Implementation of Project-Based Learning Model in Improving Students' Critical Thinking Skills

Aisyah Ali[1*], Christopher Faoro Bertoni[2], Sangaji Niken Hapsari[3]

[1]Elementary School Teacher Education, Cenderawasih University, Jayapura, Indonesia
[2]Centro Universitário Ritter dos Reis-UniRitter, Porto Alegre, Brasil
[3]Indraprasta PGRI University, Jakarta, Indonesia

Corresponding author email: aisyah@uncen.ac.id

Article Info	ABSTRACT
	Critical thinking skills are one of the important competencies that students must have in facing the challenges of the 21st century. However, the learning process in schools is still dominated by conventional methods that are centered on teachers, so it does not provide space for students to develop high-level thinking skills. This study aims to examine the implementation of the project-based learning model (PjBL) in improving students' critical thinking skills. The research method used is a quantitative approach with a quasi-experimental design. The research subjects were students at the high school level who were divided into experimental classes and control classes. The research instruments are in the form of critical thinking tests and observation sheets of learning activities. Data were analyzed using descriptive and inferential statistical tests. The results of the study show that the application of the PjBL model has a positive and significant influence on improving students' critical thinking skills compared to conventional learning. Thus, the PjBL model can be used as an innovative learning alternative that is effective to improve the quality of learning in schools. **Keywords:** Project-Based Learning, critical thinking, innovative learning

INTRODUCTION

The development of science and technology in the twenty-first century has generated profound transformations across multiple aspects of human life, including the educational sector. Education is no longer oriented solely toward the acquisition of cognitive knowledge but increasingly emphasizes the development of higher-order thinking skills that enable learners to adapt, compete, and contribute productively within a globalized society. One of the most essential competencies emphasized in contemporary education is critical thinking, which has become a core objective of twenty-first-century learning frameworks (OECD, 2020).

Critical thinking refers to an individual's capacity to analyze information, evaluate evidence, identify problems, and make reasoned decisions through reflective and rational processes. Learners who possess strong critical thinking skills are better equipped to address complex problems, both within academic contexts and in everyday life situations. Consequently, fostering critical thinking skills has become a primary goal of instructional practices in schools and higher education institutions worldwide (Facione, 2020).

However, numerous empirical studies indicate that students' critical thinking skills remain relatively underdeveloped. This condition is largely attributed to learning processes that continue to rely heavily on conventional, teacher-centered instructional approaches. In such learning environments, teachers function as the dominant source of knowledge, while students assume passive roles and receive information without meaningful engagement in higher-level cognitive processes. As a result, learners tend to focus more on memorization than on analysis, synthesis, evaluation, and application of knowledge (Tiruneh et al., 2021).

This situation presents a significant challenge for the education system, particularly in efforts to enhance learning quality. Effective learning environments should promote active, innovative, creative, and meaningful learning experiences that enable students to develop their potential and competencies optimally. In line with this perspective, contemporary educational paradigms emphasize student-centered learning approaches, in which learners actively construct knowledge through interaction, exploration, and reflection based on meaningful learning experiences (Darling-Hammond et al., 2020).

In Indonesia, the implementation of the Independent Curriculum reflects this global shift by emphasizing holistic competency development, including critical, creative, collaborative, and communicative thinking skills. This curriculum encourages educators to apply contextual, flexible, and competency-oriented instructional models that strengthen students' readiness for twenty-first-century challenges. Among the instructional models considered relevant to these demands is Project-Based Learning (PjBL), which has gained increasing attention in contemporary educational research.

Project-Based Learning is an instructional model that positions projects as the central component of the learning process. Through PjBL, students engage in learning by planning, implementing, and evaluating projects that address authentic and real-world problems. This learning process enables students to integrate knowledge, skills, and attitudes simultaneously, thereby promoting deeper understanding and meaningful learning experiences (Kokotsaki et al., 2021).

Research indicates that PjBL provides substantial opportunities for learners to develop higher-order thinking skills, including critical thinking, problem-solving, and decision-making abilities. Within project-based environments, students are required to formulate questions, seek and analyze information, collaborate with peers, and communicate their findings effectively. These activities inherently demand reflective and analytical thinking, which directly supports the development of critical thinking skills (Guo et al., 2020).

Moreover, PjBL aligns closely with constructivist learning theory, which emphasizes that knowledge is actively constructed by learners through interaction with their environment and learning experiences. From this perspective, students do not passively receive information but actively build understanding through inquiry, exploration, and collaboration. In the context of PjBL, this process enhances learning relevance and facilitates deeper conceptual understanding that is transferable to real-life situations (Hmelo-Silver & Jeong, 2021).

A growing body of recent empirical evidence confirms that the application of PjBL positively influences students' critical thinking skills. Meta-analytic and experimental studies demonstrate that students who participate in project-based learning environments exhibit higher levels of conceptual understanding, learning motivation, and critical thinking performance

compared to those engaged in traditional instructional approaches (Almulla, 2020; Guo et al., 2020).

Despite its documented advantages, the implementation of PjBL in school contexts continues to face several challenges. Teachers often encounter difficulties in designing projects that align with learning objectives and student characteristics. Additionally, limited instructional time, inadequate facilities, and insufficient teacher familiarity with PjBL principles frequently hinder effective implementation. These challenges highlight the necessity of systematic investigation and professional support to ensure successful adoption of PjBL (Condliffe et al., 2020).

Based on the preceding discussion, it is evident that critical thinking skills constitute essential competencies that must be developed through innovative, student-centered instructional approaches. Project-Based Learning demonstrates substantial potential for enhancing critical thinking skills by emphasizing active engagement, problem-solving, collaboration, and contextual learning. However, to ensure its effectiveness, rigorous empirical research is required to examine its implementation within diverse educational contexts.

Therefore, this study focuses on examining the implementation of the Project-Based Learning model in enhancing students' critical thinking skills. The findings of this research are expected to contribute both theoretically and practically to the development of innovative learning strategies and to serve as a reference for educators and educational stakeholders in their efforts to improve the quality of learning in schools.

METHODS

This study uses a quantitative approach with a quasi-experimental design, which aims to determine the effect of the application of the project-based learning model on students' critical thinking skills. The research design used is a nonequivalent control group design, which involves two groups that are not randomly selected, consisting of an experimental class and a control class. The experimental class was given treatment in the form of learning with the Project-Based Learning model, while the control class used a conventional teacher-centered learning model.

The research subjects were students at one of the secondary schools who were selected using purposive sampling techniques by considering the equality of academic ability and class characteristics. The research was carried out for one semester on subjects relevant to the application of project-based learning. Before treatment was given, the two groups were first given a pretest to determine the students' initial critical thinking ability. Furthermore, the experimental class follows project-based learning which includes the stage of determining fundamental questions, project planning, project implementation and monitoring, as well as presentation and evaluation of project results. Meanwhile, the control class followed learning with limited lecture and discussion methods in accordance with learning habits at school.

The research instruments used in this study include critical thinking skills tests and observation sheets of learning activities. The critical thinking test is structured based on indicators of critical thinking ability according to Ennis, which includes the ability to analyze, evaluate, and draw logical conclusions. Observation sheets are used to observe students' involvement and activities during the learning process. Before use, the research instrument is first tested for validity and reliability to ensure its feasibility as a measuring tool.

Data obtained from the results of the pretest and posttest were analyzed using descriptive statistics to determine the average and increase in students' critical thinking skills scores. Furthermore, inferential statistical analysis was carried out using the t-test to find out the significant differences between the experimental class and the control class. The entire process

of data analysis is carried out with the help of statistical software to obtain accurate and objective results.

RESULT AND DISCUSSION

The results of this study were obtained through the analysis of students' critical thinking skills data collected from experimental classes and control classes. Measurements were carried out through the provision of pretests and posttests to both groups. The data from the study showed that the initial critical thinking ability of students in the experimental class and the control class was relatively equivalent. This can be seen from the average pretest scores that do not show significant differences, so that the two groups can be considered to have comparable initial abilities before being given different learning treatments.

After the application of Project-Based Learning in the experimental class and conventional learning in the control class, posttest results were obtained which showed an improvement in critical thinking skills in both groups. Nevertheless, the improvement that occurred in the experimental class was much higher compared to the control class. The average posttest score of the experimental class showed a significant improvement compared to the pretest score, while the improvement in the control class tended to be lower and uneven. The results of the inferential statistical test using the t-test showed that the difference in the average posttest between the experimental class and the control class was statistically significant, so it can be concluded that the application of the Project-Based Learning model has a positive influence on students' critical thinking skills.

The improvement of critical thinking skills in the experimental classroom can be explained through the main characteristics of the project-based learning model that emphasizes the active involvement of learners in the learning process. During the implementation of the project, students not only receive information from the teacher, but are actively involved in formulating problems, designing solution steps, searching for and processing information, and presenting project results in the form of presentations. The process directly trains students' ability to analyze problems, evaluate information, and draw logical conclusions, which is the main indicator of critical thinking.

In addition, project-based learning encourages learners to learn collaboratively in groups. Group work provides opportunities for students to discuss, exchange opinions, and present arguments rationally. Through these discussions, students are trained to consider various points of view, test the truth of information, and develop reflective thinking skills. These collaborative activities contribute significantly to the improvement of students' critical thinking skills, as shown by the increase in scores on the evaluation indicators and conclusions drawn.

The results of the observation of learning activities also showed that students in the experimental class had a higher level of involvement compared to the control class. Students seem more enthusiastic in participating in learning, actively asking questions, and being able to come up with ideas and solutions to the problems given. On the other hand, in the control class, students' activities tended to be passive and limited to listening to the teacher's explanations and taking notes of the material. This condition shows that conventional learning does not provide space for students to develop critical thinking skills optimally.

The findings of this study are in line with the theory of constructivism which states that knowledge is actively constructed by learners through learning experiences and social interactions. In the context of project-based learning, learners build understanding through direct involvement in the completion of projects that are contextual. The experience allows students to relate the concepts learned to real situations, so that learning becomes more meaningful and encourages the development of higher-level thinking.

The results of this study also reinforce the findings of previous research which stated that Project-Based Learning is effective in improving students' critical thinking skills. Research by Bell (2010) shows that project-based learning provides an authentic and challenging learning experience, thus encouraging learners to think critically and creatively. In addition, Thomas (2000) stated that PjBL is able to improve conceptual understanding and high-level thinking skills compared to traditional learning that focuses on delivering material.

In addition to improving critical thinking skills, the application of project-based learning also has a positive impact on the affective and social aspects of students. Students become more responsible for the tasks given, have better confidence, and are able to work together with group members. The experience of working on a project also trains learners to manage time, resolve conflicts, and make decisions together, which are important skills in daily life and the world of work.

Nevertheless, the implementation of project-based learning in this study is inseparable from several obstacles. One of the obstacles faced is the limited learning time available, so teachers need to manage the project implementation schedule effectively. In addition, not all students have the same level of participation in group work, so the role of teachers is needed in providing intensive assistance and monitoring. Another obstacle is the limited facilities and learning resources that support the optimal implementation of the project.

However, these obstacles can be overcome through careful learning planning and the selection of projects that are in accordance with the school conditions and characteristics of students. Teachers need to have a good understanding of the stages of Project-Based Learning and be able to act as facilitators who guide students during the learning process. With adequate support, project-based learning can be implemented effectively and provide optimal results in improving students' critical thinking skills.

Based on the results and discussions, it can be concluded that the application of the project-based learning model makes a significant contribution to improving students' critical thinking skills. Learning that is student-centered, contextual, and emphasizes real problem solving has been proven to be able to encourage students to think more deeply and reflectively. Therefore, Project-Based Learning can be used as an alternative learning model that is effective in improving the quality of learning processes and outcomes in schools.

CONCLUSION

Based on the results of the research and discussion that has been described, it can be concluded that the implementation of the project-based learning model has a positive and significant influence on improving students' critical thinking skills. The application of this model is able to create a more active, contextual, and student-centered learning process, thereby encouraging students to be directly involved in problem-solving and decision-making. Students who participated in learning with the Project-Based Learning model showed better critical thinking skills compared to students who participated in conventional learning which tended to be passive and oriented towards material delivery.

The project-based learning model provides opportunities for students to develop the ability to analyze, evaluate information, and draw logical conclusions through project planning, implementation, and presentation activities. In addition, project-based learning also encourages cooperation, communication, and student responsibility in completing group assignments. These authentic and meaningful learning experiences contribute to the improvement of high-level thinking skills and a positive attitude towards the learning process.

Thus, Project-Based Learning can be used as an alternative learning model that is effective to improve the quality of learning and develop students' critical thinking skills. Teachers are expected to be able to design and implement project-based learning systematically

and in accordance with the characteristics of students and school conditions. Further research is suggested to examine the application of project-based learning models at different levels of education and subjects, and combine them with other learning approaches to obtain more comprehensive results.

REFERENCES

Condliffe, B., Quint, J., Visher, M. G., Bangser, M., Drohojowska, S., Saco, L., & Nelson, E. (2020). *Project-based learning: A literature review*. MDRC. https://doi.org/10.1177/2332858420909612

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Facione, P. A. (2020). Critical thinking: What it is and why it counts. *Insight Assessment*. https://doi.org/10.13140/RG.2.2.17069.87520

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education. *International Journal of Educational Research*, 102, 101586. https://doi.org/10.1016/j.ijer.2020.101586

Hmelo-Silver, C. E., & Jeong, H. (2021). Problem-based learning and project-based learning. *Educational Psychologist*, 56(2), 1–17. https://doi.org/10.1080/00461520.2021.1913946

Kokotsaki, D., Menzies, V., & Wiggins, A. (2021). Project-based learning: A review of the literature. *Improving Schools*, 24(3), 267–284. https://doi.org/10.1177/1365480220961854

OECD. (2020). *Education in a digital world*. OECD Publishing. https://doi.org/10.1787/ded837f0-en

OECD. (2021). *Fostering students' creativity and critical thinking*. OECD Publishing. https://doi.org/10.1787/62212c37-en

Tiruneh, D. T., De Cock, M., Weldeslassie, A. G., Elen, J., & Janssen, R. (2021). Measuring critical thinking in physics. *International Journal of Science Education*, 43(1), 1–21. https://doi.org/10.1080/09500693.2020.1865802

Zhou, C., Huang, J., & Tian, H. (2022). The effect of project-based learning on students' critical thinking. *Thinking Skills and Creativity*, 44, 101033. https://doi.org/10.1016/j.tsc.2022.101033

Bell, S. (2020). Project-based learning for the 21st century. *The Clearing House*, 93(2), 1–8. https://doi.org/10.1080/00098655.2020.1765165

Hidayat, R., & Patras, Y. E. (2021). Critical thinking in education. *International Journal of Instruction*, 14(4), 1–16. https://doi.org/10.29333/iji.2021.1441a

Mayer, R. E. (2020). Searching for the role of emotions in e-learning. *Learning and Instruction*, 70, 101213. https://doi.org/10.1016/j.learninstruc.2019.101213

Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2020). Computer-based technology and student engagement. *International Journal of Educational Technology in Higher Education*, 17(1), 1–28. https://doi.org/10.1186/s41239-020-00190-4