

Implementation of Deep Learning to Improve Critical Thinking Skills of Elementary School Students

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Abstract

Education in the 21st century faces increasingly complex demands along with the rapid development of technology, information, and social change. This study aims to analyze the application of Deep Learning in improving the critical thinking skills of elementary school students. The study used a quantitative approach with a quasi-experimental method through a one-group pretest-posttest design. The research subjects were 30 elementary school students selected using a purposive sampling technique. Data collection was carried out through critical thinking skills tests, observation, and documentation. Data were analyzed using descriptive and inferential statistics through normality tests and paired sample t-tests, as well as N-Gain analysis to determine the level of improvement in students' critical thinking skills. The results showed that the application of Deep Learning was able to improve students' critical thinking skills. The average pretest score of 62.40 increased to 82.17 in the posttest, with an increase of 19.77 points. Improvements occurred in all critical thinking indicators, namely information interpretation, problem analysis, argument evaluation, conclusion drawing, and the ability to provide logical explanations. The results of statistical tests showed a significance value of $0.000 < 0.05$, which indicates a significant difference between students' critical thinking skills before and after the application of Deep Learning. The application of learning through problem exploration, discussion, information analysis, problem-solving, argumentation, and reflection creates a more active and meaningful learning experience. Thus, Deep Learning can be an effective alternative learning strategy to improve elementary school students' critical thinking skills and support the development of higher-order thinking skills in students.

Keywords

Critical Thinking; Deep Learning; Elementary School; Higher-Order Thinking Skills



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INTRODUCTION

Education in the 21st century faces increasingly complex demands along with the rapid development of technology, information, and social change. Schools are no longer simply

required to provide students with factual knowledge, but must also be able to develop various important competencies that enable them to understand, analyze, evaluate, and use information appropriately in everyday life. One such competency plays a crucial role in this development is critical thinking skills. Critical thinking is an individual's ability to identify problems, analyze information, evaluate alternatives, construct logical arguments, and draw conclusions based on relevant evidence. The OECD lists critical thinking as one of the essential skills that need to be developed through the learning process because this ability is necessary in facing an increasingly complex, global, and digitalized society. Therefore, the development of critical thinking skills needs to begin in elementary school so that students have a strong cognitive foundation for facing the next level of education (Maulidia, 2026).

However, learning in elementary schools still faces various challenges in developing students' critical thinking skills. In practice, the learning process is often oriented towards delivering material, memorizing, and achieving a single answer. This condition results in students not having optimal opportunities to ask questions, explore a problem, compare various pieces of information, provide reasons for opinions, and reflect on their learning process. Several studies show that elementary school students still experience difficulties in identifying problems, presenting logical arguments, drawing conclusions, and solving problems independently. Learning that is too teacher-centered can limit students' active involvement in building in-depth understanding. Studies on learning in elementary schools also show that limited opportunities for exploration and problem-based learning are obstacles to the development of students' higher-order thinking skills. Therefore, learning innovations are needed that can shift the orientation of education from mere mastery of material to a more meaningful and in-depth understanding (Akbar & Ahsan, 2026).

One relevant approach to addressing these needs is the application of Deep Learning in a pedagogical context, or immersive learning. Deep Learning in learning is not simply defined as the use of artificial intelligence technology, but rather as a learning approach that encourages students to meaningfully understand concepts, connect new knowledge with prior experiences, reflect, explore problems, and apply knowledge in various real-life contexts. This approach positions students as active subjects in the learning process, so they do not merely receive information passively but are involved in the process of discovering, analyzing, and constructing knowledge. In elementary school learning, the Deep Learning approach can be implemented through inquiry activities, discovery learning, problem-based learning, project-based learning, reflective discussions, asking high-level questions, and solving contextual problems. This approach allows students to develop analytical, evaluation, inference, and decision-making skills gradually in accordance with their developmental characteristics (Nuraeni et al., 2025).

The application of Deep Learning also has great potential in improving critical thinking skills because the learning process emphasizes active engagement and deep conceptual understanding. Recent research in elementary education shows a tendency for increased critical thinking skills when Deep Learning is integrated with active learning models. Research by

Yulita et al. shows that the application of Deep Learning pedagogy in elementary school learning can be used as a strategy to encourage students' critical thinking skills. Other research shows that the integration of Project-Based Learning with deep learning processes can significantly improve students' critical thinking skills scores. Furthermore, the Deep Learning approach combined with Discovery Learning, STEAM, Design Thinking, and problem-based learning also shows potential in strengthening higher-order thinking skills, problem-solving abilities, and active student engagement in learning. These findings demonstrate that Deep Learning can be an alternative learning approach that can create a more active, contextual, reflective, and student-centered learning experience (Mareta et al., 2026).

Based on this description, the application of Deep Learning in elementary school learning is important to study in more depth as a strategy to improve students' critical thinking skills. Developing critical thinking skills from elementary school age not only provides benefits for academic achievement, but also helps students become individuals who are able to face problems, evaluate information, make rational decisions, and adapt to changes that occur in the future. In the context of education that increasingly emphasizes 21st-century competencies, teachers need to design learning that provides space for students to ask questions, explore, analyze, reflect, and apply knowledge in real situations. Therefore, research on "The Application of Deep Learning to Improve Critical Thinking Skills of Elementary School Students" is important to gain an understanding of the effectiveness of the deep learning approach in creating a more meaningful learning process while improving the quality of students' critical thinking skills.

METHODS

This study uses a quantitative approach with a quasi-experimental method *to* analyze the application of Deep Learning in improving the critical thinking skills of elementary school students. The research design used is a one-group pretest-posttest design , which is a research design carried out by providing an initial test (pretest) before the implementation of Deep Learning learning and a final test (posttest) after the implementation of learning. The research subjects were elementary school students selected using a purposive sampling technique based on certain criteria, namely students who actively participate in the learning process and are willing to participate in the entire series of research activities. The application of Deep Learning is carried out through learning that emphasizes in-depth, meaningful, and reflective learning experiences through problem exploration activities, discussions, information analysis, problem solving, argumentation, and drawing conclusions. Students' critical thinking skills are measured through indicators of the ability to interpret information, analyze problems, evaluate arguments, draw conclusions, and provide logical explanations.

Data collection was conducted through critical thinking skills tests, observation of the learning process, and documentation of research activities. Test instruments were administered before and after the implementation of Deep Learning to determine changes in students' critical thinking skills. Research data were analyzed quantitatively using descriptive statistics and

inferential statistics. Descriptive analysis was used to describe the average, minimum value, maximum value, and level of students' critical thinking skills, while inferential analysis was used to test differences in pretest and posttest results. Before hypothesis testing was carried out, the data were first tested for normality to determine the appropriate analysis technique. If the data were normally distributed, testing was carried out using a paired sample t-test, whereas if the data were not normally distributed, the Wilcoxon signed-rank test was used. In addition, improvements in students' critical thinking skills can be analyzed using the N-Gain value to determine the level of effectiveness of the application of Deep Learning in learning in elementary schools.

FINDINGS AND DISCUSSION

This study aims to analyze the application of Deep Learning in improving the critical thinking skills of elementary school students. The implementation of Deep Learning is carried out through learning activities oriented towards in-depth conceptual understanding, problem exploration, group discussions, information analysis, problem solving, reflection, and drawing conclusions. Before the learning is implemented, students are given a pretest to determine their initial critical thinking skills. After the entire learning series is completed, students are given a posttest to determine changes in critical thinking skills after receiving Deep Learning-based learning.

Based on the results of research on 30 elementary school students, the results showed that the average value of students' critical thinking skills increased after the implementation of Deep Learning. At the pretest stage, the average student score was 62.40 with a minimum score of 45 and a maximum score of 78. After the implementation of Deep Learning, the average posttest score increased to 82.17 with a minimum score of 68 and a maximum score of 96. This increase indicates a positive change in students' ability to understand problems, analyze information, evaluate various alternative answers, and draw logical conclusions.

Table 1.the results Pretest and Posttest

Indicator	Pretest	Posttest	Improvement
Interpretation of information	63.20	83.67	20.47
Problem analysis	60.83	81.50	20.67
Evaluation of arguments	59.67	80.33	20.66
Draw a conclusion	65.17	84.00	18.83
Provide an explanation	63.13	81.33	18.20
Average	62.40	82.17	19.77

The results in the table show that all critical thinking skill indicators improved. The highest increase was seen in the problem analysis indicator, which reached 20.67 points. This indicates that the implementation of Deep Learning provides students with the opportunity to more actively identify problems, connect the information obtained, and seek alternative solutions. The argumentation evaluation indicator also increased by 20.66 points because

during the learning process, students were trained to provide reasons for their answers and opinions. Meanwhile, the indicators for drawing conclusions and providing explanations improved because students were given the opportunity to reflect on the learning process.

Furthermore, the results of the statistical analysis showed that the average posttest score was higher than the pretest score. The results of the normality test showed that the data were normally distributed, so the hypothesis testing was carried out using a paired sample t-test. Based on the test results, a significance value of 0.000 was obtained, or less than 0.05. Thus, there was a significant difference between students' critical thinking skills before and after the implementation of Deep Learning. These results indicate that Deep Learning has a positive effect on improving the critical thinking skills of elementary school students (R. B. Pratama et al., 2025).

Discussion

Improved students' critical thinking skills demonstrate that deep learning can create a more active and meaningful learning process. In this learning approach, students not only receive material from the teacher but are actively involved in the process of understanding and constructing knowledge. Students are presented with problems related to everyday life, encouraging them to identify problems, seek information, discuss alternative solutions, and express opinions based on logical reasoning. These activities provide a more in-depth learning experience than learning that only emphasizes memorization.

Improved problem-analysis skills were one of the key findings of this study. During the implementation of Deep Learning, students were trained to understand a problem from multiple perspectives. The teacher did not provide direct answers but instead asked provocative questions that encouraged students to think and find solutions independently. This process helped students develop the ability to distinguish important information, connect various concepts, and determine problem-solving steps. Thus, students became more accustomed to using higher-order thinking skills in the learning process (Maulidya et al., 2025).

Furthermore, improvements in argumentation evaluation indicators demonstrate that Deep Learning is able to encourage students to not only provide answers but also explain the reasons behind those answers. Through group discussions and presentations, students have the opportunity to express their opinions, listen to their peers' perspectives, and respond to differing opinions. This creates a learning environment that supports the development of critical thinking skills as students learn to evaluate information before accepting or agreeing with an opinion. These skills are crucial in the digital age when students are faced with a vast amount of information and need to be able to assess its accuracy and relevance (Dewi et al., 2026).

Critical thinking skills are also enhanced by reflection activities within the learning process. At the end of the activity, students are given the opportunity to identify new knowledge gained, difficulties encountered, and strategies used to solve problems. Reflection activities help students understand their own thinking processes and increase awareness of

their learning styles. Through reflection, learning is not solely focused on the final outcome but also focuses on the student's process of understanding, analyzing, and solving a problem.

Overall, the research results indicate that the application of Deep Learning can be an alternative learning method to improve the critical thinking skills of elementary school students. Learning that emphasizes the processes of exploration, analysis, discussion, problem-solving, and reflection can provide a more meaningful learning experience for students. Teachers play a crucial role in designing learning activities that are appropriate to the characteristics of elementary school students and providing stimulating questions that encourage the emergence of higher-order thinking skills. Therefore, the application of Deep Learning needs to be developed sustainably as part of learning innovation to prepare students to develop critical thinking skills, problem-solving skills, and be able to face various challenges in the era of technological and information development (G. A. Pratama & Purnomo, 2026).

CONCLUSION

Based on the research results, it can be concluded that the implementation of Deep Learning has a positive influence on improving the critical thinking skills of elementary school students. This is indicated by an increase in the average learning outcomes from a pretest score of 62.40 to 82.17 in the posttest . This increase was seen in all indicators of critical thinking skills, including the ability to interpret information, analyze problems, evaluate arguments, draw conclusions, and provide logical explanations. The results of statistical tests also showed a significant difference between students' critical thinking skills before and after the implementation of Deep Learning.

The application of Deep Learning through problem exploration, discussion, information analysis, problem-solving, argumentation, and reflection can create a more active, meaningful, and student-centered learning process. This approach provides students with the opportunity to not only receive and memorize material but also to deeply understand concepts and relate them to everyday life problems. Thus, Deep Learning can be an effective alternative learning strategy for developing higher-order thinking skills, particularly critical thinking skills, in elementary school students. Therefore, teachers are expected to continuously integrate Deep Learning principles into the learning process by designing activities that are contextual, interactive, and reflective, and in accordance with student developmental characteristics.

REFERENCES

- Akbar, M., & Ahsan, M. (2026). Peningkatan Kemampuan Berfikir Kritis Siswa Menggunakan Metode Deep Learning pada Pembelajaran Matematika di SMP. *JIIP (Jurnal Ilmiah Ilmu Pendidikan)*, 9(2), 1736–1743.
- Bahri, S. (2026). Implementasi pembelajaran berorientasi deep learning untuk meningkatkan keterampilan critical reading siswa SD. *Jurnal Keguruan dan Ilmu Pendidikan*, 4(1).
- Hasanah, U., Laili, U. N., Dewi, M. A., Rahmah, M. U., & Hermanto. (2026). Implementasi deep learning berbasis problem-based reading untuk meningkatkan literasi baca kritis siswa sekolah dasar. *Jurnal Riset Pendidikan Dasar dan Karakter*, 8(1).

- Herianingtyas, N. L. R., Dewi, R., & Latip, A. E. (2026). A STEAM-integrated deep learning model with design thinking to improve elementary students' critical thinking skills. *Journal of Deep Learning*, 2(1). <https://doi.org/10.23917/jdl.v2i1.11914>
- Dewi, S., Hapsari, S., & Munali. (2026). Efektivitas Penerapan Deep Learning Untuk Meningkatkan Keterampilan Berpikir Kritis. *Research And Development Journal Of Education*, 12(1), 250–259.
- Mareta, N. P., Saputra, A. T., & Mahendra, Y. I. (2026). Penerapan Deep Learning Untuk Meningkatkan Keterampilan Berpikir Kritis Siswa Pada Mata Pelajaran Ips Di Sd Negeri 54 Seluma. *Modeling: Jurnal Program Studi PGMI*, 13(2), 75–99.
- Maulidia, Q. (2026). Peningkatan Keterampilan Berpikir Kritis dan Kolaborasi Melalui Pendekatan Pembelajaran Mendalam (Deep Learning) pada Mata Pelajaran IPAS Kelas V SD Program Studi Pendidikan Guru Sekolah Dasar. *Guru Kita*, 10(3), 246–260.
- Maulidya, D., Nur, D., Eka, A., Umamy, N. A., & Syukri, M. (2025). Analisis Literatur Peran Deep Learning dalam Mendorong Pembelajaran Bermakna di Sekolah Dasar. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, 4(2), 9072–9084.
- Nuraeni, Y., Gifari, A., & Ivanna, A. (2025). Peran Guru Dalam Menerapkan Strategi Deep Learning Untuk Meningkatkan Berpikir Kritis Siswa Sd. *Pediaqu : Jurnal Pendidikan Sosial Dan Humaniora*, 4(3), 6185–6193.
- Nabel, P. A., & Wahyuni, P. (2025). Analisis implementasi pembelajaran deep learning pada kemampuan berpikir kritis siswa sekolah dasar. *Jurnal Dharma PGSD*.
- Novianty, R., & Yuniarti, Y. (2026). Implementation of deep learning, learning engagement, and emotional regulation on the improvement of critical thinking and collaboration among elementary school students. *Sosioedukasi: Jurnal Ilmiah Ilmu Pendidikan dan Sosial*, 15(1). <https://doi.org/10.36526/sosioedukasi.v15i1.7244>
- OECD. (2019). *Fostering students' creativity and critical thinking: What it means in school*. OECD Publishing.
- Panca, I. G., & Parisu, C. Z. L. (2025). Implementasi pendekatan pembelajaran mendalam dalam meningkatkan keterampilan berpikir kritis siswa sekolah dasar. *Journal of Humanities, Social Sciences, and Education*, 1(7). <https://doi.org/10.64690/jhuse.v1i7.314>
- Permatasari, A., Sopandi, W., Hendriawan, D., & Pujiasih, Y. (2026). The effectiveness of the project based learning model with a deep learning approach on the critical thinking skills of fifth grade students at SDN Pejaten 2. *International Conference on Elementary Education Proceedings*, 8(1).
- Pratama, G. A., & Purnomo, H. (2026). Penerapan Pembelajaran Deep Learning Untuk Meningkatkan Penalaran Kritis Siswa Kelas V Sdn Rukeman Pada Mata Pembelajaran Ips. *Science And Education Journal*, 5(2), 1607–1614.
- Pratama, R. B., Laila, A., & Budianto, A. (2025). Implementasi Pendekatan Deep Learning Dalam Membangun Keterampilan Berpikir Kritis Siswa Kelas Iv Pada Pembelajaran Ips. *Pendidikan Karakter*, 2(1), 601–613.
- Seviardini, S., Faradita, M. N., & Naila, I. (2026). Pengaruh pendekatan deep learning terhadap kemampuan berpikir kritis peserta didik pada pembelajaran IPAS sekolah dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 11(1). <https://doi.org/10.23969/jp.v11i01.40949>
- Yulita, Y., Mawardi, M., Christi, S. R. N., & Akbar, A. (2025). Deep learning pada pembelajaran sekolah dasar: Upaya untuk mempromosikan kemampuan berpikir kritis. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 10(4). <https://doi.org/10.23969/jp.v10i4.35375>