learning characteristics where learning is packaged through contextual strategies with real life that are close to elementary school students to facilitate

understanding of the relevance between concepts and their lives (Siti Lestari Wahyuningsih et al., 2025) , for example, such as discussing with both educators and peers, writing reflective journals, and various other teaching strategies which must encourage students to explain the information process in their own cognitive powers as well as analyze and evaluate themselves in problem solving (Sølvik & Glenna, 2022) .

**RQ 3.** How Does *the Deep* Learning Approach Impact Elementary School Students?

Based on previous empirical studies, the *deep learning approach* can significantly improve the learning outcomes of elementary school students. This is because learning based on this approach is not merely memorizing lesson material, but understanding the material in depth conceptually (Gandi Wibowo, Deni Gunawan, 2025). In addition, the improvement in elementary school students' learning outcomes is also supported by an increase in their enthusiasm and motivation to learn through active and enjoyable learning activities (Dalia et al., 2025). This represents a learning transformation that makes elementary school students no longer passive when learning, but active, conscious, and happy students (Irfanuddin et al., 2025). The pattern captured from here is that the *deep learning approach* changes passive and monotonous learning methods for students to active, enjoyable yet in-depth learning, thereby supporting their enthusiasm and motivation to learn which ultimately can improve learning outcomes.

However, the impact of the *deep learning approach* for elementary school students is more than just their learning outcomes. For elementary school students, the deep learning approach trains the 6C skills, a categorical label of 21st-century skills consisting of *Critical thinking* , Creativity , *Collaboration* , *Communication* , *Citizenship* , *and Character* ( Epik & Setiawan, 2025) . In more detail, training in elementary school students' critical thinking skills is projected through activities in achieving deep conceptual understanding through discussion and problem solving (Gandi Wibowo, Deni Gunawan, 2025) . Meanwhile, elementary school students' creative thinking abilities are honed through learning activities that ask them to create a creative project (Wulandari & Wibawa, 2025) , one form of learning the *deep learning approach* through the application of knowledge to real-life contexts (Septyana Candra Puspita, Sri Wardani, 2025) . Furthermore, two inherent skills, collaboration and communication, are reflected through the characteristics of *deep* learning models that emphasize the importance of social interaction between students. The learning environment is built through discussion, sharing, and collaboration among peers (Chen, 2024) . Finally, citizenship skills and character development in elementary school students can be achieved through a *deep learning approach* through activities that build self-reflection as good citizens, thereby fostering a healthy character for the nation and state (Khadillah, 2025) . In a *deep learning approach* , all of these components can be accommodated not only separately but also simultaneously. Furthermore, this approach can be practiced not only in the academic field but also in areas of interest and talent in co-curricular activities (Siti Lestari Wahyuningsih et al., 2025) . This makes the *deep learning approach* highly relevant to education in this century compared to learning approaches that only rely on memorization of material.

In addition to improving 21st-century skills, the *deep learning approach* also adopts and develops elementary school students' metacognitive skills through reflective learning activities such as reflective discussions, journal writing, and so on (Burner & Schipor, 2025) . This enables students to understand the purpose and meaning contained in their own learning, not just simply knowing. Furthermore, they can also identify and evaluate errors and difficulties in learning and then find solutions in the form of appropriate learning strategies (Luthfiyah et al., 2025).

## Conclusion

Implementation approach learning *deep learning* in schools base proven give positive impact for participant his education , good from aspect results Study students , abilities 21st century , and ability metacognitive that will required they were in the past front. In in practice , approach learning *deep learning* drip weigh down activities active And formation constructive understanding in class , so that make learning the more deep And No only memorize A draft material solely. This is reflected in the learning models that are often used in the practice of implementing *deep learning* in elementary schools, namely problem-based learning and project-based learning models.

In addition, this study also shows an increasing trend in publications regarding the application of *deep learning approaches* in elementary schools, which will increase sharply in 2025. This shows that this approach is very much needed to overcome various learning problems in elementary schools, especially in Indonesia. This article is limited by the availability of articles indexed in Sinta and Scopus, as well as other exclusion and inclusion criteria. This means it may not fully represent all research on *deep learning approaches* in elementary schools. Another limitation is the limited exploration, as it has not identified issues that could hinder the implementation of this approach in elementary schools.

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Muhammad Zaidan Fadhlurahman (MZF) : Responsible answer on conceptualization , methodology , writing draft beginning , and results And discussion ; Irwandani ( I ): Responsible answer on validation , methodology , and writing as well as review ; Deri Firmansah (DF) : Responsible answer on supervision , conclusions , and review.

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