



STEAM Integration in the Pancasila Student Profile Strengthening Project: A Systematic Literature Review

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Article Info

Article history:

Received Juni 22, 2026

Revised July 25, 2026

Accepted August 24, 2026

OnlineFirst August 30, 2026

Keywords:

STEAM

Merdeka Curriculum

Pancasila Student Profile

Strengthening Project

4C skills

ABSTRACT

Purpose of the study: This study aims to examine patterns of STEAM integration in the Pancasila Student Profile Strengthening Project (P5) and to identify its benefits, challenges, and implications for project-based learning design within the Merdeka Curriculum.

Methodology: A Systematic Literature Review was conducted on relevant articles published between 2020 and 2025. Searches were performed through Google Scholar, Garuda, and Sinta using keywords related to P5, STEAM, and the Merdeka Curriculum. Based on the inclusion and exclusion criteria, 12 articles were selected, categorized, and analyzed descriptively and comparatively.

Main Findings: The review shows that contextual P5 activities support mutual cooperation, independence, creativity, communication, and responsibility, while STEAM supports creativity, critical thinking, problem solving, scientific curiosity, and 4C skills. The clearest direct evidence of integration was found in entrepreneurship and local-wisdom themes, with teacher readiness and balanced representation of STEAM elements emerging as the main challenges.

Novelty/Originality of this study: This review integrates findings from P5 and STEAM studies to map their points of convergence more systematically. Its novelty lies in identifying theme-based integration patterns, implementation success factors, and limitations in direct empirical evidence, thereby providing a basis for future STEAM-based P5 design and research.

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1. INTRODUCTION

The Merdeka Curriculum was introduced in response to the need for educational transformation in Indonesia, with greater emphasis on character development, competencies, and students' learning independence. One concrete form of this curriculum is the Pancasila Student Profile Strengthening Project (P5), a project-based co-curricular activity designed to strengthen achievement of the Pancasila Student Profile in reference to the Graduate Competency Standards [1]. P5 is implemented flexibly across subjects and is oriented toward authentic learning experiences directly encountered by students in their surrounding environment.

The Pancasila Student Profile consists of six main dimensions: faith in and devotion to God Almighty and noble character, global diversity, mutual cooperation, independence, critical reasoning, and creativity [1]. These six dimensions are expected to develop optimally through projects organized around specific themes, such as Sustainable Lifestyles, Local Wisdom, Unity in Diversity, Build the Body and Soul, Voice of Democracy, Engineering and Technology, and Entrepreneurship.

In practice, however, P5 implementation still faces various challenges. Many teachers have not fully understood the essence of P5, so the activities they design tend to focus mainly on the final product without sufficient attention to students' thinking processes and holistic competency development [2]. In addition, P5 activities are often implemented separately from academic content, limiting their contribution to critical thinking, creativity, and scientific problem-solving skills. To address these challenges, a learning approach is needed that can integrate multiple disciplines while providing enjoyable and contextual learning experiences. One relevant approach for integration into P5 is STEAM (Science, Technology, Engineering, Arts, and Mathematics). STEAM extends the STEM concept by incorporating the arts to strengthen creativity within scientific and technological thinking processes [3].

The STEAM approach is considered capable of addressing the demands of twenty-first-century skills, commonly described as the 4Cs: Critical Thinking, Collaboration, Creativity, and Communication [4]. When integrated with P5 activities, STEAM can provide a framework that helps teachers design projects that develop not only character but also students' cognitive, motor, and creative capacities in an integrated manner. The Merdeka Curriculum, which began to be implemented gradually in 2022, introduced a new paradigm in Indonesian education by emphasizing competency development, character formation, and the holistic growth of students' potential [12]. Unlike previous curricula that tended to be content-centered, the Merdeka Curriculum gives educational institutions greater flexibility to design contextual and meaningful learning according to local needs and conditions [13]. Its implementation is realized through three main pathways: differentiated classroom learning, formative assessment centered on student development, and co-curricular activities through P5 [15]. In this context, P5 serves as a strategic instrument that connects Pancasila-based values with students' everyday realities [16].

Character development through education is explicitly mandated in Indonesia's National Education System Law No. 20 of 2003, which states that national education aims to develop students' potential so that they become faithful, devoted to God, morally upright, capable, creative, independent, democratic, and responsible citizens. The six dimensions of the Pancasila Student Profile directly reflect these aspirations [17]; therefore, P5 is not merely an additional program but an integral part of the national education mission. Study [18] emphasizes that meaningful P5 implementation requires an approach that simultaneously integrates character development and academic competency strengthening rather than separating them into different learning spaces.

Project-Based Learning (PjBL) has long been recognized as an effective instructional model for fostering higher-order thinking skills and collaborative attitudes among students [14]. P5 essentially adopts PjBL principles by engaging students in investigating real-world problems, designing solutions, and producing outputs that are useful to their communities [15]. This authentic and contextual project character makes P5 a suitable vehicle for developing the twenty-first-century skills required by future generations. Ref. [14] indicates that students involved in interdisciplinary projects consistently demonstrate improvements in creativity, critical reasoning, and communication compared with students learning through conventional approaches.

Amid rapid technological development, education systems are expected to prepare students to face the challenges of Industry 4.0 and Society 5.0 [19]. Digital literacy, computational thinking, and mastery of information technology are increasingly crucial competencies for young people [20]. In this context, STEAM, which inherently integrates technology and engineering into the learning process, is highly relevant as a strategy for bridging the needs of twenty-first-century education with P5 implementation in schools [21]. The integration of simple technologies into P5 projects has been reported to increase students' enthusiasm and active engagement in learning [19].

The STEAM concept originated from the STEM (Science, Technology, Engineering, Mathematics) movement, which gained prominence in the United States in the late twentieth century in response to concerns about declining youth interest in science and technology [23]. The addition of Arts transformed STEM into STEAM by incorporating creativity, aesthetics, and humanities into science- and

technology-based learning [22]. Ref. [24] shows that the inclusion of the arts in STEAM can increase students' learning motivation by providing space for self-expression during scientific exploration. An international study [25] found that STEAM integrated with project-based learning can improve motivation, engagement, and academic achievement. At the national level, Ref. [26], through a comprehensive literature review, reported that STEAM implementation across educational levels in Indonesia has positive effects on students' creativity and problem-solving abilities.

One of the main strengths of STEAM is its ability to promote interdisciplinary learning, in which boundaries between subjects become more fluid and students are encouraged to think holistically when solving complex problems [28]. This is highly consistent with the interdisciplinary nature of P5, which is not confined to a single subject [1]. Study [29] shows that interdisciplinary project activities can improve students' conceptual understanding while fostering concern for the environment and society. Ref. [30] further emphasizes that project-module designs integrating multiple disciplines are more effective in addressing the dimensions of the Pancasila Student Profile comprehensively than learning approaches that separate subjects from one another.

Teachers' roles as learning designers and facilitators are key factors in the successful implementation of both P5 and STEAM. Teachers with a strong understanding of P5 and STEAM are better positioned to design projects that are innovative, meaningful, and beneficial to student development [31]. However, Ref. [32] reports that many teachers in Indonesia still face difficulties understanding and implementing both approaches in an integrated manner. Limited training, a lack of ready-to-use project references, and inadequate facilities and infrastructure are major constraints that need to be addressed through systematic and sustainable professional development policies [33]. Structured teacher mentoring is therefore needed to support optimal STEAM-based P5 implementation across educational levels.

From an assessment perspective, P5 integrated with STEAM also requires comprehensive and authentic assessment instruments that measure not only final products but also students' thinking processes, attitudes, and skills throughout the project [34]. Authentic assessment in this context can include observation, portfolios, self-reflection, and product presentations, which together provide a more complete picture of each student's development across the dimensions of the Pancasila Student Profile [35]. Ref. [27], using a STEAM performance-assessment approach, indicates that authentic, process-based assessment can capture scientific skills that are not visible in conventional written tests. Previous studies have examined STEAM integration in P5 across educational levels, from early childhood education to secondary school [5], [6], [36]. Ref. [36] specifically reports that P5 under the Sustainable Lifestyle theme, integrated with STEAM, encouraged students to develop innovative solutions based on simple scientific principles. Nevertheless, systematic studies that specifically synthesize and analyze patterns of STEAM integration across different P5 themes remain limited. A systematic literature review is therefore needed to map how STEAM can be integrated into P5 implementation, including its benefits and challenges, to support improved project-based learning design in schools implementing the Merdeka Curriculum

2. RESEARCH METHOD

This study employed a Systematic Literature Review (SLR), a systematic method for collecting, critically reviewing, integrating, and summarizing findings from previous studies related to a specific topic or research question [7]. The study began by formulating the research question: "How is the STEAM approach implemented through the Pancasila Student Profile Strengthening Project (P5)?" Relevant articles were then searched, identified, analyzed, evaluated, and interpreted.

The study population consisted of journal articles discussing P5 implementation and the STEAM approach in education. Articles were searched through Google Scholar, Garuda, and Sinta using keywords such as "P5 STEAM," "Pancasila Student Profile Strengthening Project," "STEAM Merdeka Curriculum," and "STEAM integration in P5." The inclusion and exclusion criteria used to select the articles are presented below.

Based on the search and selection process, 12 articles met the criteria and were considered relevant for further analysis. The articles were grouped into two categories: studies addressing P5

implementation and studies addressing STEAM in education. The analysis of these two groups formed the basis for discussing STEAM integration in P5 activities.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Articles published between 2020 and 2025	Articles published before 2020
Articles published between 2020 and 2025	Articles published before 2020
Articles addressing P5 implementation and/or STEAM approaches in education	Articles not addressing P5 or STEAM in education
Articles from national journals indexed in Sinta/Garuda or international journals	Articles not indexed and not available in full text
Article content relevant to the research objectives	Article content not relevant to the research objectives

3. RESULTS AND DISCUSSION

Table 2. Implementation of the Pancasila Student Profile Strengthening Project (P5)

Author	Title/Year	Research Findings
[5]	The Implementation of the Pancasila Student Profile Strengthening Project in Early Childhood Education	The study describes P5 implementation through the local Panjang Mulud tradition at TK Putra II Serang. The findings show that locally based P5 activities can foster cultural pride, cooperation, creativity, and communication skills from early childhood.
[9]	Implementation of the Pancasila Student Profile Strengthening Project (P5) in the Merdeka Curriculum at SD Nasima, Semarang	P5 at SD Nasima was implemented through planning, implementation, and evaluation stages with collaboration among teachers across subjects. The project was associated with the development of mutual cooperation, independence, and creativity through contextual activities.
[2]	Analysis of Teacher Preparation for P5 Activities in the Implementation of the Merdeka Curriculum	Teacher readiness to design P5 activities varied. Some teachers were not yet able to develop project modules aligned with the themes and dimensions of the Pancasila Student Profile. Continuous training and mentoring were therefore needed.
[6]	Development of a P5 Mutual-Cooperation Project Using the STEAM Approach at Sekolah Alam Dongi-Dongi	The study used the ADDIE model to develop an entrepreneurship-themed P5 project focusing on mutual cooperation and integrated with STEAM. A trial with 10 fourth-grade students indicated that the developed project was valid, practical, and effective.
[8]	Implementation of the Pancasila Student Profile Strengthening Project (P5) to Improve Student Skills at SD Negeri 11 Benteng Hulu, Siak Regency	P5 activities encouraged students to participate actively, collaborate, think critically, communicate, and develop creativity. Direct involvement also supported responsibility, independence, and environmental awareness.

Author	Title/Year	Research Findings
[11]	The Pancasila Student Profile Strengthening Project in the Implementation of the Prototype Curriculum at Elementary School Driving Schools	P5 implementation requires careful planning, including theme selection, project-module preparation, and assessment, so that the dimensions of the Pancasila Student Profile can be achieved optimally.

Table 3. The STEAM Approach in Learning

Author	Title/Year	Research Findings
[3]	STEAM Learning in Early Childhood Education: A Literature Review	The STEAM approach can address twenty-first-century challenges by integrating hard and soft skills. STEAM was reported to improve creativity, problem-solving ability, critical thinking, and children's scientific curiosity through everyday observation activities.
[10]	STEAM-Based Learning for Cognitive Development in Children	STEAM-based learning using natural materials can improve cognitive development in early childhood. Giving children freedom to play and learn makes them more active and creative, with the teacher acting as a facilitator.
[4]	STEAM-Based Learning Strategy Using Loose Parts to Develop 4C Skills in Children Aged 4–5 Years	STEAM strategies using loose-parts media were reported to be effective in developing the 4C skills: Critical Thinking, Collaboration, Creativity, and Communication in children aged 4–5 years.
[37]	STEAM Content Analysis in a P5 Module Based on Sasak Local Wisdom, 2023	The P5 module based on Sasak local wisdom included Science, Technology, Engineering, Arts, and Mathematics elements, although the proportion of each element was not yet fully balanced.
[38]	Strengthening Character Education through the Pancasila Student Profile Strengthening Project toward Society 5.0	P5 designed using innovative approaches, including the integration of simple technology and science, can strengthen character education while preparing students for the challenges of Society 5.0.
[39]	An Attempt to Evaluate STEAM Project-Based Instruction from a School Mathematics Perspective	STEAM project-based learning can improve students' understanding of mathematical concepts when connected to real-life contexts and other disciplines.

3.1. Characteristics of P5 Implementation

The synthesis of six articles on P5 implementation shows that project quality is strongly influenced by planning, the context of activities, teacher collaboration, and assessment. P5 implementation at SD Nasima involved planning, implementation, and evaluation stages supported

by cross-subject teacher collaboration and was associated with the development of mutual cooperation, independence, and student creativity [9]. This finding is consistent with Ref. [11], which emphasizes the importance of determining themes, preparing project modules, and designing assessment from the outset so that the dimensions of the Pancasila Student Profile can be achieved in a directed manner. Therefore, P5 should not be understood merely as an activity for producing a final product, but as a learning process that requires systematic design, facilitation, and evaluation.

Contextualization emerged as an important pattern in P5 implementation. Ref. [5] shows that using the local Panjang Mulud tradition in early childhood education can foster cultural pride, cooperation, creativity, and communication. Meanwhile, Ref. [8] reports that students' direct participation in P5 is associated with active engagement, collaboration, critical thinking, communication, creativity, responsibility, independence, and environmental awareness. However, teacher readiness remains uneven. Ref. [2] found that some teachers still have difficulty developing project modules aligned with the themes and dimensions of the Pancasila Student Profile. This indicates that the success of P5 depends on teachers' competence in translating profile objectives into concrete and measurable project activities.

3.2. Contribution of STEAM to Student Competencies

Six articles on STEAM show a consistent tendency that interdisciplinary approaches can support cognitive development and twenty-first-century skills. Ref. [3] reports improvements in creativity, problem-solving ability, critical thinking, and scientific curiosity through STEAM activities in early childhood education. Ref. [4] likewise indicates that STEAM strategies using loose parts support the 4C skills, while Ref. [10] emphasizes improvements in cognitive development, active participation, and creativity when students are given room to explore and teachers act as facilitators. Because these findings mainly come from early childhood contexts, their application to P5 in primary education should be treated as a conceptual basis that still requires broader empirical testing.

In the context of project-based learning, Ref. [39] shows that STEAM can support mathematical conceptual understanding when concepts are connected with real-life situations and other disciplines. This is relevant to the contextual and interdisciplinary nature of P5. In other words, the added value of STEAM in P5 lies not simply in presenting five components simultaneously, but in connecting science, technology, engineering, arts, and mathematics to solve problems that are meaningful to students.

3.3. Patterns of STEAM Integration in P5

Direct evidence of P5–STEAM integration is most clearly found in Ref. [6] and Ref. [37]. Ref. [6] developed an entrepreneurship-themed P5 project focusing on the mutual-cooperation dimension and integrated it with STEAM using the ADDIE model. A trial involving 10 fourth-grade students indicated that the developed project was valid, practical, and effective. This finding shows that entrepreneurship can provide a concrete context for integration, for example through calculating materials and production costs, using simple technology, designing and testing products, and developing visual designs. Nevertheless, the limited trial size means that the findings should be generalized with caution.

Under the local-wisdom theme, Ref. [37] found that a P5 module based on Sasak local wisdom contained elements of Science, Technology, Engineering, Arts, and Mathematics, although the proportions of these elements were not yet balanced. This finding complements Ref. [5], which shows that local traditions can serve effectively as a project context for fostering cultural pride, cooperation, creativity, and communication. Taken together, these studies suggest that local wisdom can provide an authentic context for STEAM integration, but the contribution of each STEAM element should be mapped explicitly so that integration does not remain merely a label.

Ref. [38]; [39] adds that P5 designed using innovative approaches, including simple technology and science, has the potential to strengthen character education while preparing students for the demands of Society 5.0. This finding reinforces the argument that STEAM can function as an academic framework within P5: P5 provides the values and character context, while STEAM provides processes of investigation, design, creativity, and problem solving that can make projects more structured.

3.4. Implementation Challenges and Learning Implications

The review identified two main challenges. First, teacher readiness to design projects remains variable [2]. Second, STEAM components within project modules are not always integrated in a balanced manner [37]. These conditions indicate that STEAM-based P5 development requires support that goes beyond explaining concepts; teachers also need training to map the dimensions of the Pancasila Student Profile, contextual problems, the contribution of each STEAM component, project stages, and assessment of both process and product. The teacher's role as facilitator, as emphasized in Ref. [10], is essential to ensure that project activities provide room for student exploration without losing academic direction.

Overall, the synthesis supports a conceptual alignment between P5 and STEAM because both emphasize contextual, interdisciplinary, active, and project-based learning. However, direct evidence should be distinguished from supporting evidence. Of the 12 articles analyzed, only some explicitly examined the integration of P5 with STEAM, while the others discussed either P5 or STEAM separately. Therefore, conclusions regarding the benefits of integration should be understood as a synthesis of the literature rather than as a single source of causal evidence. This limitation also highlights the need for field studies testing the effectiveness of STEAM-based P5 across different themes, educational levels, and school contexts.

4. CONCLUSION

Based on the 12 articles analyzed, P5 and STEAM converge in their emphasis on contextual interdisciplinary, student-centered, and project-based learning. P5 provides a framework for strengthening character and the dimensions of the Pancasila Student Profile, while STEAM enriches the project process through investigation, design, problem solving, creativity, and the application of interdisciplinary concepts.

The clearest direct evidence of integration in this review was found in the themes of entrepreneurship and local wisdom. The studies reviewed indicate potential for developing mutual cooperation, creativity, communication, critical thinking, problem solving, and conceptual understanding. However, implementation still faces challenges related to teacher readiness and the unequal representation of STEAM elements within projects. Because some articles discuss P5 or STEAM separately, the integration findings should be understood as a literature synthesis and should not yet be interpreted as causal evidence applicable to all school contexts.

Future research should directly test STEAM-based P5 designs across different educational levels and themes using larger samples, clearly defined assessment instruments, and evaluation of both learning processes and outcomes. For educational institutions, teacher training should focus on mapping the dimensions of the Pancasila Student Profile, integrating STEAM components, designing project activities, and applying authentic assessment.

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