

The Effectiveness of Project-Based Learning on 21st-Century Skills in Elementary Schools: A Literature Review

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Submitted: 9/10/2026

Revised: 25/10/2025

Accepted: 28/11/2025

Published: 30/12/2025

Abstract

21st-century skills (4C: Critical thinking, Creativity, Collaboration, Communication) are crucial competencies that must be instilled from an early age, especially at the elementary school level to support the implementation of the Merdeka Curriculum. One of the recommended innovative learning models to equip these skills is Project-Based Learning (PjBL). This study aims to analyze and synthesize the effectiveness of the PjBL model in Natural and Social Sciences (IPAS) and integrative learning clusters in improving the 21st-century skills of elementary school students. The method used is a literature review with a descriptive-analytical qualitative approach. Data collection was conducted through online searches on the Google Scholar database for scientific articles published between 2021 and 2026. Based on strict inclusion and exclusion criteria, 9 main articles were obtained and analyzed using content analysis techniques. The results of the literature review indicate that the PjBL model consistently has a high level of effectiveness (ranging from 45.5% to 50% highly effective) in boosting students' critical thinking skills and creativity, particularly when integrated with the STEAM approach and local wisdom values. Furthermore, the group-based syntax of PjBL significantly builds collaboration skills (mutual cooperation) and communication courage through the presentation phase of solutif products. The main challenges identified include time management limitations and teachers' low understanding of complete project syntax. This study recommends the importance of optimizing teachers' pedagogical competence in designing efficient and contextual projects.

Keywords

Project-Based Learning (PjBL), IPAS, 21st-Century Skills, Elementary School.



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INTRODUCTION

21st-century education demands a transformation of the learning paradigm from a teacher-centered approach to a student-centered one. Elementary school students are no longer expected to simply memorize facts; instead, they must be equipped with 21st-century skills—specifically critical thinking, creativity, collaboration, and communication (collectively known as the 4Cs). These skills are crucial for building a foundation for problem-solving from an early age, especially for students in the upper elementary grades. Basic education is an important foundation in the formation of character, basic knowledge, and learning skills of students (Rahayu et al., 2025, p. 32). The selection of upper elementary school (Grades 4, 5, and 6) as the focus of this study is based on children's cognitive development, specifically the "concrete operational" stage according to Piaget's theory. At this stage, students need a bridge—such as real objects or physical projects—to understand abstract concepts contained in the Natural and Social Sciences (IPAS) curriculum. The implementation of Project-Based Learning (PjBL) within the Independent Curriculum (Kurikulum Merdeka) framework offers structural flexibility through dedicated project hours designed to foster the "Pancasila Student Profile," which aligns with 21st-century skill indicators. Within the context of the Independent Curriculum, Integrated Natural and Social Sciences (IPAS) requires a contextual understanding of natural and social phenomena in the surrounding environment. However, challenges in the field indicate that IPAS teaching is often limited to delivering theoretical concepts without real-world experiences relevant to everyday life (Mazidah & Sartika, 2023). In fact, elementary school students generally understand better through concrete experiences (Nurjanah & Eling Purwantoyo, 2023). As a result, students' potential to develop critical thinking skills and collaborative abilities to solve real-world problems is hampered. Several reports indicate that science learning outcomes in many elementary schools remain below the desired level. One reason for this is the lack of innovative learning methods and low student engagement in the learning process (Rahmawati et al., 2023).

To address this gap, Project-Based Learning (PjBL) is considered one of the most effective learning models. Through PjBL, students not only learn science theory; they are actively engaged in designing, investigating, and completing meaningful, real-world projects (spanning both scientific and social domains). This approach simultaneously fosters the strengthening of science concepts, the development of collaborative attitudes, and the instilling of a sense of responsibility and environmental awareness from an early age (Bayat et al., 2023; Nurul Afni & Kurniana Bektiningsih,

2024). The characteristics of PjBL—based on a structured sequence of steps from formulating a central question to evaluating experiences—inherently encourage students to collaborate, think critically, and engage in creative work. Although numerous studies on the implementation of PjBL in Science and Social Studies (IPAS) subjects in elementary schools have been conducted in various regions, there is currently no comprehensive synthesis mapping the cumulative effectiveness of this model in developing 21st-century skills. Therefore, a literature review is needed to integrate findings from previous studies, identify trends related to its effectiveness, and examine challenges associated with its implementation at the elementary school level.

Based on this background, this literature review focuses on analyzing the effectiveness of the Project Based Learning (PjBL) model in the Natural and Social Sciences (IPAS) subject in improving 21st century skills (especially 4C) among elementary school students, especially in the last five years of scientific publications.

METHODS

This study uses a literature synthesis design that utilizes a qualitative descriptive-analytical approach. This method was chosen to integrate findings from empirical research (case studies/experiments) and previous systematic reviews relevant to the topic of the effectiveness of the Project-Based Learning (PjBL) model in improving 21st-century skills. This analysis specifically focuses on the implementation of the PjBL model in Natural and Social Sciences (IPAS) subjects—as well as the integrated science and social studies curriculum—at the Elementary School (SD) or Madrasah Ibtidaiyah (MI) level. Through this approach, secondary data from various experimental studies, classroom action research (CAR), and previous systematic reviews are synthesized narratively to provide comprehensive and objective conclusions.

Literature Search Strategy

The literature collection process was conducted online to identify high-quality scientific articles published in indexed national and international journals. Google Scholar was used as the primary search database. Document searches were conducted using keyword combinations based on Boolean operators (AND/OR), as follows:

- "Project Based Learning" OR "PjBL" OR "STEAM-PjBL"
- "IPAS" OR "Science/IPA" OR "IPS"
- "21st Century Skills" OR "Critical Thinking" OR "Creativity (4C Skills)"
- "Elementary School" OR "Islamic Elementary School"

The timeframe for articles is limited to publications from the last five years (2021–2026). This restriction aims to ensure the freshness of the scientific information and its relevance to the current implementation trends of the Independent Curriculum (Kurikulum Merdeka), which emphasizes literacy, numeracy, and character building in Indonesia.

Inclusion and Exclusion Criteria

To ensure the quality, validity, and relevance of the reviewed literature, the researchers established screening parameters through strict inclusion and exclusion criteria. During an initial search using specific keywords in the Google Scholar database, a total of 18 relevant documents were identified. Subsequent in-depth analysis of the manuscripts' originality revealed structural duplication in two documents (manuscripts by Agustina et. al., 2025). To maintain the validity of the secondary data and avoid data repetition bias in the synthesis matrix, one of these duplicate documents was excluded. Consequently, the final sample that met all eligibility criteria and underwent comprehensive analysis in this study consisted of 9 unique scientific articles.

The inclusion criteria for this study are as follows:

1. Articles sourced from peer-reviewed scientific journals in the fields of elementary education, teacher education, or learning evaluation.
2. The original research subjects were students at the elementary school level (SD or MI), especially in the upper grades (Grades IV, V, and VI).
3. The main focus of this discussion is the effectiveness of the Project Based Learning (PjBL) model—or its variations (such as the STEAM approach)—in subjects in the Natural and Social Sciences (IPAS) group, as well as supporting quantitative subjects such as Mathematics, which collectively foster students' scientific and logical thinking skills in elementary school.
4. This article explicitly measures the dependent variable in terms of 21st century skills indicators (focusing on aspects such as Critical Thinking, Creative Thinking, Collaboration, or Communication).

Exclusion criteria for this study include:

1. Journal articles that discuss the PjBL model but are applied outside the basic education level (such as in junior high school, senior high school, vocational high school, or college).
2. Scientific articles that do not contain empirical evaluation data or clear synthesis results regarding student skill improvement.

3. Documents other than formal journal articles, such as textbooks, unindexed conference proceedings, unpublished theses or dissertations, or popular opinion in the mass media.

Study Selection Stages

The literature screening process was conducted in stages using an elimination method to ensure that the articles analyzed were truly relevant. An initial search of the Google Scholar database yielded numerous potential articles. The researchers then screened them based on titles and abstracts to eliminate articles that did not meet the subject and variable criteria. In the final stage, a full-text eligibility review was conducted on the remaining articles, resulting in 18 primary journal articles that met 100% of the eligibility requirements for in-depth analysis in the findings and discussion sections.

Data Analysis Techniques

Data extracted from 18 selected journal articles were analyzed using qualitative content analysis methods. The data analysis steps are outlined as follows:

1. Data Reduction: Identify, record, and sort key data from each article, including author name, year of publication, journal title, type of project created, and its impact on students' 4C skills.
2. Categorization and Synthesis Matrix: Entering the reduced data into a literature summary matrix table. This step facilitates mapping the similarities, differences, and research trends found in previous expert work.
3. Narrative Interpretation: Descriptively explaining the findings obtained from the matrix table. At this stage, the researcher connects the PjBL syntax with the cognitive and psychomotor development of elementary school students in solving real-world problems.
4. Drawing Conclusions: Formulating final conclusions that answer the research questions regarding the effectiveness of the PjBL model in improving 21st century skills in elementary schools.

FINDINGS AND DISCUSSION

Results (Findings) of Literature Synthesis

Based on the selection and screening steps applied to the literature obtained from the Google Scholar database, nine unique journal articles were identified that fully met the inclusion criteria. Overall, these articles demonstrate that the implementation of the Project-Based Learning (PjBL) model—and its variations (such as the integration of STEAM approaches and local wisdom-based

methods)—has a significant impact on improving students' 21st-century skills at the elementary school level (SD or MI). To facilitate data mapping, the characteristics of each article reviewed have been synthesized into a literature matrix presented in Table 3.1 below:

Table 3. Synthesis Matrix of Articles on the Effectiveness of PjBL in Elementary Schools

No.	Author & Year	Journal Name	Study Focus & Project Format	Measurable 21st Century Skills	Main Results / Empirical Findings
1.	Alwanda (2025)	Journal of Advances in Education (AEJ)	PjBL model in science subjects (Independent Curriculum).	Creative Thinking	The PjBL model has been proven to be effective at 45.5% to very effective at 50% in developing creativity, courage to express opinions, and the ability to design effective solutions.
2.	Thursina, et al., (2025)	Collaborative Journal of Science	Meta-analysis/Systematic Literature Review (SLR) on the implementation of PjBL in elementary schools.	Critical thinking	The implementation of PjBL in elementary schools consistently outperforms conventional learning models in stimulating critical reasoning and problem solving.
3.	Agustina, et al., (2025)	Tahsinia Journal	Case study on the implementation of PjBL in Natural and Social Sciences (IPAS) for upper grade level.	Critical Thinking & Active Participation	The PjBL model can stimulate learning activities and critical thinking through concrete projects. However, challenges related to teacher competency and facilities have been identified.
4.	Cahyani, et al., (2025)	Journal of Educational Management	The effectiveness of the PjBL model for Madrasah Ibtidaiyah (MI) students.	4C Skills (Critical, Creative, Communication, Collaboration)	The PjBL model is very effective in fostering students' teamwork (soft skills) by discussing real-life issues contextually.
5.	Nugraha, et al., (2023)	Journal of Social Studies Research and Education (JPPI)	Small group project-based assignment strategies in elementary schools.	Mathematical Creativity and Independence	Group work within the PjBL framework triggers the emergence of various creative ideas and effectively builds students' self-confidence.
6.	Fauzi &	Islamic	Integration of the	Critical	The integration of local

	Setiawati (2024)	Elementary School	PjBL model with local wisdom values in the Social Sciences subject group.	Thinking, Creativity, & Mutual Cooperation	cultural context into the project successfully fostered a spirit of collaboration (<i>mutual cooperation</i>) and awareness of cultural identity among students.
7.	Hidayatullah, et al., (2025)	Indonesian Journal of Educational Literacy (JLPI)	Adaptive PjBL model design for 21st century competencies.	4C Skills (Comprehensive Overview)	The syntactic structure of PjBL provides opportunities for students to present their products (communication) and engage in discussions (collaboration).
8.	Rohman, et al., (2022)	Ibtida': Communication Media for PGMI Research Results	The effectiveness of STEAM-based learning in the 21st century.	21st Century Skills and Technology Literacy	The STEAM approach integrated into projects (STEAM-PjBL) helps students adapt to the challenges of digital technology and science.
9.	Nurhasnah, et al., (2023)	Science Education Journal (SEJ)	An analytical study on the implementation of STEAM-PjBL in science education.	Critical Thinking & Solution-Oriented Product Design	Integrating engineering and science aspects into projects encourages students to design physical products that address real-world environmental problems.
10.	Puspita, et al., (2022)	TUNAS: Journal of Elementary School Teacher Education [source: 2]	PjBL model in science subjects for grade III elementary school by utilizing recycling projects (<i>recycle</i>) simple trash as a medium and learning resource [source: 2].	Creative Thinking Skills [source: 2]	The implementation of PjBL waste recycling has been proven to be effective in improving students' creative thinking skills (expressing new ideas, flexibility of thinking), managerial skills (time/stress management), and group cooperation [source: 2].
11.	Wicaksono, et al., (2025)	Citra Bakti Scientific Journal of Education [source: 3]	Genially's integration of interactive digital media with the PjBL model in the Science subject for Grade IV Elementary	Student Involvement (Activity, Responsibility, Cooperation) [source: 3]	Genially's integration in PjBL successfully increased student activity by 31.25%, responsibility by 21.25%, and group cooperation by 26.25% [source: 3].

			School (topic of natural resource conservation and climate change mitigation) [source: 3].		
12.	Rokhmah, al., (2026)	et Scientific Journal of Elementary Education (JIPDAS)	Implementation of project-based learning (PjBL) models through practical experiments (such as experiments on candles absorbing water) in elementary school science subjects [source: 4].	Creative Thinking Skills and Scientific Attitude [source: 4]	PjBL effectively increases students' creativity and learning activity consistently, encourages student participation to reach 80%, and directly strengthens the understanding of scientific concepts (capillarity) [source: 4].
13.	Zahra & Masyithoh (2024)	& ELSCHO: Journal of Elementary School Teacher Education	Analysis of student-centered PjBL implementation strategies (<i>student-centered</i>) at the elementary school level in the context of the Independent Curriculum [source: 5].	Creativity, Collaboration, and Problem Solving [source: 5]	PjBL requires students to actively construct knowledge independently through research, group discussions, and idea testing. The use of supporting technology can minimize the obstacles faced by students with low learning interest [source: 5].
14	Ilham, Adri, & Laeli (2025)	Global Didactics: Journal of Educational Sciences	Quantitative studies (<i>pre-experimental, one group pretest-posttest</i>) regarding the influence of PjBL on the subject of science (human respiratory system material) in grade V of elementary school.	Cognitive (Learning Outcomes), Active Learning, & Collaboration	The implementation of PjBL significantly improved students' cognitive learning outcomes (the average score rose from 60.63 to 84.06) with a very strong influence (<i>effect size</i> of 0.798). Learning becomes more active, meaningful, and relevant.
15	Halimah Supriatna (2025)	& Pendas: Scientific Journal of Elementary	Literature review of various empirical articles (2022–2024)	Critical Thinking, Creativity, Collaboration	The STEM approach significantly improves cognitive learning outcomes (conceptual

		Education	regarding the influence of the STEM approach on science learning in elementary schools.	(Teamwork), and Motivation/Enthusiasm for Learning	understanding) by up to 30% compared to conventional methods. Through project-based activities (<i>project-based learning</i>), STEM is also effective in honing students' critical reasoning, creativity, and collaboration skills to solve real-world problems (such as waste management). However, challenges include limited laboratory facilities and limited teacher training.
16	Rohman, Musa, Falkhah, & Annur (2022)	IBTIDA': Communicati on Media for Research Results on Elementary Madrasah Teacher Education	<i>Library study</i> (literature review) regarding the effectiveness of STEAM-based learning methods in improving the skills of MI/SD students in the 21st century.	21st Century Skills (4C Characteristics: <i>Critical Thinking, Collaboration, Communication, Creativity</i>), Problem Solving, Independence, and Technological Literacy	Integration of arts content (<i>Art</i>) into STEM gave birth to the STEAM method which has been proven to be effective in fostering aesthetic values, artistic creativity, as well as students' cognitive, affective, and psychomotor capacities as a whole. When STEAM is synergized with the PjBL syntax (<i>student-centered</i>), this model can improve collaboration skills, environmental awareness, independent learning, and the ability to design prototype solutions to real-world problems. The main challenge is that implementing this method requires well-coordinated school management to ensure its uniform implementation across all school levels.
17	Patras, Yolanita, Wildan, &	Kalam Cendekia: Scientific	Literature study using the <i>Systematic</i>	Critical Thinking (Critical	STEM-based learning in elementary schools significantly

	Fajrudin (2024)	Journal of Education	<i>Literature Review</i> (SLR) to evaluate the effectiveness of STEM-based learning in improving the critical thinking skills of elementary school students.	Thinking as the mother of competence), Collaboration, Communication, Creativity (4C), and Problem Solving.	outperforms conventional learning in students' critical thinking skills. STEM trains students to think independently through solving concrete, everyday problems. Integrating STEM with innovative models like Problem-Based Learning (PBL) and Project-Based Learning (PjBL) has proven highly effective as a solution for improving 21st-century life skills.
18	Hendranti, Aldenina, Indriani, & Iskandar (2025)	Pendas: Scientific Journal of Elementary Education	Literature study (Systematic Literature Review) on the effectiveness of integrating the Project-Based Learning (PjBL) model with the STEM approach in science learning in elementary schools.	Understanding Science Concepts (<i>Concept Mastery</i>), Critical Thinking, Creativity, Problem Solving, Activeness, Collaboration, and Learning Motivation.	The combination of PjBL-STEM has been proven to be effective in significantly improving understanding of science concepts compared to traditional learning because it is based on constructivist theory. This model facilitates students' learning through real-world contexts and engineering processes (<i>engineering design</i>), which not only reduces science misconceptions but also increases students' learning activity to the very active category.

The table above presents a comprehensive mapping of 18 empirical and literature studies (2022–2026) that examine the effectiveness of the model. *Project-Based Learning*(PjBL), both implemented independently and integrated with the STEM/STEAM approach in elementary schools (SD/MI). Based on this data, several key findings can be formulated as follows:

1. **21st Century Skills (4C) Enhancement:**The majority of studies show that PjBL syntax consistently stimulates critical thinking skills (*critical thinking*), creativity (*creativity*), communication (*communication*), and collaboration (*collaboration*). The integration of local wisdom contexts and simple recycling projects has proven effective in triggering new ideas and flexibility in students' contextual thinking.
2. **Strengthening Concept Understanding and Learning Outcomes:**The application of PjBL,

especially when combined with a STEM/STEAM approach, can boost mastery of cognitive concepts (such as in science/social science subjects) by up to 30% compared to conventional methods. Activities based on practical experiments and manipulation of real objects have been shown to significantly reduce science misconceptions.

3. **Optimizing Student Engagement and Independence:** Student-centered learning approach (*student-centered*) forces students to actively explore real problems. When PjBL is synergized with interactive digital media such as *Genially*, student activity was boosted by 31.25% and group responsibility increased by 21.25%.
4. **Synergy of Arts and Technology (STEAM):** Integration of artistic elements (*Art*) into STEM has been shown to enrich students' sensory and aesthetic capacities. The STEAM-PjBL model equips not only cognitive abilities but also affective and psychomotor readiness to adapt in the digital era.
5. **Identify Implementation Challenges:** Despite having a very strong positive impact, several studies identified real challenges in the field, such as limited laboratory/school facilities, readiness of school management coordination, and the need to improve teacher competency training in designing adaptive projects.

Discussion

Philosophical Foundation and Syntactic Dynamics of PjBL related to 4C Components

To understand how Project-Based Learning (PjBL) cumulatively contributes to 21st-century competencies, it is important to analyze the sociocultural relationships and developmental psychology that underlie it. Philosophically, PjBL is rooted in constructivist theory—pioneered by Jean Piaget and Lev Vygotsky—which posits that knowledge is not passively transferred from teacher to student, but is actively constructed through empirical experience and social interactions. In the context of primary education, this principle gained momentum through Kurikulum Merdeka (Independent Curriculum), which provides students with greater scope to explore and learn from their real-world environments. The 21st-century skills encapsulated in the 4Cs framework—critical thinking, creativity, collaboration, and communication—do not develop in isolation within a conventional classroom; rather, they emerge as part of an integrated learning ecosystem facilitated by the systematic stages of the Project-Based Learning (PjBL) syntax. Each phase of this model engages different cognitive and affective functions; collectively, these interactions shape the profile of a learner capable of adapting to the challenges of the modern era. The initial phase of PjBL—defining the essential question—serves as a key catalyst for critical thinking. Rather than providing immediate answers or presenting material to be memorized, teachers introduce real-world anomalies or problems from students' immediate environment (such as the accumulation of plastic

waste or the scarcity of clean water). These provoking questions force students' cognitive structures to conduct initial analysis, identify root causes, and formulate hypotheses. This process stimulates intellectual curiosity, which fosters higher-level logical reasoning.

Next, the project plan and schedule development phase simultaneously activates collaboration and creativity. During this phase, students must work in small groups to devise concrete steps to complete the project, select necessary tools and materials, and distribute roles equitably. This activity fosters social-emotional maturity in upper elementary students, encouraging them to set aside personal egos, listen to peers, respect differing perspectives, and make decisions together to achieve a common goal. The freedom to explore ideas while designing a functional product during this phase truly fosters the originality of students' creative thinking. The phase involving project monitoring and outcome assessment serves as a testing ground where students test the reliability of their solutions. If a physical failure occurs during the project—such as with a science demonstration kit or a social studies model—students are required to reflect, evaluate their mistakes, and redesign their solution. This trial-and-error process is crucial for developing mental resilience and contextual problem-solving skills, which are crucial in the modern era.

Finally, the experiential evaluation phase serves as a prime opportunity for students to fully demonstrate their communication skills. Students are not only required to create a product but also to logically explain the scientific rationale behind it to the class. Through presentations, question-and-answer sessions, and feedback between groups, students practice organizing their language systematically, speaking confidently, answering critical questions spontaneously, and accepting criticism objectively. Thus, the PjBL framework comprehensively integrates the cognitive, affective, and psychomotor domains into a cohesive and meaningful learning cycle. This aligns with research showing that PjBL implementation is effective in increasing students' motivation, involvement, and creative thinking skills in science learning (Setiawan & Wulandari, 2025; Yuliani & Lestari, 2021).

The Effectiveness of PjBL in Improving Critical Thinking and Problem Solving

Based on a literature review, the PjBL model has been empirically proven to be highly effective in stimulating critical thinking skills among elementary school students, particularly in the Natural and Social Sciences (IPAS) subject—an integrated science-social studies curriculum. A meta-analysis by Thursina et al. (2025) confirmed that this improvement occurs because PjBL positions students not as passive recipients of information, but as active problem investigators. This is supported by the findings of Agustina et al. (2025) in the context of science lessons, where upper-

grade students are encouraged to analyze natural or social phenomena directly through concrete projects. This approach aligns with the characteristics of upper-grade elementary school students, who are in the concrete operational stage of development (according to Piaget's theory). Through tangible, physical projects in IPAS, abstract scientific concepts can be visualized, thereby stimulating students' logical and critical reasoning without burdening their cognitive capacities. This critical thinking process emerges organically from the beginning of PjBL implementation—particularly during the phase of defining fundamental questions and designing project steps. Students are required to identify problems, gather information from various sources, and evaluate arguments before deciding what type of product to create. This mental activity fosters Higher-Order Thinking Skills (HOTS), which serve as fundamental pillars of 21st-century competencies.

The Effectiveness of PjBL in Increasing Student Creativity and Innovation

Creativity skills stand out as the area that shows the most significant improvement during the implementation of PjBL. In a systematic review, Alwanda (2025) noted that the PjBL model demonstrated an effectiveness rate of 45.5% to 50% in improving students' creative thinking skills. This creativity emerges when students are challenged to design solutions or create functional physical products (artifacts). Furthermore, variations of the PjBL model that integrate the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach—as studied by Rohman et al. (2022) and Nurhasnah et al. (2023)—demonstrate an expansion of the scope of students' creativity. Students do not only focus on scientific concepts; they also combine them with aesthetic elements (Art) and product design (Engineering). This approach encourages students to generate unique and innovative ideas to solve environmental problems—for example, through projects involving the construction of a simple water purification device or the reuse of waste materials into learning aids for Natural and Social Sciences (IPAS).

The integration of literature focused on mathematical creativity (e.g., Nugraha et al., 2023) and the STEAM approach (Rohman et al., 2022; Nurhasnah et al., 2023) into this study represents an integrative need, not an inconsistency. From an epistemological perspective, the teaching of Natural and Social Sciences (IPAS) in elementary schools cannot be separated from the foundations of mathematics and technological literacy. Scientific and social concepts in IPAS require mathematical reasoning and product engineering to ensure that student-designed projects are realized appropriately and functionally. Consequently, the effectiveness of Project-Based Learning (PjBL) in IPAS is maximized when supported by such cross-disciplinary integration. This is in line with the

view of Nugraha et al., (2023), who stated that project-based assignments offer the freedom to explore, thereby fostering the confidence needed for students to innovate.

A critical comparison reveals a strong common thread among the findings of Alwanda (2025), Rohman et al. (2022), and Nurhasnah et al. (2023) regarding the stimulation of creativity. Alwanda (2025) quantitatively showed that PjBL achieved an effectiveness rate of 50%, which is classified as “very effective.” This significant percentage is theoretically explained by the study of Nurhasnah et al. (2023), which noted that integrating physics engineering elements into science projects encourages students to engage motor and cognitive skills simultaneously. According to Nugraha et al. (2023), this freedom to determine product design is what triggers a variety of unique ideas in small groups, enabling indicators of creativity—particularly originality and flexibility of thinking—to be optimally achieved at the elementary level.

The Role of PjBL in Encouraging Collaboration and Communication

Beyond cognitive abilities (critical and creative thinking), the literature shows that PjBL has a significant impact on students' socio-emotional dimensions—specifically, collaboration and communication skills. Cahyani et al. (2025) highlighted that the small-group nature of PjBL encourages students to interact, distribute tasks fairly, and take responsibility for their respective portions of the work. These activities foster a spirit of mutual cooperation (*gotong royong*) and tolerance from an early age. When the PjBL model is integrated with the local context or local wisdom—as observed by Fauzi & Setiawati (2024)—its effectiveness in fostering a spirit of mutual cooperation and social awareness increases dramatically. Students learn to complete projects rooted in real-world issues in their local communities. Meanwhile, communication skills develop rapidly during the final phase of the PjBL process: the presentation of project results and evaluation of the experience (Hidayatullah et al., 2025). In a classroom setting, each group is required to present its product to the teacher and peers, answer questions, and receive critical feedback. These activities foster confidence in expressing opinions, the ability to construct logical arguments, and the capacity to appreciate the work of others. Efriyana and Marpaung (2023) added that through a project-based approach, students can learn creatively, work in groups, and communicate ideas effectively.

Analysis of Challenges and Obstacles to Implementing PjBL in Elementary Schools

Although the literature review demonstrates the high effectiveness of PjBL, an objective analysis of the reviewed articles also reveals several substantial challenges related to its practical implementation. Based on an empirical study by Agustina et al. (2025), the main obstacles frequently

encountered at the elementary school level include:

1. **Limitations of Teacher Understanding:** Many educators have not fully mastered the syntax of the PjBL model; as a result, the learning process often turns into a mere “craft-making” activity, without reinforcement of important scientific or social concepts.
2. **Time Management:** Structurally, the PjBL model requires a relatively longer time allocation (covering several sessions) compared to the conventional model, so it risks disrupting the speed of delivery of other curriculum materials if not managed carefully.
3. **Limited Facilities and Infrastructure:** Some schools—especially those in regional areas—still lack the supporting facilities, materials, tools, or technology needed for students to design a variety of projects.

Therefore, the synthesis of this literature review recommends intensive teacher training on project management in the classroom, as well as the use of affordable and easily accessible eco-friendly materials from the school environment to overcome budget and facility limitations. It can be said that the development of these methods seeks to develop intellectually gifted students which does not reflect the evolution of the education system alone (Susanti, 2023). To overcome time and competency constraints, this study proposes a collaborative Project-Based Learning (PjBL) scheme involving different subject teachers, where the main IPAS (Natural and Social Sciences) project can be integrated with Arts and Culture or Indonesian Language lessons, thus avoiding a unilateral reduction in allocated curriculum time.

CONCLUSION

Based on a literature review of relevant scientific articles, it can be concluded that the implementation of the Project-Based Learning (PjBL) model in Natural Sciences and Social Sciences (IPAS) and related social science subjects is highly effective in improving elementary school students' 21st-century skills (4C Skills). This model consistently encourages students' critical thinking and creativity through problem-solving activities and solution-oriented product design—especially when integrated with the STEAM approach and local wisdom. Furthermore, the group-based structure of PjBL effectively fosters students' collaborative skills (mutual cooperation) and confidence in communication. Despite challenges related to teacher competency and time management, the PjBL model remains a recommended innovative learning strategy and is highly relevant to the demands of the current Independent Curriculum (Kurikulum Merdeka).

REFERENCE

- Afni, N., & Bektiningsih, K. (2024). Genially interactive media: Improving learning outcomes of Indonesian cultural wealth. *Journal of Education Research and Evaluation*, 8(2), 266-275. <https://doi.org/10.23887/jere.v8i2.77004>
- Agustina, D., Kurnisa, R., Safa'atun, N., & Andrian, F. (2025). Implementation of the Project-Based Learning (PjBL) model to improve critical thinking skills in natural and social sciences in elementary school. *Tahsinia Journal*, 6(12), 1866-1880.
- Alwanda, M. A. (2025). Application of the Project-Based Learning model to improve creative thinking skills of elementary school students in natural and social sciences learning: A systematic review. *AEJ (Advances in Education Journal)*, 3(2), 115-128.
- Bayat, P. A., Nusantara, T., & Suciptaningsih, O. A. (2023). Development of gamification-based digital flipbook media on IPAS material. *International Education Trend Issues*, 1(2), 262-275.
- Cahyani, E. L., Ningsih, D. S., Khamidah, L., Latifah, U., Maulandari, S. D. M., & Suttriso. (2025). The effectiveness of the project-based learning model in improving 21st-century skills of Madrasah Ibtidaiyah students. *Journal of Educational Management*, 10(2), 658-672. <https://doi.org/10.34125/jmp.v10i2.608>
- Efriyana, T., & Marpaung, M. P. (2023). Implementation of Project-Based Learning to improve collaboration, creativity, and communication in social studies learning for fifth-grade students of SD ST. PRS North Jakarta. *Innovative: Journal of Social Science Research*, 3(3), 8968-8981. <https://j-innovative.org/index.php/Innovative/article/view/3207>
- Fauzi, W. N. A., & Setiawati, Y. (2024). Integration of Project-Based Learning (PjBL) and local wisdom in social studies learning in elementary school. *Islamic Elementary School*, 4(2), 1-15.
- Hallimah, S., & Supriatna, E. (2025). The effect of the STEM approach on the natural and social sciences learning outcomes of elementary school students. *Pendas: Scientific Journal of Elementary Education*, 10(1), 727-731.
- Hendranti, A. H., Aldenina, B., Indriani, T. L., & Iskandar, S. (2025). The effectiveness of STEM learning models and project-based learning in improving science understanding in elementary school. *Pendas: Scientific Journal of Elementary Education*, 10(2), 209-219.
- Hidayatullah, M. I., Udayani, N. W. A., & Hamdiana. (2025). A Project-Based Learning model design for Social Studies to develop 21st-century skills in primary school students. *JLPI (Journal of Indonesian Educational Literacy)*, 1(1), 45-59.
- Ilham, A. M., Adri, H. T., & Laeli, S. (2025). The influence of the project-based learning model on student learning outcomes in natural and social sciences learning in elementary school. *Global Didactics: Journal of Educational Sciences*, 2(3), 224-231. <https://didaktikglobal.web.id/index.php/adri>
- Mazidah, N. R., & Sartika, S. B. (2023). The influence of the Contextual Teaching and Learning (CTL) approach on cognitive learning outcomes in science subjects of fifth-grade at SDN Grabagan. *Papeda Journal: Journal of Elementary Education Publication*, 5(1), 9-16.
- Nugraha, I. R. R., Supriadi, U., & Firmansyah, M. I. (2023). The effectiveness of the Project-Based Learning strategy in improving student creativity. *Journal of Social Studies Research and Education (JPPI)*, 17(1), 39-47.
- Nurhasnah, Festiyed, & Yerimadesi. (2023). Review analysis: Implementation of STEAM-Project-Based Learning in natural science learning. *Science Education Journal (SEJ)*, 7(1), 11-22. <https://doi.org/10.21070/sej.v7i1.1623>
- Patras, Y. E., Yolanita, C., Wildan, D. A., & Fajrudin, L. (2024). STEM-based learning in elementary

- school to improve critical thinking skills in preparation for 21st-century student competency achievement. *Kalam Cendekia: Scientific Journal of Education*, 12(2), 858–867.
- Puspita, A. M., Utomo, E., & Purwanto, A. (2022). Project-based learning model for third-grade science subject in improving students' creative thinking ability. *TUNAS: Journal of Elementary School Teacher Education*, 7(2), 55–65. <http://journal.umpalangkaraya.ac.id/index.php/tunas>
- Rahayu, G. D., Setiyadi, R., Fauzi, M. R., & Mulyono, D. (2025). Training on the implementation of project-based learning model for elementary school teachers to improve 21st-century skills. *Journal of Professional Service (JP-Pro)*, 1(2), 31–35. <https://journal.ikipsiliwangi.ac.id/index.php/jppro/article/view/29024/7577>
- Rahmawati, T., Sutanto, A., & Widodo, H. (2023). STEM-based learning to enhance critical thinking skills. *International Journal of Primary Education*, 12(4), 112–120.
- Rohman, A. D., Musa, M. M., Falkhah, A. N., & Annur, A. F. (2022). The effectiveness of STEAM-based learning methods on improving student skills of MI/SD in the 21st-century era. *Ibtida': Communication Media Results of Research on Elementary Madrasah Teacher Education*, 3(1), 48–58. <https://doi.org/10.37850/ibtida'.v3i1>
- Rokhmah, F. N., Anggraini, I. S., Ali, M. Y. V., Masrurroh, S., & Yanis, S. F. (2026). Project-based learning model for science subjects in improving students' creative thinking ability. *Scientific Journal of Elementary Education (JIPDAS)*, 6(2), 2519–2524. <https://doi.org/10.37081/jipdas.v6i2.4457>
- Setiawan, D., & Wulandari, I. (2025). Systematic review: Project-based learning model as an effort to strengthen creative thinking skills in science learning. *Journal of Primary Education Studies*, 13(1), 33–45.
- Susanti, R. (2023). The effect of project-based learning methods on mathematics learning achievement of elementary school students. *Journal of Elementary Education*, 6(2), 3999–4005.
- Thursina, A., Mauliddiah, D. N., Septiani, F. S., An Najmi, M., & Putri, H. E. (2025). Research analysis on the effectiveness of the Project-Based Learning model on critical thinking skills of elementary school students: A Systematic Literature Review study. *Collaborative Journal of Science*, 8(12), 8198–8213.
- Wicaksono, S. T. B., Suciptaningsih, O. A., & Mas'ula, S. (2025). The effectiveness of Genially in project-based IPAS learning to increase elementary student engagement. *Citra Bakti Scientific Journal of Education*, 12(4), 965–978. <https://doi.org/10.38048/jipcb.v12i4.5477>
- Yuliani, N., & Lestari, W. (2021). Implementation of Project-Based Learning model to improve creative thinking skills of elementary school students. *Indonesian Journal of Elementary Education*, 8(2), 101–112.
- Zahra, N., & Masyithoh, S. (2024). Project-based learning strategies in elementary school children. *ELSCHO: Journal of Elementary School Teacher Education*, 2(2), 24–30. <https://journal.uir.ac.id/index.php/elscho>