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Increasing Students' Activeness and Critical Thinking Skills Through the Application of the Deep Learning Integrated Discovery Learning Model to Human Digestive System Materials

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Abstract
This research aims to increase students' activeness and critical thinking skills through the application of a discovery learning model integrated with a deep learning approach to the human digestive system. The research method used is Classroom Action Research which is carried out in two cycles, involving grade V students in one of the Bandungrejosari 1 elementary schools in Malang City. Data was collected through observation, critical thinking tests, and documentation of activities, then analyzed descriptively quantitatively. The results of the study showed an increase in student activity from 68% in the first cycle to 85% in the second cycle. The average critical thinking ability of students also increased from 70.2 to 84.5. The integration of Discovery Learning and Deep Learning in this study is carried out by optimizing the stages of data mining and verification of Discovery Learning through deep reflection activities, elaboration of concepts based on real contexts, and analytical discussions that encourage students to reason more deeply on the concept of digestion. This improvement shows that the application of deep learning-based discovery learning can encourage active student involvement while improving critical thinking skills in science learning. The novelty of this research lies in the integration of these two approaches in elementary school learning, which has not been widely implemented in the context of the Independent Curriculum.

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Introduction

In the 21st century era, critical thinking skills are one of the main skills that students must have, along with the demands of 21st century competencies which include higher order thinking skills (HOTS) such as analyzing, evaluating, and creating (Brookhart, 2010). According to the Programme for International Student Assessment (PISA) 2018 report, the science literacy ability of Indonesian students is still below the OECD average, especially in the aspects of reasoning and critical thinking (OECD, 2019). This condition shows the importance of developing learning that is able to encourage students' critical thinking skills, especially in Natural Sciences subjects in elementary school. Critical thinking is defined as a reflective and rational process in evaluating information and making appropriate decisions (Ennis, 2011).

In the elementary school environment, students' critical thinking skills in science materials are still relatively low. The results of initial observations in grade V of Bandungrejosari 1 Malang City showed that only about 42% of students were actively involved in discussions, while the average score of students' critical thinking skills only reached 68 out of a scale of 100 based on the results of teacher assessments (Science Teacher Documentation, 2024). This condition shows that most students still tend to be passive in learning and have difficulty in analyzing and relating the concept of science to the surrounding phenomena. This problem occurs because classroom learning is still dominated by lecture and assignment methods, without optimizing students' active involvement in finding concepts or applying knowledge in real-world situations (Hamatun & Nita, 2022).

Several learning models have been developed to overcome this problem, one of which is the Discovery Learning model proposed by Bruner (1961). This model places students as active subjects in the learning process by encouraging them to explore, observe, analyze, and discover the concepts or principles of the material being studied (Hosnan, 2014). In addition, the Deep Learning approach based on meaningful understanding, deep reflection, and active student involvement has also begun to be widely applied in Indonesian education. According to Houghton et al. (2020) and Simonovic et al. (2022), Deep Learning is not just deep learning, but a process in which students associate concepts with real experiences, reflect, and construct new meaningful, sustainable understandings. This approach emphasizes collaboration, problem-solving, reasoning, and cross-contextual knowledge integration (Biggs & Tang, 2011).

Several previous studies have proven the effectiveness of Discovery Learning in improving science learning outcomes (Sari, 2020) and Deep Learning in strengthening students' critical thinking and reflection skills (Arifin, 2021). However, the integration of the two in one learning design in elementary schools is still very rare. This research gap needs to be followed up because the collaboration of the two approaches is expected to be able to create more active, reflective, contextual learning, and encourage higher-level thinking skills (Rahayuningsih & Ramli, 2024; Supriyanto & Pappachan, 2024).

Theoretically, this study contributes to expanding the study of the integration of the exploratory model of Discovery Learning with the reflective approach of Deep Learning in science learning based on the Independent Curriculum which emphasizes the development of HOTS explicitly. Practically, this research can be a reference for elementary school teachers in designing interactive, meaningful, and contextual science learning, as well as increasing

students' activeness and critical thinking skills through an applicative and fun learning experience (Sari & Zulaikah, 2022).

Based on this background, this study aims to increase the activeness and critical thinking skills of grade V students of Bandungrejosari 1 elementary schools in Malang City on the material of the human digestive system through the application of Discovery Learning integrated with Deep Learning. In addition, this study also aims to test the effectiveness of the combination of the two approaches in creating an active, deep, and contextual learning environment in elementary schools.

Method

This research is a Class Action Research which is carried out in two cycles following the spiral model from Kemmis and McTaggart, which includes the planning stage, the implementation of actions and observations, as well as reflection in each cycle. The subject of the study is grade V students in one of the elementary schools in Malang City in the even semester of the 2024/2025 school year, with a focus on increasing students' activeness and critical thinking skills on the material of the human digestive system through the application of the Discovery Learning model integrated with the Deep Learning approach. Data collection was carried out using observation of student activity, critical thinking ability tests prepared based on Ennis (2011) indicators including the ability to analyze, evaluate, and infer information logically, as well as documentation of learning activities. The validity of the test instrument was tested through expert judgment by two science education lecturers and one classroom teacher, while the reliability was tested using the Alpha Cronbach formula with a coefficient of ≥ 0.70. The research procedure begins with an initial study to identify the problem, followed by the preparation of learning tools, the implementation of actions, observation of student involvement and test results, as well as reflection to design improvements in the next cycle. The integration of Discovery Learning and Deep Learning is carried out by optimizing the six stages of Discovery Learning which is combined with real-context-based problem-solving activities, reflective discussions, deep thinking tasks, and analysis activities of relationships between scientific concepts to actively build meaningful understanding. The data was analyzed in a quantitative descriptive manner through the calculation of the percentage increase in students' activeness and critical thinking skills in each cycle, with the success criteria set at least 85% of students achieving the good category. This research has obtained approval from the principal and all procedures are carried out in accordance with the ethical principles of educational research by maintaining the confidentiality of identities and the comfort of students during the process.

Results and Discussion

Results

The implementation of Class Action Research is carried out in two cycles, each of which consists of the stages of planning, implementation of actions, observation, and reflection. The results of observations show a significant increase in student learning activity from cycle I to cycle II. In the first cycle, student activity was in the moderate category with an average score

of 68%, while in the second cycle it increased to 85% which was in the very active category. This increase is due to the application of Discovery Learning which encourages students to be active in the process of discovery and reflection of learning materials (Bruner, 1961; Hosnan, 2014). Activities such as group discussions, simple experiments, and presentations encourage students to engage directly. Deep Learning also plays a role in forming students' full awareness of the meaning of the material learned (Mu'ti in DetikEdu, 2024; Simonovic et al., 2022).

Students' critical thinking skills are measured using test instruments compiled based on Ennis (2011) indicators, including the ability to analyze, evaluate, and conclude. The test results showed that in cycle I, the average score of students' critical thinking was 70.2, while in cycle II it increased to 84.5. This increase confirms that the integration of Discovery Learning and Deep Learning models contributes positively to improving students' critical thinking skills (Rahayuningsih et al., 2024; Sari & Zulaikah, 2022). This increase can be seen from students' answers that are more argumentative, systematic, and based on logic in solving problems based on real problems.

Observations during learning activities also show significant changes in student interaction. In the first cycle, many students are still hesitant to express their opinions or ask questions. However, in cycle II, the classroom atmosphere became more lively, discussions were dynamic, and students seemed more confident. This shows that a mindful, meaningful, and joyful deep learning approach has succeeded in creating a comfortable and meaningful learning climate (Mu'ti in Detik.com, 2024; Rahayuningsih & Ramli, 2024). Students feel that the learning process is not just memorizing, but understanding concepts thoroughly and contextually.

From the results of documentation and field notes, it was found that students were more interested in participating in learning because the activities provided were exploratory and challenging. For example, when students are asked to create a flowchart of the human digestive system through a simple simulation using real food ingredients. This activity facilitates meaningful learning as mandated in the Deep Learning approach (Simonovic et al., 2022; Larsson, 2017). In addition, students are also better able to relate material to daily life, such as the importance of healthy eating, fiber function, and the process of nutrient absorption.

Quantitatively, the results of the pre-test and post-test showed a significant increase in learning outcomes. The average score of the students' pre-test was 65.4, while the post-test after two cycles of action rose to 82.1. The increase in activeness and critical thinking skills can be seen in Table 1 below.

Table 1. Results of Pre-Test and Post-Test Comparison as well as Indicators of Activeness and Critical Thinking

Aspect	Average Score Cycle I	Average Score Cycle II	Percentage of Improvement (%)
Student Activeness	68,0	85,0	25,0
Critical Thinking Ability	70,2	84,5	20,4
Test Scores (Pre–Post Test)	65,4 → 82,1	-	25,5

Discussion

The results of this study strengthen Bruner's (1961) theory about the effectiveness of the Discovery Learning model in increasing student involvement in learning. When students are

given the opportunity to discover concepts for themselves through exploration, they become more active, engaged, and have a sense of responsibility for their learning process. Integration with the Deep Learning approach provides a deeper reflective space, so that the student's thinking process does not stop at simply finding answers, but continues at the stage of analyzing concept relationships, evaluating information, and reflecting on their understanding (Hosnan, 2014; Simonovic et al., 2022). This is in line with the 21st century learning paradigm that emphasizes the development of high-level thinking skills and meaningful learning.

A significant increase in critical thinking skills in cycle II showed that the combination of Discovery Learning exploration activities and Deep Learning reflection spaces effectively encouraged students to think more analytically, evaluatively, and contextually. Activities such as hypothesis, simple experiments, and reflective discussions in each stage of learning encourage students to not only understand concepts, but also relate them to everyday life phenomena (Sari & Zulaikah, 2022; Rahayuningsih et al., 2024). The interaction between these exploratory and reflective aspects is the key to the successful integration of the two approaches, as students are actively involved in discovering concepts and are encouraged to think deeply about the meaning behind the concepts (Larsson, 2017; Ennis, 2011).

In addition, the increase in student activity from cycle I to cycle II reflects the success of creating an inclusive, participatory, and fun learning atmosphere. Mu'ti (2024) stated that the principle of joyful learning in Deep Learning plays an important role in shaping a classroom atmosphere that encourages students' courage to express their opinions without fear of being wrong. This is reinforced by the findings of Simonovic et al. (2022) and Oktari (2024) who show that a positive classroom atmosphere is able to increase active participation and the quality of learning interactions.

This research also reflects a shift in the learning paradigm from teacher-centered to student-centered. Teachers act as facilitators who provide stimulus, while students become the center of learning, constructing knowledge from experiences and group discussions (Hosnan, 2014; Bruner, 1961). This shift is essential in building learning independence and encouraging students to actively reflect and deepen their understanding of concepts contextually.

However, this study has limitations. The research sample was limited to one class in one elementary school so the results could not be generalized widely to the student population in different schools or regions. In addition, measurements of the improvement of critical thinking skills were only carried out in the short term during two action cycles. It is not yet known how sustainable this learning effect will be in the long term. Going forward, similar studies are suggested using experimental designs with control groups and larger sample numbers to test the validity of these findings more robustly. In addition, follow-up studies can explore the integration of Discovery Learning and Deep Learning in a variety of other science materials or different levels of education to measure consistency of effectiveness.

Thus, the results of this study make an important contribution to the development of effective and contextual science learning strategies in elementary schools, while complementing the results of previous research related to the effectiveness of the two approaches separately (Rahayuningsih & Ramli, 2024; Manurung & Pappachan, 2025), as well as opening up a wider space for advanced research.

Conclusion

Based on the results of the study, it can be concluded that the application of the Discovery Learning model integrated with the Deep Learning approach is effective in increasing students' activeness and critical thinking skills on the material of the human digestive system in elementary school. Student activity increased from the moderate category with a percentage of 68% in the first cycle to very good with 85% in the second cycle, while the critical thinking ability increased from an average score of 70.2 to 84.5. This improvement shows that the integration of the two approaches is capable of creating a learning environment that encourages active engagement and the strengthening of high-level thinking skills. This research makes a practical contribution to the development of exploration-based and reflection-based science learning models in elementary schools, as well as enriching scientific references on the integration of Discovery Learning and Deep Learning that were rarely applied simultaneously. In addition, these findings open up opportunities for the implementation of similar strategies in other subjects or different levels of education. For further research, it is recommended to conduct longitudinal studies to determine the sustainability impact of the integration of these two approaches in the long term, as well as the replication of research in various school contexts and different teaching materials to test the consistency and generalization of findings in supporting the strengthening of competencies in the 21st century according to the direction of the Independent Curriculum.

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Authors' Note

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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