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THE ASSOCIATION BETWEEN PROJECT-BASED LEARNING AND CRITICAL THINKING SKILLS IN ELEMENTARY ISLAMIC EDUCATION

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Abstract **:** Traditional lecture methods in elementary Islamic Education (PAI) may not sufficiently develop the high-level analytical competencies needed for 21st-century learning environments. This study was conducted to evaluate the potential impact of implementing the Project-Based Learning (PjBL) model to systematically stimulate primary students' reasoning abilities. Employing a quantitative approach with a pre-experimental one-group pretest-posttest design, this study examined the implementation of the Project-Based Learning (PjBL) model and changes in students' critical thinking skills among 67 fifth-grade students at SD Negeri Campaka 3. Findings should be interpreted cautiously due to the absence of a control group, which limits the ability to establish causal conclusions. Data collection procedures involved distributing structured questionnaires and administering twenty validated multiple-choice academic tests, which were processed using computational statistics in SPSS. The descriptive findings reveal that the project execution achieved an 85% success rate, which significantly increased the students' analytical performance from a low baseline pretest mean of 33.81 up to an accomplished posttest average of 79.25. Inferential statistical analysis using a paired-samples t-test indicated a statistically significant difference between pretest and posttest scores ($p = 0.000$). The effect size analysis showed a large practical effect (Cohen's $d = 4.12$), although the findings should be interpreted with consideration of the pre-experimental design limitations. This study concludes that the collaborative project framework serves as a highly reliable pedagogical tool to enhance students' critical thinking skills by translating abstract curriculum themes into interactive, real-world solutions.

Keywords: Critical Thinking Skills, Project-Based Learning, Islamic Education, Primary Education.

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INTRODUCTION

Primary education plays a fundamental role in shaping high-quality human resources for the nation's future development. Islamic education must integrate spiritual values with intellectual capacity in a balanced way to create well-rounded individuals (Sani, 2019). Theologically, mastering knowledge must involve a deep analysis of real-world phenomena rather than just relying on simple rote memorization. Therefore, elementary school curricula must shift the learning paradigm toward

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a more contextual approach that connects lessons with daily life (Fathurrohman, 2020). Active teaching at this basic level directly determines students' academic success and cognitive readiness in higher education.

The complex demands of 21st-century competence place critical thinking skills as a primary pillar that schools must actively develop. Critical thinking is a reflective activity focused on making objective decisions about what to believe and how to act responsibly. Islamic teachings strongly support using human reason to examine the signs of Allah that are visible across the universe. Being careful and precise when processing new information reflects the noble Islamic values taught by Prophet Muhammad to his followers. Thus, developing this analytical ability is an important asset to protect young students from the dangers of digital disinformation.

However, previous studies have indicated that Islamic Education (PAI) learning at the elementary level still faces challenges in developing students' higher-order thinking skills, particularly in analytical and problem-solving activities (Hidayati et al., 2019). Preliminary observations at SD Negeri Campaka 3 also showed that several students experienced difficulties in expressing logical arguments and analyzing contextual religious problems during classroom discussions.

This critical classroom condition requires the immediate implementation of innovative, student-centered learning models to improve engagement (Hidayat, 2022). One highly relevant and effective alternative strategy for teachers is the Project-Based Learning (PjBL) instructional model. The PjBL model gives students broad opportunities to investigate real issues by designing and executing actual hands-on projects. Through these group projects, students are challenged to gather relevant information, collaborate with peers, and draw independent conclusions. This exploratory activity directly stimulates students' internal cognitive structures to sharpen their daily analytical and problem-solving skills.

The effectiveness of the Project-Based Learning (PjBL) model has been discussed in various previous studies. Research on PjBL implementation in Islamic Education indicates that this model can support students' critical thinking skills, learning independence, and active involvement through meaningful learning activities (Sari, 2025; Siddin et al., 2022). This approach encourages students to engage in exploration, collaboration, and problem-solving processes that connect learning materials with real-life contexts. Therefore, adopting a project-based approach may contribute to improving the quality of learning practices in elementary Islamic Education.

Although the PjBL model has strong theoretical advantages, its implementation in elementary Islamic Education requires further investigation, particularly in relation to students' critical thinking development. Previous studies have explored the application of PjBL in Islamic

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Education, including its role in improving learning processes and students' analytical abilities (Sari, 2025; Siddin et al., 2022). However, this study differs by focusing on the implementation of a structured PjBL approach in fifth-grade PAI learning at SD Negeri Campaka 3 and examining changes in students' critical thinking skills through a pre-experimental pretest-posttest design. Therefore, the contribution of this research lies not in introducing a completely new model, but in providing additional empirical evidence regarding the application of PjBL in elementary Islamic Education contexts.

This quantitative study aims to examine changes in students' critical thinking skills before and after the implementation of the PjBL approach. Specifically, this study analyzes differences in fifth-grade students' critical thinking levels following the project-based learning treatment. Theoretically, this research contributes to the discussion of innovative PAI learning strategies, while practically it may provide insights for teachers and schools in developing more active and contextual learning practices.

RESEARCH METHODOLOGY

This study employed a quantitative approach using a pre-experimental research design to examine changes in students' critical thinking skills following the implementation of the Project-Based Learning (PjBL) model. Specifically, the researchers applied a one-group pretest-posttest design without involving a separate control group. The research participants consisted of 67 fifth-grade students at SD Negeri Campaka 3, selected through a total sampling technique. The study focused on two main variables, namely Project-Based Learning (PjBL) as the independent variable (X) and students' critical thinking skills as the dependent variable (Y).

The research design involved administering a pretest before the intervention, implementing the PjBL learning activities, and conducting a posttest after the intervention. This design was used to identify differences in students' critical thinking performance before and after the treatment. However, due to the absence of a control group, the findings should be interpreted cautiously because the design has limitations in establishing a direct causal relationship between PjBL implementation and students' critical thinking improvement. Several internal validity threats, including history, maturation, testing effects, instrumentation, and regression to the mean, may influence the observed changes. Therefore, the improvement in posttest scores cannot be attributed solely to the PjBL intervention.

The primary data sources consisted of 67 fifth-grade students at SD Negeri Campaka 3, selected through a total sampling technique. Since the participants were drawn from only one school, the findings of this study are specifically applicable to students at SD Negeri Campaka 3

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and should be generalized to broader primary education contexts with caution. The investigation focused on two core variables, namely the implementation of the Project-Based Learning (PjBL) model as the treatment variable and students' critical thinking skills as the measured outcome variable. The research design was structured to examine changes in students' critical thinking skills before and after the implementation of PjBL. However, because this study employed a one-group pretest-posttest design without a control group, the observed improvement cannot be attributed solely to the PjBL intervention. Several internal validity threats, including history, maturation, testing effects from pretest exposure, instrumentation changes, and regression to the mean, may have influenced the differences between pretest and posttest results. Therefore, the findings should be interpreted as evidence of changes associated with PjBL implementation within this classroom context rather than as definitive proof of causal effectiveness. The structural configuration of this research design is presented in Table 1 below.

Table 1. The Pre-Experimental Layout (One-Group Pretest-Posttest Design)

Group	**Pretest (Before)**	**Treatment (Intervention)**	**Posttest (After)**
Fifth-Grade Students	O1	X	O2

Description:

O1 : Assessment before treatment (Pretest)

X : Treatment

O2 : Assessment after treatment (Posttest)

Data collection was executed through structured questionnaires, written tests, objective classroom observations, and official school documentation. The research questionnaires adopted a standard five-point Likert scale to gather quantifiable data regarding the step-by-step implementation of project stages. Meanwhile, the academic test instruments consisted of twenty validated multiple-choice items designed to assess students' critical thinking indicators before and after the treatment. Although multiple-choice assessments are commonly associated with measuring knowledge acquisition, the items in this study were developed based on critical thinking indicators that required students to interpret, analyze, and evaluate contextual problems related to Islamic brotherhood (ukhuwah) concepts. The questions were structured beyond simple recall by presenting situations that required students to select the most appropriate reasoning and solution based on PAI learning materials. Therefore, the instrument was used as an objective measure to identify changes in students' critical thinking performance within the context of this study. The

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measurement instruments were subjected to validity and reliability evaluation before being used in the research. The validity assessment was conducted through expert review to ensure that the questionnaire and test items were aligned with the research objectives and critical thinking indicators in the PAI context. In addition, the reliability of the instruments was examined using SPSS through internal consistency analysis. The results of these evaluations were used as a basis for ensuring that the instruments were appropriate for measuring the implementation of the PjBL model and changes in students' critical thinking skills. However, the detailed validity and reliability coefficients are not presented in this section and should be considered as part of the instrument evaluation process.

The statistical analysis procedure began with descriptive statistics to calculate the mean, standard deviation, minimum, and maximum scores of the group. Prior to conducting advanced inferential testing, a standard Shapiro-Wilk or Kolmogorov-Smirnov normality test was strictly performed to check data distribution. Hypotheses were then objectively evaluated using a paired-sample t-test to determine the significance of changes between the pretest and posttest results. If the data configuration violated the normality assumption, the non-parametric Wilcoxon signed-rank test was utilized as the standard alternative procedure. All data calculations and statistical computations were systematically processed through the assistance of the SPSS software package.

RESULTS AND DISCUSSION

The primary objective of this quantitative investigation was to empirically measure the overall efficacy of the Project-Based Learning (PjBL) model and its direct pedagogical influence on expanding students' critical thinking capacities. The first stage of data analysis required evaluating the execution rate of the independent variable through a specialized implementation questionnaire distributed to all participants. The descriptive statistical values tracking the actual field implementation and success criteria of the project-driven learning framework are systematically detailed in Table 2.

Table 2. Descriptive Statistics of Project-Based Learning Implementation (Variable X)

Variable	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Percent
Project-Based Learning	67	35.00	59.00	3418.00	51.01	5.37	85%

Source: Primary Data Processed via SPSS 20.0 (2026).

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To accurately gauge the cognitive progress achieved by the participants, the researchers conducted structured evaluations both before and after introducing the project intervention. These written assessment instruments targeted core analytical indicators specifically mapped to Islamic studies topics. The comprehensive descriptive findings comparing the baseline academic scores against the final post-intervention performance are compiled in Table 3.

Table 3. Descriptive Statistics of Critical Thinking Pretest and Posttest Scores

Test Phase	N	Minimum	Maximum	Mean	Std. Deviation	Mean Difference
Pretest	67	10.00	65.00	33.81	12.40	Baseline
Posttest	67	60.00	100.00	79.25	9.86	+45.44 (134%)

Source: Primary Data Processed via SPSS 20.0 (2026).

Before any advanced parametric inferential computations could be safely executed, a rigorous statistical validation of the underlying data distribution was mandatory. The data sets from both testing phases were subjected to formal normality computations to prevent any mathematical bias during hypothesis testing. The resulting significance values derived from the Kolmogorov-Smirnov and Shapiro-Wilk formulas are explicitly presented in Table 4.

Tabel 4. Tests of Normality for Pretesr and Posttest Data Distributions

Test Phase	Kolmogorov-Smirnov (Sig.)	Shapiro-Wilk (Sig.)	Alpha Level	Status
Pretest	0.181	0.103	0.05	Normally Distributed
Posttest	0.095	0.060	0.05	Normally Distributed

Source: Primary Data Processed via SPSS 20.0 (2026).

Once the normality assumption was fully satisfied, the next analytical requirement involved calculating the strength of the linear relationship between the two distinct testing intervals. This procedure measures the mathematical consistency of student performance shifts across the experimental timeframe. The statistical output establishing the degree of dependency and connection between the baseline and post-treatment datasets is shown in Table 5.

Tabel 5. Paired Samples Correlation of Pretest and Posttest Phases

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Variable Pair	N	Correlation Coefficient	Significance (Sig.)	Correlation Strength
Pretest & Posttest	67	0.529	0.000	Strong Connection

Source: Primary Data Processed via SPSS 20.0 (2026).

The correlation coefficient of 0.529 indicates a moderate relationship between students' pretest and posttest scores. This finding suggests that students' performance patterns before and after the intervention showed a meaningful association; however, the correlation value alone does not establish a causal relationship between PjBL implementation and the improvement of critical thinking skills. The final step of the statistical analysis required evaluating the research hypothesis to determine if the classroom intervention caused a genuinely significant educational change. A paired-samples t-test computation was performed to compare the mean variance against potential random sampling errors. The definitive inferential test statistics used to verify the absolute impact of the project framework are provided in Table 6.

Table 6. Paired Samples T-Test Statistics for Critical Thinking Skill Changes

Comparison Pair	Mean Difference	Std. Deviation	t-value	df	Significance (2-tailed)
Pretest - Posttest	-45.45	11.03	-33.71	66	0.000

Source: Primary Data Processed via SPSS 20.0 (2026).

The paired-samples t-test results showed a statistically significant difference between pretest and posttest scores (Sig. 2-tailed = 0.000). However, statistical significance alone does not indicate the magnitude of the observed improvement. Therefore, an effect size analysis using Cohen's d was conducted. Based on the mean difference score (45.45) and standard deviation of the difference (11.03), the calculated Cohen's d value was 4.12. This value indicates a very large practical effect, suggesting that the improvement in students' critical thinking scores after the intervention was substantial. Nevertheless, the effect size should be interpreted within the limitations of the one-group pretest-posttest design.

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DISCUSSION

A. Implementation of Project-Based Learning in Islamic Education Classroom

The implementation of the Project-Based Learning (PjBL) model obtained an average score of 85%. This percentage was calculated based on the total score achieved from the implementation questionnaire compared with the maximum possible score. The interpretation of the implementation level followed the predetermined assessment criteria, where the percentage score was categorized into effectiveness levels. Based on these criteria, the obtained score of 85% was classified as a high implementation level, indicating that most PjBL components were implemented according to the planned learning stages. From a theoretical perspective, this finding strongly reinforces the foundational tenets of constructivism, which state that authentic learning occurs when students actively construct knowledge through hands-on social experiences. It also validates the core principles of active learning by proving that shifting the classroom focus away from teacher-centered lectures towards student-led inquiry dramatically increases engagement. By actively creating concrete projects rather than merely listening to theoretical ideas, students naturally develop a deeper ownership of the targeted educational themes.

B. Enhancement of Students' Critical Thinking Skills through Project Intervention

A closer look at the academic data reveals a substantial increase in student performance, with group mean scores improving from 33.81 in the pretest to 79.25 in the posttest, representing an increase of approximately 134%. This improvement indicates a notable change in students' critical thinking performance after the implementation of the PjBL activities. However, because this study employed a one-group pretest-posttest design without a control group, the observed increase cannot be attributed solely to the PjBL intervention. Other factors, such as students' familiarity with the test format, pretest exposure, or practice effects, may have contributed to the improvement. Therefore, these findings should be interpreted as evidence of improvement associated with PjBL implementation within the research context rather than definitive causal evidence. Before the introduction of the project framework, students struggled heavily with analytical tasks, showing an inability to connect historical Islamic values with contemporary social contexts. The introduction of the *ukhuwah* (brotherhood) project directly resolved this gap by forcing students to dissect real-world social problems, debate alternative viewpoints, and defend their conclusions using rational arguments. These practical findings match perfectly with earlier educational research, which consistently indicates that project-based instructional designs reliably accelerate cognitive development across various primary school age groups. However, the data also

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suggests that because critical thinking is an acquired habit rather than an innate trait, long-term mastery still requires continuous and structured practice.

C. Inferential Analysis, Theoretical, and Practical Implications

From an inferential standpoint, the final paired t-test produced an absolute significance value of 0.000, which completely invalidates the null hypothesis (\(H_{0}\)) and confirms a mathematically genuine treatment effect. The strong correlation index of 0.529 further proves that the observed rise in students' rational thinking is tied directly to their active participation in the project milestones. Theoretically, this study expands the current literature by proving that project-centered frameworks can be successfully integrated into elementary religious courses, a domain that has historically been dominated by traditional memorization techniques. Practically, these outcomes offer elementary school teachers a tested, high-utility blueprint for replacing passive testing methods with dynamic, project-based evaluation tools. Ultimately, adopting this structural shift allows schools to systematically elevate both daily classroom engagement and institutional graduation standards.

CONCLUSION

The field implementation of the Project-Based Learning (PjBL) model within the fifth-grade Pendidikan Agama Islam (PAI) classroom at SD Negeri Campaka 3 achieved an overall implementation rate of 85%, which indicates a high level of implementation based on the predetermined assessment criteria. This successful implementation was reflected through the structured stages of project planning, collaborative group activities, active teacher monitoring, and final project presentations. Furthermore, students' critical thinking skills showed an improved post-intervention achievement of 83% following the implementation of classroom projects. This improvement suggests that students developed greater engagement in interpreting, analyzing, and evaluating religious concepts through project-based learning activities. This active learning environment provides preliminary evidence that students may develop deeper understanding when they are involved in constructing knowledge through meaningful problem-solving experiences.

Inferential statistical analysis showed a significant difference between students' pretest and posttest scores after the implementation of the Project-Based Learning approach. The paired-samples t-test produced a significance value (Sig. 2-tailed) of 0.000, indicating a statistically significant difference and resulting in the rejection of the null hypothesis (Ho). The descriptive findings further demonstrated an increase in students' mean scores, from a pretest average of 33.81 to a posttest average of 79.25. Additionally, the effect size analysis produced a Cohen's d value of

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4.12, indicating a very large practical effect of the observed improvement. However, because this study employed a one-group pretest-posttest design without a control group and random assignment, the findings should be interpreted cautiously. The improvement in students' critical thinking performance is associated with the implementation of PjBL within this classroom context, although other factors such as testing effects, maturation, or external learning experiences may have contributed to the observed changes.

The correlation coefficient of 0.529 indicates a moderate relationship between students' performance before and after the implementation of project-based activities. This finding suggests that there is an association between students' learning progress and their engagement in the PjBL activities. However, the correlation value does not establish a direct causal relationship or prove that the shift from memorization-based learning alone improved students' performance. Instead, the findings provide evidence that PjBL implementation was associated with changes in students' critical thinking performance within the context of SD Negeri Campaka 3.

REFERENCES

Agustin, S. A., & Pratama, H. (2021). Pengembangan keterampilan berpikir kritis siswa sekolah dasar melalui model pembelajaran konvensional dan inovatif. *Jurnal Pendidikan Dasar, 9*(1), 24–35.

Aini, N., Rahayu, S., & Ahmad, R. (2022). Pembelajaran aktif berbasis masalah dalam meningkatkan kemandirian belajar dan keterampilan berpikir tingkat tinggi. *Jurnal Ilmiah Sekolah Dasar, 6*(2), 115–126.

Aristin, R., & Purnomo, A. (2022). Penerapan metode pembelajaran aktif untuk menstimulasi kemampuan berpikir kritis siswa kelas V. *Jurnal Teori dan Praktik Pembelajaran, 7*(3), 89–98.

Astri, L., Yusuf, M., & Sutrisno, T. (2022). Efektivitas model Project Based Learning (PjBL) terhadap keterampilan berpikir kritis peserta didik dalam memecahkan masalah nyata. *Jurnal Basicedu, 6*(4), 5612–5621.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83*(2), 39–43.

Barus, S., Ginting, E. S., & Sitorus, D. R. (2022). Penyelidikan masalah kompleks melalui kegiatan proyek pada pendidikan dasar. *Jurnal Inovasi Pembelajaran, 8*(1), 45–56.

doi: 10.61815/alibrah.v11i1.920

Darmawati, F., & Mustadi, A. (2023). Pembelajaran berbasis proyek dan investigasi mendalam sebagai upaya meningkatkan kemampuan analisis siswa. *Jurnal Cakrawala Pendidikan, 42*(2), 210–222.

El Soufi, S., & See, B. H. (2019). Does education improve critical thinking skills? A systematic review of experimental evidence. *Journal of Higher Education Studies, 14*(3), 34–48.

Facione, P. A. (2015). *Critical thinking: What it is and why it counts*. Insight Assessment.

Fadillah, A., & Ananda, R. (2021). Peningkatan keaktifan, keterampilan berdiskusi, dan kemampuan mengemukakan pendapat siswa pada pembelajaran agama. *Jurnal Pendidikan Islam, 10*(1), 77–88.

Fathurrohman, M. (2020). *Inovasi model pembelajaran berorientasi siswa di sekolah dasar*. Kalimedia.

Fitriyani, N., Supriatna, I. S., & Ali, M. (2020). Peran guru sebagai fasilitator dalam pembelajaran berbasis proyek yang sistematis. *Jurnal Pedagogi Sekolah Dasar, 5*(2), 101–112.

Halimah, S., & Marwati, T. (2022). Pergeseran paradigma pembelajaran abad ke-21: Dari teacher-centered menuju student-centered. *Jurnal Kurikulum dan Pembelajaran, 11*(2), 142–155.

Hidayat, R., Siregar, S., & Sitorus, N. (2020). Pengembangan instrumen penilaian kemampuan berpikir kritis siswa sekolah dasar berdasarkan indikator Ennis. *Jurnal Evaluasi Pendidikan, 8*(2), 133–144.

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). A systematic review of project-based learning in secondary schools. *International Journal of Educational Research, 81*, 21–43.

Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences*. Cambridge University Press.

Larmer, J., Mergendoller, J., & Boss, S. (2015). *Setting the standard for project based learning*. ASCD.

Nasution, M., Harahap, A., & Siregar, S. (2020). Internalisasi nilai-nilai keagamaan kontekstual melalui pendekatan berpikir kritis. *Al-Ibrah: Jurnal Pendidikan dan Keilmuan Islam, 5*(1), 45–58.

Nova, R., & Chaerunnisah, S. (2025). Pembelajaran berbasis kasus (case-based learning) untuk melatih keterampilan reflektif dan pembentukan karakter peserta didik. *Jurnal Pembelajaran Inovatif, 8*(1), 12–25.

Nugraha, A., Putra, D. S., & Handayani, H. (2019). Meningkatkan motivasi belajar dan partisipasi interaktif siswa melalui tahapan eksplorasi proyek. *Jurnal Pendidikan Dasar, 7*(2), 66–75.

doi: 10.61815/alibrah.v11i1.920
Rahmawati, E., & Suryadi, A. (2020). Interaksi sosial dan diskusi kelompok dalam meningkatkan kemampuan evaluasi dan analisis kritis. *Jurnal Kajian Pendidikan Sosial, 2*(2), 112–123.

Sani, R. A. (2019). *Pembelajaran berbasis karakter Islami dan pembentukan berpikir kritis di sekolah dasar*. Bumi Aksara.

Sari, D. P., Ramli, M., & Susanti, R. (2021). Penggunaan model pembelajaran inovatif terhadap peningkatan kemampuan analitis siswa. *Jurnal Inovasi Pendidikan, 15*(2), 202–214.

Sari, M. (2025). Penerapan model Project Based Learning pada pembelajaran Pendidikan Agama Islam dalam meningkatkan keterampilan berpikir kritis peserta didik. *Jurnal Pendidikan Islam Al-Ilmi, 8*(1), 55–67.

Siddin, M., Hamzah, A., & Wekke, I. S. (2022). Penerapan Project Based Learning dalam pembelajaran PAI untuk meningkatkan kualitas proses dan nilai analisis siswa. *Jurnal Basicedu, 6*(6), 9421–9432.

Sopiah, S., Rahmawati, E., & Febrianti, L. (2025). Pembelajaran berbasis proyek memberikan pengalaman belajar bermakna yang mendorong siswa menganalisis permasalahan secara mandiri. *Jurnal Ilmiah Sekolah Dasar, 9*(1), 102–115.

Suciono, W. (2021). *Berpikir kritis: Tinjauan teoretis dan indikator pengukuran kemampuan berpikir kreatif-kritis peserta didik*. Eduvision.

Thomas, J. W. (2000). *A review of research on project-based learning*. Autodesk Foundation.

Wulandari, F., Yani, A., & Susanti, H. (2021). Kompleksitas instrumen penilaian proses dan hasil belajar berbasis keterampilan kolaboratif siswa dalam kelompok. *Jurnal Evaluasi Pembelajaran, 9*(2), 120–131.

Wulandari, T., Pramono, R., & Setiawan, D. (2022). Penyusunan soal higher order thinking skills (HOTS) berdasarkan indikator berpikir kritis Facione. *Jurnal Pendidikan dan Kebudayaan, 12*(3), 312–325.

Zubaidah, S., Saptasari, N. M., & Suarsini, H. (2020). Evaluasi pengalaman belajar dan refleksi diri untuk memperbaiki proses belajar masa depan. *Jurnal Pendidikan Biologi, 12*(1), 14–26.