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The Effectiveness of Inquiry-Based Learning with a Deep Learning Approach on Critical Thinking Skills of 8th Grade Junior High School Students

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ABSTRACT

This research endeavors to evaluate the efficacy of implementing the Inquiry-Based Learning (IBL) model, augmented by a Deep Learning methodology, for the enhancement of critical thinking abilities and academic achievements in eighth-grade students at SMP Plus Al-Ittihad Cianjur, specifically concerning the human circulatory system. A quasi-experimental methodology, utilizing a one-group pretest-posttest framework, was adopted for this investigation. A cohort of 30 students was chosen via purposive sampling to constitute the study's sample. Data acquisition was performed utilizing pretest and posttest instruments, followed by analysis through descriptive statistical methods, the Shapiro–Wilk normality test, the Wilcoxon Signed Rank Test, and N-Gain analysis. The findings revealed a significant difference between pretest and posttest scores (Sig. 0.000 < 0.05). However, the average N-Gain score was 0.1311 or 13.11%, categorized as low and less effective. This indicates that although the IBL model with a Deep Learning approach has the potential to enhance critical thinking skills, its implementation has not yet been optimal. Contributing factors include students' low readiness for active learning and teachers' limited ability to facilitate reflective processes. Therefore, further teacher training and student engagement strategies are needed to maximize the effectiveness of this integrated approach in improving science learning quality in secondary education.

INTRODUCTION

In an era of globalization and rapid technological advancement, critical thinking skills are a key competency that students must possess to face the challenges of the 21st century. Research shows that junior high school students still have relatively low critical thinking skills (Azmi et al., 2022). In the era of fast and complex information, critical thinking skills have become one of the main competencies in the 21st century education framework (Utami, 2022). In the context of secondary education, especially for 8th grade junior high school students, this critical thinking ability becomes increasingly important because they are at a transition stage from basic learning to more complex learning (Sholeh et al., 2024).

Inquiry based learning has gained attention as a strategy capable of moving students from a passive position of receiving information to an active position of exploring, questioning, investigating, and constructing their own knowledge. However, the implementation of IBL in schools still faces several obstacles. Many students are not accustomed to deep thinking processes, while some teachers still struggle to facilitate the inquiry stage that requires conceptual reflection (Yusnarti et al., 2025). Therefore, an additional approach is needed that can foster a deeper understanding of concepts, namely Deep Learning. This approach emphasizes interconnections between concepts, metacognitive reflection, and the application of concepts in new contexts. The combination of Inquiry-Based Learning and Deep Learning is expected to create a comprehensive learning experience: students not only actively conduct scientific investigations but also understand the conceptual meaning of what they learn (Shaban et al., 2024).

Deep Learning in education, which focuses on in-depth conceptual understanding, contemplation, teamwork, and application in practical scenarios, is increasingly recognized as an effective method for developing cognitive capabilities, including critical thinking skills (Akmal et al., 2025).

This material on the human circulatory system in junior high school science is a crucial subject that has the potential to foster critical analytical skills in students. This topic covers not only the anatomy and function of body organs, but also provides opportunities for students to investigate the interconnections between organs, appreciate the body's physiological processes, and evaluate lifestyle patterns that affect health (Ningtyas et al., 2022).

Various studies also indicate that junior high school students' critical thinking skills have not yet reached an optimal level. Consequently, more participatory, introspective, and comprehensive teaching methods are needed to equip students not only to be passive recipients of information but also to be responsive in conducting research and evaluation (Dhamayanti, 2022).

Therefore, integrating inquiry-based learning with a deep learning approach appears to be a strategic choice for strengthening the critical thinking skills of eighth-grade junior high school students. This combination allows students not only to explore and investigate through questions and discovery, but also to engage in in-depth reflection, collaboration, and the application of personal meaning to the learning material. However, research is still needed to empirically test the effectiveness of this integration in the learning context of eighth-grade junior high school students in Indonesia

METHOD

The type of research used is quantitative research. The method used in this study is quasi-experimental, with a one-group pretest-posttest research design with a sample of one class as the research subject.

Table 1. Research design (*one-group pretest-posttest design*)

Class	Pretest	Treatment	Posttest
Experiment	O1	X	O2

This study was conducted on class VIII A students at SMP Plus Al-Ittihad Cianjur during the odd semester of the 2025/2026 academic year. All class VIII students of SMP Plus Al-Ittihad Cianjur constituted the population in this study. Class VIII A, consisting of 30 students, was selected as the research sample. The sample selection method applied was purposive sampling, based on the consideration that the class showed a fairly uniform level of academic ability, as reflected in the average grade of the previous natural science report card.

The data collection used a questionnaire in questionnaire format. The data collected from the initial test (pretest) and final test (posttest) were processed using SPSS software version 25. The analysis included descriptive analysis, data normality testing using the Shapiro-Wilk test, and hypothesis testing using the non-parametric Wilcoxon test. The Wilcoxon test was used because the data were not normally distributed, to identify significant differences between pretest and posttest scores, and to calculate the N-Gain score.

Using a non-parametric test (Wilcoxon test), differences in learning outcomes were found before and after the intervention. Next, a Gain score (N-gain test) was calculated to evaluate the effectiveness of the Inquiry-Based Learning model combined with the Deep Learning Approach on students' critical thinking skills. The formula used is:

Table 2. Category Interpretation Average N-Gain score

$$N\ Gain = \frac{Skor\ \ postest - Skor\ \ pretest}{Skor\ ideal - skor\ \ pretest}$$

Description: The ideal score is the maximum (highest) score that can be obtained.

The categorization of the N-gain score is determined based on the N-gain value in percentage form as follows:

Table 3. N-Gain Effectiveness Interpretation Category

Persentase(%)	**Interpretation**
< 40, 00	Ineffective
40,00 - 55,99	Less Effective
56,00 - 75,00	Quite Effective
> 75,00	Effective

RESULTS AND DISCUSSION

Research result

1. Value Data

Table 4 Pre-Test & Post-Test Value Data

No	Siswa	Pretest	Posttest
1	1	50	70
2	2	20	50
3	3	20	40
4	4	50	60
5	5	60	70
6	6	30	50
7	7	30	50
8	8	20	60
9	9	50	70
10	10	50	80
11	11	60	70
12	12	50	70
13	13	60	80
14	14	40	50
15	15	70	90
16	16	40	50
17	17	30	60
18	18	30	70
19	19	30	50
20	20	30	50
21	21	20	60
22	22	30	50
23	23	10	50
24	24	40	70
25	25	40	60
26	26	20	50
27	27	40	60
28	28	30	70
29	29	10	50
30	30	40	60

2. Data Analysis
   a. Descriptive Statistics

Table 5. Descriptive Statistical Test Results

Descriptive Analysis	Pretest 8A	PostTest 8A
Minimum Value	10	40
Maximum Value	70	90
Standard Deviation	15,388	11,725
Mean	36,67	60,67
Median	35,00	60,00
Skewness	0,241	0,551

   b. Normality Test Results

Table 6 Normality Test Results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Posttest	.219	30	.001	.898	30	.008
Pretest	.168	30	.031	.954	30	.213
a. Lilliefors Significance Correction						

Based on Table 6, it can be seen that the researcher used the Shapiro-Wilk test based on a sample size of less than 50. Therefore, the significance value for the pretest was 0.213. A significance value greater than 0.05 indicates normal data. The posttest value was 0.008. A significance value less than 0.05 indicates abnormal data.

   c. Hypothesis Test Results

Table 7. Non-Parametric Statistical Test (Wilcoxon Test)

Test Statistics[a]	
	Posttest - Prettest
Z	-4.851[b]
Asymp. Sig. (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

Based on table 7, it can be observed that the significance value of the non-parametric test (Wilcoxon test) to the pretest posttest value using the Inquiry Based Learning learning model with a Deep Learning Approach is 0.000, so it can be concluded that the hypothesis decision is H0 is rejected and H1 is accepted. So the conclusion is that there is a difference in students' critical thinking skills between the group before using the Inquiry Based Learning learning model with a Deep Learning Approach and the group after using the Inquiry Based Learning learning model with a Deep Learning Approach.

d. N-Gain Test Results

Table 8 N-Gain Test Results

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_Score	30	.17	.67	.3796	.13111
Ngain_Persen	30	16.67	66.67	37.9630	13.11071
Valid N (listwise)	30				

From the results in the table above, the N-Gain test shows an average of 0.1311, while the N-Gain percentage is 13.11%. Therefore, it can be concluded that the effectiveness level of implementing the IBL learning model with a deep learning approach on students' critical thinking skills is low and less effective.

Discussion

The results of the study show that the implementation of the Inquiry Based Learning (IBL) model combined with the Deep Learning approach has a constructive impact on improving student learning outcomes for the topic of the circulatory system in class VIII A students of SMP Plus Al-Ittihad Cianjur. Referring to the descriptive analysis, the average score (mean) of student learning outcomes reached 60.67 in the posttest, a significant increase compared to the average pretest score of 36.67. There is an indication of progress in students' conceptual understanding after the implementation of the IBL learning model (Harahap, 2024).

This improvement indicates that inquiry-based learning can stimulate active student involvement in constructing their knowledge. Students not only act as recipients of knowledge but also as inventors through the stages of exploration, observation, and hypothesis testing. This involvement aligns with the characteristics of Deep Learning, which prioritizes meaningful, conscious, and enjoyable learning. When students are

actively involved, the learning process becomes more reflective and in-depth, thus contributing to improved critical thinking skills.

Furthermore, the IBL syntax, which encompasses the stages of orientation, problem formulation, data collection, hypothesis testing, and conclusion drawing, provides students with the opportunity to systematically practice critical thinking skills. Through the Deep Learning approach, students are encouraged to not only understand concepts but also relate them to real-life experiences and foster reflective awareness in their learning (Kartiningsih, 2022).

The Shapiro-Wilk normality test indicates that the distribution of posttest data is not normal (Sig. = 0.008 < 0.05). In contrast, the pretest data shows a normal distribution (Sig. = 0.213 > 0.05). However, the hypothesis test analysis carried out using a non-parametric method, namely the Wilcoxon test, showed a significance value of 0.000 < 0.05. This indicates a significant difference in students' critical thinking skills between the group that has not implemented the Inquiry Based Learning model with a Deep Learning Approach and the group that has implemented it. Therefore, the research hypothesis is proven correct, which states that the Deep Learning model with an IBL approach has a significant impact on improving students' critical thinking capabilities. In addition, the analysis of the effectiveness of this study is also supported by the use of the N-Gain test. The findings show that the experimental class obtained a percentage score of 13.11% with an average value of 0.1311. These results indicate that its effectiveness is relatively low and is in the very minimal average category in developing students' critical thinking skills at SMP Plus Al-Ittihad, Cianjur.

Figure 1. Class 8 A of Al-Ittihad Plus Middle School in Cianjur

The ineffective N-Gain results and very low average are due to several factors that influence student engagement in the learning process. This was also demonstrated through direct observations at Al-Ittihad Plus Middle School in Cianjur. One of the main factors is students' lack of preparedness for learning models that require active participation (Wahab et al., 2021).

Students accustomed to conventional learning models may have difficulty adapting to the IBL model, which requires independent exploration and collaboration.

This can result in low participation in students' critical thinking skills. As a result, even using the Inquiry-based learning model with a Deep Learning approach, the learning process cannot achieve optimal results because students have difficulty understanding the material presented. The role of the teacher can also be a factor because it significantly impacts students' ability to create effective learning. Thus, it can be said that the integration between the IBL model and the Deep Learning approach is completely ineffective in creating an active, reflective, and collaborative learning environment (Dewi & Yuniarsih, 2020).

CONCLUSION

Based on the research results, the application of the Inquiry Based Learning (IBL) model with the Deep Learning approach has been proven to have a positive influence on improving students' learning and critical thinking skills on the topic of the circulatory system. Hypothesis testing analysis indicates a significant difference between pretest and posttest scores, although the level of effectiveness based on N-Gain is still relatively low. This situation illustrates that IBL with the Deep Learning approach has the potential to be effective if applied consistently and supported by students' readiness to participate in active, reflective, and collaborative learning. The scientific inquiry process in IBL helps students understand concepts through direct experience, while Deep Learning deepens the meaning of concepts through reflection and application in real-life contexts.

However, the low effectiveness results indicate that there are still obstacles in implementation in the field, such as low student readiness for independent and participatory learning, as well as teachers' adaptation to approaches that require reflective and exploratory facilitation. Therefore, this study suggests the need for training for teachers to optimize IBL syntax and Deep Learning strategies synergistically. With such support, it is hoped that this model can create more meaningful and contextual science learning, and encourage students to think critically and deeply significantly in the future.

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