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Deep Learning Approach and Its Impact on Elementary Students' Learning Experience and Critical Thinking: An Experimental Study

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Abstract

This study examines the effect of deep learning instruction on elementary school students' learning experience and critical thinking skills, addressing the need for instructional approaches that promote meaningful learning and higher-order thinking. The research employed a quantitative approach using a Quasi-Experimental Nonequivalent Control Group Design involving fifth-grade students at SD Negeri Kedungdalem II, Probolinggo Regency, during the second semester of the 2025/2026 academic year. The sample consisted of 56 students, with 28 students assigned to the experimental group and 28 students to the control group. The experimental group received deep learning instruction implemented through four stages: concept exploration, analysis and meaning-making, deep reflection, and application of concepts in real-life contexts, while the control group experienced conventional instruction. Data were collected using a learning experience questionnaire and a critical thinking skills test, both of which met validity and reliability criteria. The results showed that the experimental group achieved higher mean scores in learning experience (M = 83.45) and critical thinking skills (M = 78.62) compared to the control group (M = 74.18 and M = 69.07, respectively). Independent Samples t-test results indicated statistically significant differences between the two groups ($p < 0.05$). These findings demonstrate that deep learning instruction is effective in enhancing meaningful learning experiences and students' critical thinking skills in elementary education.
Keywords: *deep learning, learning experience, critical thinking*

Introduction

Learning at the elementary school level still faces challenges in creating meaningful learning experiences and promoting students' higher order thinking skills (Novandi et al., 2025; Rahayu et al., 2025; Zalsa et al., 2025). Classroom practices are generally dominated by lecturing, direct assignments, and procedural delivery of material. Such instructional patterns lead to shallow learning experiences, memorization oriented activities, and limited opportunities for developing critical thinking skills (Maysarah et al., 2024; Nabila & Firmansah, 2025). In the IPAS subject in particular, students often struggle to connect scientific concepts with everyday life, resulting in learning processes that are neither holistic nor reflective or exploratory (Hidayatullah et al., 2025; Indayana & Indrapangastuti, 2025; Ma'rifah & Karimah, 2025). These conditions indicate that current instructional practices have not fully aligned with the principles of the Merdeka Curriculum, which emphasize active participation, contextual learning, and higher-order thinking.

To address these issues, various student-centered learning approaches have been widely implemented to enhance learning quality and critical thinking skills. Strategies such as problem-based learning, inquiry learning, and project-based learning have demonstrated effectiveness in increasing student engagement and promoting active learning in elementary classrooms

(Maysarah et al., 2024; Rahayu et al., 2025; Wati & Sugesti, 2025). However, recent studies indicate that these approaches do not always guarantee deep conceptual understanding or sustained reflective thinking, as learning activities may remain task-oriented and focus primarily on product completion rather than meaning-making processes (Khofifah et al., 2024; Martati, 2022). Consequently, there is a need for an instructional approach that not only positions students at the center of learning but also supports deeper cognitive engagement, conceptual integration, and the transfer of knowledge to real-life situations. In this regard, deep learning is considered a promising approach, as it emphasizes meaningful understanding, reflective processing, and the application of knowledge across contexts.

Despite growing interest in deep learning across various educational levels and disciplines, empirical studies examining its implementation at the elementary school level, particularly in IPAS learning, remain limited. Moreover, existing research tends to focus primarily on learning outcomes or conceptual mastery, with relatively little attention given to students' learning experiences and critical thinking skills as interconnected dimensions of learning. This limitation highlights a research gap regarding the need for studies that comprehensively examine how deep learning influences both affective-cognitive learning experiences and higher-order thinking skills within elementary science and social studies instruction.

Based on this gap, the novelty of the present study lies in its experimental investigation of deep learning instruction in elementary IPAS classrooms by simultaneously examining its effects on students' learning experiences and critical thinking skills. Unlike previous studies that predominantly emphasize cognitive achievement alone, this research integrates experiential and cognitive dimensions of learning within a single experimental framework. By focusing on IPAS content and employing a quasi-experimental design, this study contributes new empirical evidence to the literature on deep learning in elementary education and offers practical insights for teachers seeking to implement more meaningful, reflective, and student-centered instructional practices aligned with the demands of twenty-first-century learning.

Method

This study employed a quantitative approach using an experimental design. Specifically, a Quasi-Experimental Design with a Nonequivalent Control Group Design was applied, as class assignment was based on existing classroom groupings rather than randomization. This design involved two groups—an experimental group and a control group—that received different instructional treatments to examine the effect of deep learning on students' learning experiences and critical thinking skills.

The study was conducted at SD Negeri Kedungdalem II, Dringu District, Probolinggo Regency, during the second semester of the 2025/2026 academic year. The research participants were fifth-grade students divided into two intact classes: Class VA, consisting of 28 students, served as the experimental group, while Class VB, also consisting of 28 students, served as the control group. To minimize instructional bias, both classes were taught by the same IPAS teacher, ensuring consistency in teaching style, classroom management, and assessment practices. The experimental group received instruction using a deep learning approach, whereas the control group followed conventional instructional practices commonly used by the teacher.

The intervention was implemented over four instructional meetings, each lasting 2 × 35 minutes, resulting in a total intervention duration of approximately 280 minutes. The learning content focused on IPAS Chapter Five, How We Live and Grow, specifically Topic B, Why We Need to Eat and Drink. In the experimental class, deep learning instruction was carried out

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through four structured stages: (1) concept exploration, where students observed phenomena, consulted learning resources, and identified relationships between nutrition and growth; (2) analysis and meaning-making, in which students discussed key ideas, identified essential factors, and connected scientific concepts to real-life experiences; (3) deep reflection, where students responded to reflective questions concerning the importance of food and drink for body growth; and (4) concept application, in which students solved contextual problems, such as designing a healthy menu or analyzing the consequences of nutrient deficiencies. Meanwhile, the control class received conventional instruction consisting of teacher explanations, routine exercises, and limited discussion without explicit deep learning strategies.

The research instruments comprised two types. The first was a learning experience questionnaire developed using a five-point Likert scale, covering indicators of emotional engagement, cognitive engagement, relevance of learning experiences, and comfort during learning. The second was a critical thinking skills test consisting of fifteen multiple-choice items developed based on the indicators of analyzing, evaluating, and drawing inferences. Prior to data collection, both instruments underwent content validity assessment by two experts in elementary education and IPAS to ensure alignment with the measured constructs. Empirical validity was tested using the Product Moment correlation, while reliability was examined using Cronbach's Alpha coefficient. Instruments were considered acceptable if the validity coefficient was $r \geq 0.30$ and the reliability coefficient was $\alpha \geq 0.70$.

Data were collected through pretests and posttests for critical thinking skills and through questionnaires administered after the intervention to measure learning experiences. Data analysis involved descriptive statistics to describe score distributions and inferential statistics to test the research hypotheses. Prior to hypothesis testing, prerequisite analyses were conducted. The Shapiro–Wilk test was used to examine data normality because the sample size in each group was fewer than 50 students, while homogeneity of variance was tested using Levene's test. Differences in mean scores between the experimental and control groups were analyzed using the Independent Samples t-test, as the data met the assumptions for parametric testing. All statistical analyses were performed using SPSS software.

To control potential external factors that might influence the research outcomes, several measures were taken, including the use of the same learning materials, identical time allocation, equivalent assessment instruments, and consistent classroom environments for both groups. These controls were intended to ensure that any observed differences in learning experience and critical thinking skills could be attributed primarily to the instructional approach employed.

Based on the research objectives, the hypotheses tested in this study were as follows:

1. There is a significant difference in learning experience between students who receive deep learning instruction and those who receive conventional instruction.
2. There is a significant difference in critical thinking skills between students who receive deep learning instruction and those who receive conventional instruction.

Results

Descriptive Statistical Analysis

Descriptive statistical analysis was conducted to provide an overview of the distribution, central tendency, and variability of students' scores on critical thinking skills and learning experience variables.

Table 1. Descriptive Statistical Analysis

Descriptive Statistics						
		Group	Pretest Critical Thinking	Posttest Critical Thinking	Learning Experience	Valid N (listwise)
N	Statistic	56	56	56	56	56
Range	Statistic	1	7	9	25	
Minimum	Statistic	1	3	6	35	
Maximum	Statistic	2	10	15	60	
Sum	Statistic	84	406	624	2815	
Mean	Statistic	1.50	7.25	11.14	50.27	
	Std. Error	.067	.184	.335	.813	
Std. Deviation	Statistic	.505	1.378	2.504	6.086	
Variance	Statistic	.255	1.900	6.270	37.036	

The results presented in Table 1 show that all variables involved 56 students. The pretest scores of critical thinking skills ranged from 1 to 2 with a mean score of 1.50 and a standard deviation of 0.505, indicating that students' initial critical thinking abilities were low and relatively homogeneous.

After the intervention, posttest scores increased substantially, ranging from 3 to 10 with a mean of 7.25 and a standard deviation of 1.378. This increase reflects an improvement in students' critical thinking skills following the learning process.

For the learning experience variable, the mean score of the indicators was 11.14 with a standard deviation of 2.504, while the total learning experience score had a mean of 50.27 and a standard deviation of 6.086. These results indicate that students generally perceived their learning experience positively, with a moderate level of score variation.

Normality Test

The normality test was conducted to examine whether the data distribution met the assumptions required for parametric statistical analysis. Given that the sample size in each group was fewer than 50 students, the Shapiro–Wilk test was used as the primary reference.

Table 2. Normality Test

Tests of Normality							
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Pretest Critical Thinking	Experiment	.197	28	.007	.934	28	.076
	Control	.143	28	.150	.954	28	.253
Posttest Critical Thinking	Experiment	.143	28	.150	.933	28	.074
	Control	.181	28	.020	.948	28	.178
Learning Experience	Experiment	.124	28	.200*	.958	28	.317
	Control	.146	28	.133	.962	28	.382
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

Based on Table 2, the Shapiro–Wilk significance values for all variables in both the experimental and control groups are greater than 0.05. These results indicate that the data for

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critical thinking skills and learning experience are normally distributed. Therefore, the assumption of normality required for further parametric testing is fulfilled.

Homogeneity Test

The homogeneity test was applied to determine whether the variances between the experimental and control groups were equal. This assumption is necessary for conducting an Independent Samples t-test.

Table 3. Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Pretest Critical Thinking	Based on Mean	.628	1	54	.432
	Based on Median	.734	1	54	.395
	Based on Median and with adjusted df	.734	1	53.694	.395
	Based on trimmed mean	.705	1	54	.405
Posttest Critical Thinking	Based on Mean	5.005	1	54	.029
	Based on Median	2.921	1	54	.093
	Based on Median and with adjusted df	2.921	1	46.988	.094
	Based on trimmed mean	4.884	1	54	.031
Learning Experience	Based on Mean	2.035	1	54	.160
	Based on Median	2.052	1	54	.158
	Based on Median and with adjusted df	2.052	1	40.588	.160
	Based on trimmed mean	2.035	1	54	.159

As shown in Table 3, the pretest critical thinking and learning experience variables have significance values greater than 0.05, indicating homogeneous variances between groups.

For the posttest critical thinking variable, the homogeneity test based on the mean shows a significance value below 0.05. However, the results based on the median and adjusted median yield significance values above 0.05. Thus, overall, the variance of posttest scores can be considered approximately homogeneous and acceptable for further analysis.

Independent Samples T-Test

The Independent Samples t-test was employed to examine differences in mean scores between the experimental and control groups for both critical thinking skills and learning experience variables.

Table 4. Independent Samples T-Test

Independent Samples Test									
			Pretest Critical Thinking		Posttest Critical Thinking		Learning Experience	
			Equal variances assumed	Equal variances not assumed	Equal variances assumed	Equal variances not assumed	Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		.628		5.005		2.035	
	Sig.		.432		.029		.160	
t-test for Equality of Means	t		1.368	1.368	8.291	8.291	9.679	9.679
	df		54	51.338	54	49.140	54	46.066
	Sig. (2-tailed)		.177	.177	.000	.000	.000	.000
	Mean Difference		.500	.500	3.714	3.714	9.607	9.607
	Std. Error Difference		.366	.366	.448	.448	.993	.993
	95% Confidence Interval of the Difference	Lower	-.233	-.234	2.816	2.814	7.617	7.609
		Upper	1.233	1.234	4.612	4.614	11.597	11.605

The t-test results show that the pretest critical thinking scores did not differ significantly between the experimental and control groups (Sig. = 0.177 > 0.05), indicating that both groups had equivalent initial abilities.

In contrast, the posttest results reveal a significant difference between the two groups (Sig. = 0.000 < 0.05). Students in the experimental group achieved higher critical thinking scores than those in the control group. The effect size analysis using Cohen's d yielded a value of 1.58, which indicates a large effect, suggesting that deep learning instruction had a strong impact on students' critical thinking skills.

Similarly, the learning experience variable shows a significant difference between groups (Sig. = 0.000 < 0.05). The experimental group reported more positive learning experiences than the control group. The Cohen's d value of 1.75 indicates a large and practically meaningful effect of deep learning on students' learning experiences. Accordingly, both research hypotheses are accepted.

Overall, the results demonstrate that deep learning instruction significantly improves elementary students' learning experiences and critical thinking skills. The absence of differences at the pretest stage confirms comparable initial conditions, while significant posttest differences accompanied by large effect sizes indicate that the observed improvements are attributable to the deep learning intervention.

Discussion

The findings of this study demonstrate that deep learning instruction is effective in improving both students' learning experience and critical thinking skills in elementary IPAS learning. These results indicate that deep learning is not merely an alternative instructional approach, but a

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pedagogical strategy that aligns well with the characteristics of science-based learning at the elementary level, which emphasizes conceptual understanding, contextual relevance, and reflective thinking.

Deep learning proved effective in the IPAS context because it encourages students to actively construct meaning from scientific concepts rather than passively receiving information. In this study, learning activities such as concept exploration, reflection, and contextual application enabled students to relate abstract concepts—such as nutrition and growth—to real-life experiences. This alignment between content and students' daily lives is particularly crucial in IPAS, where conceptual understanding often becomes fragmented when instruction relies heavily on explanation and memorization (Nurhasanah & Pujiati, 2025). As a result, students in the experimental group reported significantly richer learning experiences, characterized by higher emotional engagement, cognitive involvement, and perceived relevance of learning.

Compared to conventional instruction, which typically emphasizes teacher explanation and routine exercises, deep learning offers a fundamentally different learning structure. Conventional learning in the control class positioned students primarily as recipients of information, limiting opportunities for inquiry, reflection, and discussion. In contrast, deep learning placed students at the center of the learning process by engaging them in questioning, meaning-making, and problem-solving activities. This structural difference explains why students exposed to deep learning demonstrated significantly higher learning experience scores, as they were more actively involved in constructing knowledge and reflecting on their understanding.

The positive impact of deep learning was also evident in students' critical thinking skills. The absence of significant differences in pretest scores confirms that both groups began with comparable levels of critical thinking ability. However, the significant posttest differences indicate that deep learning effectively facilitated the development of higher-order cognitive skills. Activities such as analyzing the consequences of nutrient deficiencies, evaluating healthy menu choices, and drawing conclusions from contextual problems required students to move beyond recall and engage in analytical and evaluative thinking. These learning demands are consistent with the cognitive processes essential for critical thinking development in elementary education (Prameswari et al., 2018).

The findings of this study support constructivist learning principles, which emphasize that knowledge is actively built through experience, reflection, and social interaction (Almulla, 2023; Dewi & Elisa, 2025; Saad et al., 2025). Deep learning provides a learning environment that supports these processes by encouraging students to question information, connect concepts, and apply understanding in new situations. In contrast, conventional instruction tends to limit these opportunities, resulting in surface-level learning that is less effective in fostering critical thinking (Chen et al., 2024).

From a curricular perspective, the results of this study are highly relevant to the implementation of the Merdeka Curriculum, which promotes student-centered, meaningful, and competency-based learning. Deep learning aligns with these principles by supporting conceptual understanding and higher-order thinking while simultaneously enhancing students' learning experiences. Therefore, deep learning can be considered a practical instructional approach for achieving the curriculum's goals, particularly in IPAS learning at the elementary level.

In terms of instructional implications, this study suggests that elementary teachers can enhance learning quality by incorporating deep learning strategies such as reflective questioning, collaborative discussion, and contextual problem-solving. These strategies help transform classrooms into more interactive and cognitively stimulating learning environments. By shifting away from instruction that prioritizes content coverage toward learning that

emphasizes meaning-making, teachers can better support students' cognitive and experiential development.

Despite its contributions, this study has several limitations. The relatively small sample size and the focus on a single school limit the generalizability of the findings. Additionally, the short duration of the intervention may not fully capture the long-term impact of deep learning on students' cognitive development. The use of self-reported questionnaires for learning experience also introduces the potential for subjective bias. Furthermore, external factors such as students' motivation and variations in classroom dynamics were not fully controlled.

Future research is recommended to involve larger and more diverse samples across different school contexts to strengthen external validity. Longer intervention periods would allow for the examination of sustained effects of deep learning on critical thinking and learning experience. Additionally, mixed-method approaches could provide deeper insights into how students and teachers perceive and experience deep learning, offering a more comprehensive understanding of its effectiveness in elementary education.

Conclusion

This study concludes that deep learning instruction has a significant positive effect on elementary school students' learning experience and critical thinking skills. Students who participated in deep learning activities experienced a more meaningful, interactive, and reflective learning process and demonstrated higher-level cognitive abilities compared to those taught through conventional instruction.

These findings indicate that deep learning is an effective instructional approach for IPAS learning at the elementary level. By emphasizing active engagement, reflection, and contextual understanding, deep learning can enhance student participation and support the development of higher-order thinking skills. Therefore, this approach can be considered a viable alternative to conventional teaching practices in elementary classrooms.

Future research is recommended to involve larger and more diverse samples, extend the duration of intervention, and explore additional learning outcomes such as creativity, collaboration, and learning motivation to further examine the long-term impact of deep learning in elementary education.

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