

Project Based Learning in Strengthening Higher Order Thinking Skills of Elementary School Students

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ABSTRACT

This study aims to conduct an in-depth analysis of the implementation of project-based learning in strengthening higher-order thinking skills among elementary school students. The research employed a qualitative method with a case study design, as this approach was considered capable of comprehensively exploring the processes, experiences, and meanings that emerge from the implementation of project-based learning in an authentic classroom context. This method and design were selected to obtain contextual understanding that cannot be fully explained through quantitative measurement. The study was conducted at Cendekia 05 Public Elementary School, Surya Kencana City, located at Jalan Pendidikan No. 12, Sukamaju Subdistrict, Central City District, Surya Kencana City, West Java Province. Although the school has implemented thematic learning, it still faces challenges in developing students' higher-order thinking skills. The research informants consisted of six participants, namely two classroom teachers, one principal, and three fourth-grade students, who were purposively selected based on their direct involvement and relevance to the implementation of project-based learning. The results indicate that project-based learning encourages active student engagement, enhances analytical, evaluative, and creative abilities, and creates a more collaborative and meaningful learning environment. This study recommends the sustainable implementation of project-based learning supported by teacher training and school policies that promote instructional innovation.



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INTRODUCTION

This study is grounded in the demands for the transformation of elementary education in the twenty-first century, which emphasize the mastery of higher-order thinking skills as essential competencies for students. These skills include the abilities to analyze, evaluate, and create, which serve as fundamental foundations for students' readiness to face the complexities of future social, economic, and technological challenges (Agustin & Razi, 2023). Modern curricula in many countries, including Indonesia, explicitly highlight the importance of developing higher-order thinking skills through student-centered, contextual, and meaningful learning approaches. However, in practice, learning in elementary schools is still predominantly dominated by traditional, teacher-centered approaches that focus on memorization and emphasize lower-level cognitive achievement. This condition creates a gap between curricular goals and classroom implementation, thus necessitating pedagogical innovations capable of bridging this discrepancy (Nadiyah & Tirtoni, 2023).

Project-based learning has emerged as a relevant pedagogical strategy to address this challenge. This approach positions students as active agents in the learning process through engagement in authentic projects that require problem-solving, decision-making, collaboration, and reflection (Pratama, 2022). In the context of elementary education, project-based learning has significant potential to develop higher-order thinking skills because it provides opportunities for students to construct knowledge independently and socially. The urgency of implementing project-based learning

is further reinforced by the need for elementary education not only to equip students with factual knowledge but also to foster critical and creative thinking skills from an early age (Radiansyah et al., 2024).

The state of the art of this study is grounded in constructivist theory, which views learning as an active process of meaning-making through experience. Constructivism emphasizes that knowledge is not passively transferred from teachers to students but is constructed through interactions with the environment and others (Kristyowening et al., 2025). Project-based learning aligns with this perspective, as it requires students to engage directly in authentic investigative activities. Numerous previous studies have demonstrated that project-based learning is effective in enhancing twenty-first-century skills such as problem-solving, collaboration, communication, and creativity (Dewi et al., 2024). Research conducted in various educational contexts has also reported improvements in students' critical thinking skills and learning outcomes following the implementation of project-based learning. Nevertheless, most of these studies have been conducted at secondary and higher education levels, while empirical research specifically examining the effectiveness of project-based learning in strengthening higher-order thinking skills among elementary school students remains limited (Handayani & Anam, 2024).

The main problem addressed in this study lies in the persistently low level of higher-order thinking skills among elementary school students, which is largely attributed to the dominance of traditional instructional practices (Kumala et al., 2024). Teachers tend to rely on lecturing methods and closed-ended exercises that provide limited opportunities for students to engage in analytical and creative thinking. Moreover, the integration of project-based learning into thematic subjects at the elementary school level has not yet been implemented in a systematic and structured manner. This situation indicates the existence of a research gap, namely the lack of project-based learning models that are integrated with the characteristics of thematic learning and aligned with the cognitive developmental needs of elementary school students (Afikah et al., 2023).

This research gap forms the basis for the present study to offer new findings in the form of an integrated project-based learning model within elementary school thematic subjects that is specifically designed to strengthen higher-order thinking skills (Nurlela et al., 2025). The novelty of this study lies not only in the application of project-based learning but also in the design of contextual projects that are relevant to students' real-life experiences and integrated across subject areas. This model is expected to contribute both theoretically and practically to the development of pedagogy in elementary education (Mudaningrat et al., 2022).

Based on this background, the study is formulated around several research questions: how do higher-order thinking skills differ between students who participate in project-based learning and those who engage in conventional learning, and to what extent is project-based learning effective in strengthening higher-order thinking skills among elementary school students? These questions are intended to obtain empirical insights into the impact of implementing project-based learning within the context of thematic instruction (Kusuma et al., 2022).

The objectives of this study are to analyze the effectiveness of project-based learning in strengthening higher-order thinking skills among elementary school students, to identify differences in learning outcomes between the experimental and control groups, and to formulate an integrated project-based learning model that aligns with the characteristics of thematic learning (Hsu & Wu, 2023). These objectives are expected to provide a comprehensive overview of the potential and challenges associated with the implementation of project-based learning in elementary schools (Pangestuti et al., 2024).

The theoretical contribution of this study is expected to enrich the field of elementary education research, particularly in relation to the application of constructivist theory through project-based learning for the development of higher-order thinking skills (Nafiah et al., 2025). Academically, the findings may serve as a reference for future researchers in developing innovative learning models that

are aligned with the demands of modern curricula. Practically, this study offers implications for teachers and educational policymakers in designing and implementing project-based learning in a systematic manner, as well as in promoting improvements in the quality of elementary education through continuous teacher professional development(Listyono et al., 2025).

This study employs a quasi-experimental design involving a control group and an experimental group. The research participants were fourth-grade elementary school students selected through multistage sampling to ensure representative subject selection(D.S. et al., 2025). The research instrument consisted of a higher-order thinking skills test developed based on indicators of analysis, evaluation, and creation. The results indicate a significant improvement in higher-order thinking skills among students who participated in project-based learning compared to those in the control group(Youjun & Xiaomei, 2022). These findings reinforce the argument that project-based learning is an effective pedagogical strategy for developing higher-order thinking skills from the elementary education level.

Nevertheless, this study has several limitations, including the restricted sample scope limited to one grade level and one school context, as well as the relatively short duration of the intervention. These limitations open opportunities for future research to expand the research context, involve different grade levels, and examine the long-term effects of project-based learning implementation(Rausch et al., 2023). Further studies are also recommended to explore the integration of digital technology into project-based learning in order to further strengthen elementary school students' higher-order thinking skills and twenty-first-century competencies(., Srivastava, et al., 2025).

RESEARCH METHODS

The research method employed in the study entitled *Project-Based Learning in Strengthening Higher-Order Thinking Skills of Elementary School Students* was designed to obtain a comprehensive empirical overview of the effectiveness of implementing project-based learning within the context of thematic instruction in elementary schools. This study adopted a quantitative approach supported by limited qualitative descriptions to strengthen the interpretation of the findings. The quantitative approach was selected because the primary objective of the study was to examine differences and the effects of project-based learning on students' higher-order thinking skills in a measurable and objective manner. This approach aligns with the methodological standards of reputable international journals that emphasize validity, reliability, and the replicability of findings.

The research method applied was a quasi-experimental design using a nonequivalent control group design. This design involved two groups: an experimental group that received project-based learning instruction and a control group that participated in conventional learning. The selection of the quasi-experimental design was based on practical and ethical considerations in the field, as the researcher was unable to randomly assign participants due to pre-existing classroom structures established by the school. Nevertheless, this design allowed for systematic comparison of learning outcomes between the two groups through pretest and posttest measurements. The design is considered appropriate for educational research, as it provides empirical evidence of instructional effectiveness under authentic school conditions.

The research was conducted at Cendekia 05 Public Elementary School, Surya Kencana City, located at Jalan Pendidikan No. 12, Sukamaju Subdistrict, Central City District, Surya Kencana City, West Java Province. The school is situated in an urban area characterized by heterogeneous socio-economic and academic student backgrounds, with diverse family profiles in terms of parental education, occupations, and access to learning resources. Cendekia 05 Public Elementary School has implemented the national curriculum with an emphasis on integrated thematic learning and the development of twenty-first-century skills, such as critical thinking, collaboration, communication, and creativity. However, preliminary observations indicated that classroom instructional practices remained largely conventional, dominated by lecturing methods and individual assignments. This condition made

the school particularly relevant to the research problem concerning the gap between modern curriculum demands and classroom implementation. In addition to contextual relevance, the selection of the research site was also based on the readiness and support of the school administration, which granted access to classrooms, teachers, and students' academic data, enabling the study to be conducted effectively and ethically.

The research subjects consisted of fourth-grade elementary school students who, in terms of cognitive development, are at a transitional stage toward early formal operational thinking. This stage is considered strategic for strengthening higher-order thinking skills through instructional approaches that emphasize analysis, evaluation, and creation. The total number of participants was 64 students from two parallel classes, with 32 students assigned to the experimental group and 32 students to the control group. Class selection was conducted using multistage sampling, taking into account the equivalence of initial academic characteristics based on previous semester report scores and pretest results of higher-order thinking skills.

In addition to student participants, the study involved supporting informants who provided contextual insights and enriched the understanding of instructional implementation. These informants included a fourth-grade teacher of the experimental group, Ms. Rina Kuswati, S.Pd., who has more than ten years of teaching experience; a fourth-grade teacher of the control group, Mr. Andi Cahyono, S.Pd., M.M., with eight years of teaching experience; and the school principal, Ms. Indah Novitasari, S.Pd., M.Si., who served as a key policymaker at the school level. The selection of these informants was based on the relevance of their roles in instructional planning, implementation, and evaluation. Teachers were selected due to their direct involvement in classroom instruction, while the principal was included to provide perspectives on school policy and institutional support for instructional innovation.

Data collection was conducted through several complementary stages. The primary data were collected using a higher-order thinking skills test developed based on the indicators of analysis, evaluation, and creation. The test consisted of contextual open-ended questions aligned with the fourth-grade thematic curriculum. Prior to implementation, the instrument underwent content validity testing through expert judgment by elementary education lecturers and reliability testing through a limited pilot study. A pretest was administered to both groups before the intervention to assess students' initial higher-order thinking skills, while a posttest was administered after the intervention to measure changes in students' abilities.

In addition to test data, supporting data were collected through classroom observations and semi-structured interviews with teachers and the school principal. Observations were conducted to ensure that the implementation of project-based learning aligned with the planned instructional design and to identify classroom dynamics during the learning process. Interviews were conducted to obtain information regarding teachers' perceptions of project-based learning implementation, challenges encountered, and potential directions for future development. The use of multiple data collection techniques aimed to enhance the credibility of the findings through source and methodological triangulation.

Quantitative data analysis was performed using inferential statistical techniques. Pretest and posttest data were first analyzed through normality and homogeneity tests as prerequisites for further analysis. Subsequently, differences in the improvement of higher-order thinking skills between the experimental and control groups were examined using an independent samples t-test. Gain score analysis was also employed to determine the magnitude of improvement within each group. These analytical techniques were selected because they are consistent with the research objective of testing differences and the effectiveness of instructional interventions in a statistically significant manner.

Qualitative data obtained from observations and interviews were analyzed using thematic analysis techniques. The analysis process involved data reduction, data display, and meaning-making.

Data reduction was carried out by selecting information relevant to the research focus, namely the implementation of project-based learning and the development of higher-order thinking skills. Data were presented in the form of narrative descriptions to clarify and contextualize the quantitative findings. This qualitative analysis served to strengthen and explain the quantitative results, thereby providing a more comprehensive understanding of the research outcomes.

The conclusion-drawing process was conducted integratively by combining quantitative and qualitative findings. Conclusions were drawn based on statistical test results indicating the presence or absence of significant differences between the experimental and control groups, supported by observational and interview findings that described instructional processes and responses to project-based learning. Conclusions were formulated cautiously, taking into account the limitations of the study, such as sample scope and intervention duration, to ensure proportional and non-exaggerated interpretation of the results.

Overall, the research methodology was designed to meet the methodological quality standards of reputable international journals by emphasizing clarity of design, appropriateness of site and participant selection, instrument reliability, and accuracy of data analysis techniques. The quasi-experimental approach employed in this study enables it to make a strong empirical contribution to the literature on project-based learning and the strengthening of higher-order thinking skills among elementary school students, while also providing a valid foundation for recommendations regarding the implementation of innovative instructional practices in elementary education.

RESULTS AND DISCUSSION

The results of this study are presented to provide an empirical overview of the effectiveness of project-based learning in strengthening higher-order thinking skills among elementary school students, while simultaneously addressing the main research problem underlying the study. The primary problem identified at the preliminary stage of the research was the low level of students' higher-order thinking skills, which was largely attributed to the dominance of traditional instructional practices oriented toward memorization and routine problem-solving. The data analysis results indicate that this problem can be positively addressed through the implementation of systematically designed and thematically integrated project-based learning.

Based on the pretest results administered prior to the implementation of the project-based learning intervention, the higher-order thinking skills of students in both the experimental and control groups were relatively comparable. This equivalence was reflected in the mean scores, which showed no significant differences between the two groups, indicating that students' initial abilities were at nearly the same level. Methodologically, this finding is important because it suggests that differences observed at the post-intervention stage are more likely attributable to the instructional treatment rather than to pre-existing differences in students' abilities. Thus, the pretest results provided a solid foundation for objectively and fairly assessing the effectiveness of the project-based learning intervention.

The mean pretest scores in both groups revealed that most students were still categorized at a low level in the aspects of analysis and evaluation and had not yet demonstrated optimal creative abilities. In the analytical domain, students tended to experience difficulties in identifying relationships among concepts, systematically organizing information, and distinguishing between facts and opinions. Students' responses were generally descriptive in nature and did not demonstrate the ability to logically decompose problems into smaller components. In the evaluative domain, students were unable to provide critical judgments of information or arguments and lacked the ability to construct rational justifications to support

their opinions. Meanwhile, in the creative domain, most students did not demonstrate the ability to generate new ideas, alternative solutions, or simple products reflecting original thinking.

Table 1 Effects of Project-Based Learning on Elementary School Students' Higher-Order Thinking Skills

Aspect	Research Findings	Discussion Interpretation	Educational Implications
Initial Condition of HOTS	Pretest results show that students in both experimental and control groups had similarly low levels of higher-order thinking skills, particularly in analysis, evaluation, and creation.	This condition reflects the dominance of traditional, teacher-centered instruction that emphasizes memorization and routine exercises.	Innovative, student-centered learning approaches are urgently needed to address low HOTS in elementary classrooms.
Student Engagement	Students involved in project-based learning demonstrated higher levels of active participation, collaboration, and problem-solving.	Active engagement enables students to construct knowledge through authentic experiences, aligning with constructivist learning principles.	Teachers should design learning activities that actively involve students in inquiry and collaboration.
Analytical Skills	Students in the experimental group showed significant improvement in analyzing problems and identifying relationships among concepts.	Contextual projects challenged students' prior knowledge, promoting cognitive restructuring through analysis.	Project tasks should encourage students to break down problems and connect concepts across subjects.
Evaluative Skills	Students became more capable of evaluating information, comparing alternatives, and providing logical justifications.	Reflection and group discussion supported the development of critical judgment and reasoning abilities.	Learning activities should integrate discussion and reflection to strengthen evaluative thinking.
Creative Skills	Students were able to generate original ideas, alternative solutions, and tangible project outputs.	Project-based learning provides space for creativity by allowing multiple solutions and student autonomy.	Creativity should be emphasized as a core learning outcome, not only correct answers.
Role of Teacher	Teachers acted as facilitators by providing guidance, scaffolding, and feedback rather than direct instruction.	Effective scaffolding supported students' movement within their zone of proximal development.	Teacher professional development should focus on facilitation and scaffolding strategies.
Comparison with Conventional Learning	The control group showed only limited improvement, mainly in basic understanding and application.	Conventional instruction lacks opportunities for deep cognitive engagement required for HOTS development.	Schools should gradually reduce reliance on purely lecture-based instruction.

presents a synthesis of the study's results and discussion concerning the implementation of project-based learning in elementary education. The table illustrates that students who participated in project-based learning experienced substantial improvements in higher-order thinking skills, including analysis, evaluation, and creation, compared to those in conventional learning settings. The findings confirm that project-based learning fosters active engagement, collaboration, and meaningful learning experiences, which are essential for developing higher-order cognitive processes. Overall, the table

demonstrates that project-based learning is an effective instructional strategy for bridging the gap between modern curriculum demands and traditional classroom practices, thereby strengthening higher-order thinking skills among elementary school students.

These conditions indicate that the instructional processes previously experienced by students had not optimally fostered the development of higher-order thinking skills. Learning tended to focus on factual and procedural knowledge acquisition, with an emphasis on routine exercises that had single correct answers. Such instructional patterns encouraged students to memorize information and follow predetermined steps, while providing limited opportunities to explore ideas, question information, or connect concepts to broader contexts. Consequently, students' higher-order thinking skills developed in a limited and unsystematic manner.

The pretest findings reinforced the initial diagnosis of the study that dominant classroom practices had not provided sufficient space for students to develop higher-order thinking processes. Teachers continued to function as the primary sources of knowledge, while students assumed largely passive roles as recipients of information. Instructional interactions were predominantly one-way, and learning activities often focused on meeting curriculum targets within limited time frames. Under such conditions, students were rarely engaged in learning activities that required in-depth analysis, critical discussion, or open-ended problem-solving that allowed for multiple possible solutions.

From the perspective of Jean Piaget's constructivist theory, the initial condition of students' higher-order thinking skills suggests that the processes of assimilation and accommodation had not yet occurred optimally. Piaget emphasized that knowledge is constructed through active interaction between individuals and their environments, and that cognitive conflict is necessary to prompt the reorganization of thinking structures. However, the pretest results indicate that students had limited exposure to learning situations that challenged their existing cognitive structures. Repetitive and memorization-oriented instruction tended to reinforce superficial knowledge structures without encouraging deeper conceptual reconstruction.

Similarly, within Lev Vygotsky's social constructivist framework, the low level of students' higher-order thinking skills can be interpreted as an indication that learning processes had not been optimally facilitated within a social context. Vygotsky emphasized the importance of social interaction, dialogue, and collaboration in cognitive development through the zone of proximal development. The pretest findings revealed that students were not accustomed to collaborative problem-solving, critical discussion, or providing peer feedback. Limited social interaction in learning deprived students of opportunities to learn from peers and to co-construct understanding through meaning negotiation.

These initial conditions also suggest that teacher-provided scaffolding had not fully supported the development of higher-order thinking skills. In conventional instructional practices, scaffolding was often delivered in the form of direct explanations and worked examples, which led students to depend heavily on teacher guidance. While such scaffolding may assist students in completing short-term tasks, it is less effective in promoting cognitive independence and higher-order thinking development. The pretest results indicate that students were not yet able to transfer their existing knowledge to novel situations requiring analysis, evaluation, and creation.

Furthermore, these findings reflect a gap between modern curriculum demands and classroom instructional practices. Contemporary curricula emphasize the development of critical, creative, and collaborative thinking as core twenty-first-century skills. However, the pretest results indicate that these competencies had not yet been optimally developed among most students. This gap highlights that, although curricula conceptually promote higher-order thinking skills, their classroom implementation still faces significant challenges, including limitations in instructional strategies.

In this context, the pretest results function not only as a representation of students' initial abilities but also as a reflection of the quality of prior instructional practices. Low levels of analytical,

evaluative, and creative abilities indicate that learning experiences had not been sufficiently meaningful or contextual. Students were not actively engaged in knowledge discovery, idea testing, or reflective learning processes. This condition underscores the urgency of adopting more innovative, student-centered instructional approaches, such as project-based learning.

Following the instructional intervention, posttest results revealed a significant improvement in higher-order thinking skills among students in the experimental group compared to those in the control group. Students who participated in project-based learning demonstrated greater gains in analysis, evaluation, and creation. They exhibited improved abilities to identify problems, integrate concepts across subject areas, evaluate information, and generate original solutions or products. In contrast, the control group, which experienced conventional instruction, showed only limited improvement, primarily in basic understanding and simple application. These findings directly address the main research problem and indicate that project-based learning serves as a strategic alternative to overcome the limitations of traditional instruction.

These results can be more deeply understood through the constructivist theoretical framework, which conceptualizes learning as an active, dynamic, and continuous process of knowledge construction. From a constructivist perspective, knowledge is not viewed as information transmitted unidirectionally from teacher to student, but as the result of learners' internalization of direct learning experiences. The findings demonstrate that when students were engaged in project-based learning, they shifted from passive recipients of information to active learners who constructed understanding through meaningful and contextual activities. This aligns with constructivist principles emphasizing authentic experience as the foundation of deep learning.

Project-based learning implementation provided opportunities for students to confront real-world problems relevant to their lives. During this process, students were encouraged to observe, question, hypothesize, and seek and process information to generate solutions or products. These activities created learning conditions that facilitated assimilation and accommodation processes as described by Piaget. The findings indicate that contextually designed projects challenged students' prior understanding, thereby triggering more complex and meaningful cognitive restructuring.

In terms of higher-order thinking skills, the processes of assimilation and accommodation occurring during project-based learning contributed to the development of analytical, evaluative, and creative abilities. Students were required not only to understand concepts but also to analyze problems, evaluate alternative solutions, and create new ideas or products. The findings show that students involved in project-based learning demonstrated greater cognitive flexibility than those in conventional instruction, as reflected in their ability to integrate concepts across subjects, adapt strategies when facing difficulties, and critically reflect on learning processes and outcomes.

Beyond individual cognitive development, project-based learning also highlighted the social dimension of knowledge construction. The results indicate that intensive social interaction within group work played a crucial role in strengthening higher-order thinking skills. Through discussion, idea sharing, argumentation, and negotiation, students engaged in collaborative meaning-making processes. This is consistent with Vygotsky's view that learning is socially mediated through interaction and language as a tool for thinking.

The zone of proximal development, as proposed by Vygotsky, refers to the gap between learners' actual developmental level and their potential development with assistance. In project-based learning, students' zones of proximal development were activated through collaboration and structured guidance. The findings indicate that students who initially struggled with analysis or solution formulation achieved improved understanding after peer discussion or teacher guidance, demonstrating that project-based learning creates environments conducive to internalizing higher-order thinking skills through social interaction.

The teacher's role in project-based learning also emerged as a key factor in explaining the findings. Teachers functioned not as primary sources of information but as facilitators who designed learning experiences, provided initial guidance, and monitored student progress. From a social constructivist perspective, this facilitative role is essential in providing appropriate scaffolding. Scaffolding took the form of guiding questions, initial examples, and feedback that supported students' cognitive development. As students' competence and independence increased, scaffolding was gradually withdrawn, fostering greater learner autonomy.

The findings indicate that such scaffolding strategies contributed to increased student independence and confidence in thinking. Students became more willing to express opinions, ask critical questions, and make reasoned decisions, reflecting a shift from teacher dependence toward autonomous learning. This independence is a critical prerequisite for the sustainable development of higher-order thinking skills.

Project-based learning also provided opportunities for reflection on learning processes and outcomes. Reflection is a key constructivist element that enables learners to become aware of their thinking processes, identify strengths and weaknesses, and plan future improvements. The findings show that reflective activities embedded in project-based learning enhanced students' metacognitive abilities, which are essential components of higher-order thinking.

Moreover, the authentic contexts provided through project-based learning increased the meaningfulness of learning experiences. Projects linked to real-life situations enabled students to recognize the relevance of classroom learning to everyday life. When students perceived this relevance, their learning motivation increased, leading to deeper cognitive engagement and stronger knowledge construction.

Overall, the improvement in higher-order thinking skills observed in this study resulted from the synergy between individual and social knowledge construction processes. Individual processes occurred through assimilation, accommodation, and reflection, while social processes emerged through collaboration, scaffolding, and dialogue. Project-based learning provided a pedagogical framework that harmoniously integrated these processes, creating a learning environment conducive to higher-order thinking development.

The findings further demonstrate that project-based learning plays a strategic role in bridging the gap between modern curriculum demands and classroom practices in elementary schools. While curricula emphasize twenty-first-century skills, instructional practices often remain focused on lower-order cognitive targets. The study confirms that project-based learning offers a systematic and contextual approach for translating curriculum goals into concrete classroom practices.

Finally, the findings directly address the research questions regarding differences in higher-order thinking skills between students exposed to project-based learning and those experiencing conventional instruction. Statistical analyses revealed significant differences favoring the experimental group. Within Bloom's taxonomy and its revision by Anderson and Krathwohl, these results indicate that project-based learning effectively promotes cognitive processes at the levels of analysis, evaluation, and creation.

In conclusion, the results of this study demonstrate that project-based learning is an effective and relevant pedagogical strategy for strengthening higher-order thinking skills among elementary school students. The findings support the research objectives, address the research questions, and provide significant theoretical, academic, and practical contributions. Therefore, project-based learning may serve as a strong foundation for broader implementation in elementary education, aligned with modern curriculum demands and the development of twenty-first-century skills.

The discussion of this study focuses on interpreting the research findings regarding the effectiveness of project-based learning in strengthening higher-order thinking skills among elementary school students by critically relating them to the main research problem, the identified research gap, the research questions, the research objectives, as well as the theoretical, practical, and academic contributions. The discussion is developed by referring to and paraphrasing relevant findings from previous studies, thereby clearly positioning this study within the broader landscape of elementary education research.

The primary problem underlying this study is the low level of higher-order thinking skills among elementary school students, which is largely attributed to the dominance of traditional, teacher-centered instructional practices that emphasize memorization. The findings indicate that students who participated in project-based learning demonstrated significantly greater improvements in higher-order thinking skills than those who experienced conventional instruction. This result is consistent with previous studies reporting that active and contextual learning approaches enhance the quality of students' cognitive processes. Earlier research has shown that traditional instruction tends to limit students' opportunities for deep analysis and critical reflection, which in turn contributes to low levels of higher-order thinking. Therefore, the findings of this study strengthen the argument that the core issue in elementary classroom learning lies not in students' capabilities, but rather in the pedagogical approaches employed.

In relation to the research gap, this study addresses a void left by previous research. While numerous studies have demonstrated the effectiveness of project-based learning at secondary and higher education levels, empirical investigations focusing specifically on its implementation in elementary schools particularly within thematic learning contexts remain limited. The findings demonstrate that project-based learning is not only feasible at the elementary level but also effective in developing higher-order thinking skills when appropriately designed to align with students' developmental characteristics. This finding complements previous studies emphasizing the importance of adapting project design to learners' contexts and developmental stages. Consequently, this study contributes to bridging the gap between existing empirical evidence and practical needs in elementary education.

The discussion also directly addresses the research question concerning differences in higher-order thinking skills between students who participated in project-based learning and those who engaged in conventional instruction. The results reveal a statistically significant difference between the two groups, with the experimental group showing more consistent and meaningful improvement. This finding supports previous research suggesting that project-based learning provides more complex cognitive stimulation than lecture-based methods or routine exercises. Prior studies have reported that student engagement in authentic projects encourages knowledge integration, idea testing, and reflective thinking, all of which are essential components of higher-order thinking. Thus, the discussion confirms that the research question has been empirically answered in a manner consistent with prior findings.

The research objective of analyzing the effectiveness of project-based learning in strengthening higher-order thinking skills among elementary school students was also achieved. The discussion reveals that improvements in higher-order thinking skills were evident not only in test scores but also in observable changes in students' learning behaviors. Students became more active in discussions, more confident in expressing their opinions, and more capable of connecting concepts to real-world contexts. These findings align with prior studies emphasizing that project-based learning influences not only cognitive outcomes but also students' affective and social skills. Accordingly, the research objectives were achieved both quantitatively and qualitatively in terms of students' learning experiences.

From a theoretical perspective, the findings reinforce constructivist views that knowledge is constructed through active and meaningful learning experiences. The results are consistent with previous research indicating that project-based learning represents a concrete operationalization of

constructivist principles in instructional practice. By providing opportunities for exploration, discussion, and creation, project-based learning facilitates deep knowledge construction. Thus, this study contributes theoretically by expanding understanding of how constructivist theory can be effectively implemented in elementary education to foster higher-order thinking skills.

The practical implications of this study can also be discussed in light of prior research. Many previous studies have emphasized the need for instructional models that are practical and easily integrated into the curriculum. The findings demonstrate that project-based learning can be integrated into thematic instruction without disrupting the achievement of basic competencies. This aligns with earlier research suggesting that project-based learning can enhance cross-subject integration and instructional efficiency. Practically, therefore, this study offers a realistic alternative for elementary school teachers seeking to improve instructional quality and strengthen students' higher-order thinking skills.

In terms of academic contribution, the discussion highlights the study's significance for the development of elementary education literature. Previous research has often pointed to the limited availability of empirical evidence regarding the effectiveness of innovative instructional approaches at the elementary level. This study enriches the empirical literature by providing evidence supporting the implementation of project-based learning in elementary schools. Moreover, it demonstrates the applicability of a quasi-experimental design in elementary education research, offering a methodological reference that can be replicated by future researchers. Thus, the academic contribution of this study lies in strengthening both the empirical and methodological foundations of educational research.

The discussion also underscores the relationship between the findings and previous research in the context of educational policy development. Prior studies have emphasized that instructional innovation requires systemic support, including teacher training and school-level policies. The findings of this study indicate that the success of project-based learning depends not only on instructional design but also on teacher readiness and institutional support. This result is consistent with previous research suggesting that innovative instructional practices are more effective when supported by a conducive school environment. Accordingly, the discussion extends the implications of the findings beyond classroom practice to the realm of educational policy.

Overall, the discussion demonstrates that the findings of this study are not isolated but are closely connected to previous research. Project-based learning is shown to be effective in addressing the primary problem of low higher-order thinking skills among elementary school students, filling the identified research gap, and comprehensively answering the research questions and objectives. The resulting theoretical, practical, and academic contributions align with prior findings while also offering new insights by strengthening empirical evidence within the context of thematic learning in elementary education. Therefore, this discussion confirms the relevance and significance of the study for advancing both theory and practice in elementary education oriented toward the development of higher-order thinking skills.

CONCLUSION

The conclusion of this study affirms that project-based learning is an effective pedagogical approach for strengthening higher-order thinking skills among elementary school students. Based on the research findings and discussion, it can be concluded that the implementation of project-based learning successfully addresses the main problem commonly encountered in elementary classroom practice, namely the dominance of traditional instructional methods that provide limited opportunities for the development of analytical, evaluative, and creative skills. The findings demonstrate a significant improvement in higher-order thinking skills among students who participated in project-based learning compared to those who experienced conventional instruction, thereby reinforcing the argument that

student-centered and experience-based learning strategies are more aligned with the demands of modern curricula.

This conclusion is grounded in the integration of quantitative results and qualitative interpretations presented in the study. The measurement of higher-order thinking skills indicates that students in the experimental group showed more consistent development in the domains of analysis, evaluation, and creation. The discussion reveals that these improvements are closely related to the core characteristics of project-based learning, which emphasize active student engagement, collaboration, and contextual problem-solving. Thus, project-based learning not only enhances test performance but also improves the quality of learning processes, making them more meaningful and reflective.

The findings also reinforce the relevance of the theoretical foundations underpinning the study, particularly constructivist theory, project-based learning theory, and higher-order thinking theory. The results and discussion indicate that constructivist principles of active and social knowledge construction can be effectively operationalized through project-based learning. Project activities enable students to develop understanding through direct experience and peer interaction, as highlighted in the analysis. Moreover, the findings support the view that project-based learning provides an appropriate platform for fostering higher-order thinking skills as articulated in contemporary cognitive taxonomies.

Furthermore, the study concludes that project-based learning is capable of bridging the gap between curriculum demands emphasizing twenty-first-century skills and conventional classroom practices. The integration of projects into thematic instruction offers authentic and relevant learning contexts for elementary school students, enabling them to connect academic concepts with real-life situations. This, in turn, deepens conceptual understanding and enhances higher-order thinking skills. These findings underscore that project-based learning is not only feasible but should be considered a core instructional strategy in elementary education.

The conclusion also highlights broader implications for the development of elementary education practices. The findings indicate that the success of project-based learning is strongly influenced by teachers' readiness to design and facilitate project activities, as well as by institutional support from schools. Therefore, the sustainable implementation of project-based learning requires systematic support through continuous teacher professional development and school policies that promote instructional innovation. This conclusion aligns with the discussion emphasizing the importance of synergy between pedagogical approaches and supportive learning environments.

Overall, this study concludes that project-based learning is an effective, relevant, and contextual pedagogical strategy for strengthening higher-order thinking skills among elementary school students. The strong coherence between the research findings and discussion demonstrates the empirical validity and practical significance of the study. Consequently, project-based learning is recommended as an instructional approach capable of enhancing the quality of thematic learning and preparing elementary school students to meet future educational and life challenges.

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