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Application of Deep Learning-Based Problem Based Learning to Increase Motivation and Critical Thinking of Elementary School Students

Nurul Ain [1*], Resta Eka Kurniawati [1], Luluk Faridatus Zuhro [2]

[1] Universitas PGRI Kanjuruhan Malang, Indonesia
[2] Sekolah Dasar Negeri 1 Bandungrejosari Malang, Indonesia
* Author Correspondence

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Abstract

This study aims to describe the application of the Problem Based Learning model based on the Deep Learning approach to improve learning motivation and critical thinking ability of grade V elementary school students. The research was motivated by the low motivation and student involvement in learning, particularly in understanding the importance of preserving regional food and beverages. The method used was Classroom Action Research conducted in two cycles, each consisting of planning, implementation, observation, and reflection stages. The research subjects were 27 students of grade 5B at Bandungrejosari I Public Elementary School Malang City. Data were collected through observations, learning motivation questionnaires, and critical thinking ability tests, then analyzed descriptively and quantitatively. The results showed that the application of Problem Based Learning integrated with the Deep Learning approach effectively improved students' motivation and critical thinking skills. Learning completeness increased from 33.33% in the pre-cycle to 66.66% in the first cycle, and reached 92.59% in the second cycle, with an average final score of 85. Students became more active, reflective, and able to connect learning materials with local cultural contexts. This study not only confirms the theoretical effectiveness of integrating Problem Based Learning and Deep Learning in developing 21st-century competencies in elementary education but also offers a practical, contextual, and participatory learning strategy alternative.

Contact : Corresponding author e-mail: nurulain@unikama.ac.id

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Introduction

21st century education requires students to have critical, creative, communicative, and collaborative thinking skills (4Cs) as the foundation of lifelong learning competencies (Arends, 2012; Hosnan, 2014). However, the reality in the field shows that the learning motivation and critical thinking skills of elementary school students are still relatively low (Brookhart, 2010). This can be seen in contextual learning, such as the preservation of local culture, where students often show indifference and difficulty relating the subject matter to real life (Rahman, 2022). This condition is strengthened by Yuliana and Mustadi (2023) who state that low motivation to learn is the main obstacle to developing high-level thinking skills of elementary school students.

A similar problem was found in class 5B of Bandungrejosari I Public Elementary School Malang City. The results of the initial observation showed that only 9 out of 27 students (33.33%) achieved learning completeness with an average score of 65. Students tend to be passive, unenthusiastic, and find it difficult to relate the subject matter to the local cultural context. Conventional learning that lacks active participation and rarely involves students in the reflective thinking process is one of the causes (Hmelo-Silver, 2023). Therefore, learning innovations are needed that are able to activate students in the learning process while building a deep understanding of the material.

One of the effective approaches to answer these challenges is the combination of the Problem Based Learning model and the Deep Learning approach. Problem Based Learning is a learning model that puts students in real problem-solving situations, encourages collaboration, and stimulates students' curiosity (Joyce, Weil, & Calhoun, 2009). Meanwhile, Deep Learning as a pedagogical approach does not just absorb surface information, but encourages students to reflect, relate new concepts to previous experiences, and understand the material meaningfully and applicatively in various life contexts (Biggs & Tang, 2011; Darmawati & Mustadi, 2023). This approach encourages students to think deeply, understand the relationships between concepts, and transfer knowledge.

Deep Learning-based Problem Based Learning integration is considered effective because these two approaches have complementary principles. Problem Based Learning provides authentic problem-solving situations that demand students to think critically and collaboratively, while Deep Learning ensures that the learning process is reflective, meaningful, and long-term oriented (Loyens et al., 2022). Research by Darmawati and Mustadi (2023) proves that the integration of the two is able to increase learning engagement, critical thinking skills, and students' understanding of contextual materials. In addition, Rahman (2022) emphasized that Deep Learning-based Problem Based Learning can encourage creativity, collaboration, and logical reasoning of elementary school students.

In the context of local cultural preservation, this approach is relevant because it not only teaches cultural concepts, but also trains students to think critically about the problems around them, build empathy, and be able to make decisions based on analysis (Timor et al., 2021). Thus, the application of Problem Based Learning based on Deep Learning is expected to not only

improve learning outcomes, but also build 21st century skills, especially critical and reflective thinking.

Therefore, this classroom action research aims to describe the effectiveness of the application of the Deep Learning-based Problem Based Learning model in increasing the learning motivation and critical thinking skills of elementary school students in learning to preserve local culture. This study is expected to enrich the reference for the application of contextual, reflective, and relevant integrative pedagogical approaches to basic education in Indonesia.

Method

This study uses the Kemmis and McTaggart model Classroom Action Research approach which is reflective, participatory, and directly oriented towards improving the learning process in the classroom. The research was carried out in class 5B of Bandungrejosari I Public Elementary School Malang City in the even semester of the 2024/2025 school year for two cycles. The research subjects consisted of 27 students, who were selected purposively based on the results of initial observation on motivation and critical thinking skills. Each cycle consists of the stages of planning, implementation of actions, observation, and reflection. At the planning stage, a Problem Based Learning-based teaching module was prepared combined with a Deep Learning approach, in the form of learning scenarios, Student Worksheets, and research instruments. Deep Learning is operationalized through activities to elaborate the meaning of material in local cultural discussions, individual and group reflection on the importance of cultural preservation, and knowledge transfer by linking subject matter to students' daily experiences. The implementation of actions is carried out in group learning that solves problems around the preservation of regional specialties. Observations were carried out to record teacher and student activities, student involvement, and data collection on learning motivation and critical thinking skills using observation sheets, questionnaires, and tests. Reflection is carried out to analyze the advantages, shortcomings, and results of achievements to determine improvements in the next cycle. The research instrument consisted of observation sheets, a learning motivation questionnaire totaling 15 items on a Likert scale of 1–4, a critical thinking test of 5 open-ended questions, and reflection notes. All instruments were validated by expert lecturers and partner teachers with a content validity result (CVI) of > 0.80 and the reliability of the motivational questionnaire trial of 0.85 and a critical thinking test of 0.79. The data analysis technique used quantitative descriptive analysis for the percentage of completeness of learning outcomes, motivation scores, and critical thinking categorized into very high, high, medium, and low, as well as qualitative analysis using the Miles, Huberman, and Saldana models through data reduction, data presentation, and conclusion drawn. This research has obtained permission from the principal and is carried out by paying attention to the ethical principles of basic education research, such as voluntary consent of students and maintaining the confidentiality of students' identities.

Results and Discussion

Results

In the early stages of the research, namely the pre-cycle, observation and evaluation of the initial condition of class 5B students of Bandungrejosari I Public Elementary School Malang City were carried out. From the measurement results, it is known that only 9 out of 27 students or around 33.33% met the learning completeness with an average score of 65. This figure is still below the Minimum Completeness Criteria set at 75. In other words, the majority of students, namely 18 students (66.67%), have not achieved the completeness of their studies and show unsatisfactory results. This indicates that there are serious problems in terms of learning motivation and mastery of the material by students.

Furthermore, the motivation questionnaire distributed to students in the pre-cycle revealed that most students had low motivation to learn. This low motivation to learn negatively impacts their involvement in the learning process, so they tend to be passive and lack initiative in following lessons. This low motivation to learn also contributes to students' low critical thinking skills due to a lack of interest and attention to the material being taught. This condition is certainly a major concern in the study because the limitations of students' motivation and critical thinking skills will hinder the achievement of the expected learning goals.

Table 1. Observation and Evaluation Results in the Pre-Cycle

Aspects	Number of Students	Percentage (%)	Grade Point Average	Information
Complete Learning	9 students	33,33%	65	Under MOH
Incomplete Learning	18 students	66,67%	-	Action needed

Based on this data, it is clear that learning interventions are needed that are able to increase students' motivation and critical thinking skills. Therefore, in cycle I, the researcher applied the Problem Based Learning model based on the Deep Learning approach as an innovative learning strategy. The Problem Based Learning model was chosen because of its characteristics that require students to actively participate in real problem-solving, so it is expected to generate intrinsic motivation and encourage active student involvement.

After the implementation of the Deep Learning-based Problem Based Learning model in cycle I, there was a significant increase in terms of learning completeness. The results of the evaluation showed that the number of students who achieved learning completeness increased to 18 students or 66.66%, with an average score of 75. This means that student learning completeness has doubled compared to pre-cycle. In addition, 9 other students still have not reached completeness so they still need to get further assistance.

This improvement is not only seen from the test results, but is also reflected in student activities during learning. Students began to show higher enthusiasm in participating in learning, actively discussing in groups, and began to dare to express ideas and opinions independently. This shows that the Deep Learning-based Problem Based Learning approach is able to encourage students' active participation and increase their confidence in the learning process.

Student learning motivation has also increased significantly. The results of the motivation questionnaire conducted in the first cycle showed a change in the category from low motivation to moderate motivation. Although it has not reached a high level, this is an encouraging progress and indicates that this learning model is able to have a positive influence on students' enthusiasm and involvement in learning.

Table 2. Observation and Evaluation Results in Cycle I

Aspects	Number of Students	Percentage (%)	Grade Point Average	Information
Complete Learning	18 students	66,66%	75	There was an increase in learning completeness compared to pre-cycle
Incomplete Learning	9 students	33,34%	-	Still need assistance and reinforcement of materials
Student Activities	-	-	-	Actively discussing, enthusiastic, expressing opinions independently
Learning Motivation	-	-	-	Increased from low to medium

Furthermore, in cycle II, learning is enhanced by emphasizing more students' reflection and the relationship of the material with the real-life context. Reflection is seen as an important stage in Deep Learning learning because students not only work on problems, but also reflect on their learning experiences, relate concepts to real-life situations, and map out more applicable solutions. This approach is expected to encourage students to think more critically and be able to transfer knowledge to other contexts.

The results of the evaluation in cycle II showed a significant increase from the previous cycle. The number of students who achieved learning completeness increased sharply to 25 students or 92.59%, with the average score increasing to 85. This is a very satisfactory achievement, indicating that almost all students have managed to master the learning material well. Meanwhile, only 2 students have not completed and still need further assistance.

Not only in terms of academic results, student activities have also improved in quality. They are not only active in discussing and expressing opinions, but are also able to identify local problems related to cultural preservation and formulate solutions logically and systematically. This shows that students' critical thinking skills have actually undergone significant development along with the application of the Deep Learning-based Problem Based Learning model.

Students' motivation to learn in cycle II also rose to the high category. Students become more motivated, enthusiastic, and show a great sense of responsibility for their own learning process. The learning atmosphere becomes more fun and meaningful because the material learned is relevant to their daily lives and is able to foster concern for local culture.

Table 3. Observation and Evaluation Results in Cycle II

Aspects	Number of Students	Percentage (%)	Grade Point Average	Information

Complete Learning	25 students	92,59%	85	Significant improvement from the previous cycle
Incomplete Learning	2 students	7,41%	-	Still need further assistance
Student Activities	-	-	-	Able to identify local problems and devise logical solutions
Learning Motivation	-	-	-	Rise to the high category

Discussion

Based on the results of the study, the application of the Problem Based Learning model based on Deep Learning has proven to be effective in increasing the learning motivation and critical thinking skills of elementary school students, especially in local cultural preservation materials. This model encourages students to think more deeply, reflect on learning experiences, and connect the knowledge gained to the cultural context and real-life around it. These results are in line with the findings of Loyens et al. (2022) and Hmelo-Silver (2023) who stated that Problem Based Learning is effective in increasing learning engagement and mastery of the material in a meaningful way. In addition, this study supports the view of Brookhart (2010) and Timor et al. (2021) that learning that relates to local issues is able to build students' concern as well as reflective thinking skills, so that learning becomes more contextual and relevant for students.

The successful implementation of this model is also supported by the concept of Deep Learning which emphasizes the importance of deep thinking processes, knowledge transfer, and experiential reflection in learning. Through problem-solving activities based on the context of the local culture, students not only become passive recipients of knowledge, but actively build understanding through group discussions, information exploration, and real-world situation analysis. These findings reinforce the research results of Darmawati and Mustadi (2023) and Rahman (2022) who stated that the integration of Problem Based Learning and Deep Learning is effective in building critical thinking skills, creativity, collaboration, and student learning motivation at the elementary school level. Thus, this learning model is highly recommended to be used as an effective learning strategy in elementary schools to prepare students who are ready to face the challenges of the 21st century.

Although the results of the study show a positive trend, the study has some limitations. The research was only carried out in one class and in two cycles, so it could not ensure the sustainability of increasing learning motivation and critical thinking skills in the long term. In addition, the application of this model requires teachers' readiness to design meaningful contextual problems and the ability to manage the dynamics of group discussions, which has the potential to be a challenge in schools with limited resources. Therefore, further research is recommended to expand the research subjects, test the effectiveness of this model on different teaching materials and grade levels, and examine its impact on long-term learning outcomes to ensure the durability of the results of the intervention and the potential generalization of this model in various Indonesian primary school contexts.

Conclusion

Based on the results of class action research conducted in class 5B of Bandungrejosari I Public Elementary School Malang City, it can be concluded that the application of the Problem Based Learning model based on the Deep Learning approach is effective in increasing students' learning motivation and critical thinking skills. This model encourages students to actively think deeply, reflect on experiences, and connect subject matter with cultural and real-life contexts, thus having a positive impact on learning activities, courage to speak up, and the completeness of student learning outcomes. Theoretically, this research enriches the study of the implementation of Problem Based Learning based on Deep Learning, which in this context is operationalized as a pedagogical approach based on deep conceptual understanding, critical reflection, knowledge transfer, and contextual connection with local cultural issues. Practically, the results of this study provide recommendations for elementary school teachers to adapt this model in thematic learning to build 21st century skills and foster students' concern for the preservation of regional culture. However, this study has limitations because it was only conducted in one classroom in two cycles, so it needs to be further tested on different subjects, levels, and school contexts, and it is recommended that future studies test the effectiveness of this model in the long term and use inferential statistical analysis to strengthen the validity of the results.

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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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