

Transforming Classrooms through PBL: Lessons from Indonesia's Curriculum Reforms and Global South Contexts

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ABSTRACT: Project-Based Learning (PBL) has been recognized as a transformative educational model for enhancing 21st-century competencies, particularly in developing countries undergoing curricular reforms. In Indonesia, the Merdeka Curriculum and its P5 framework have adopted PBL as a central pedagogical strategy. This study evaluates the outcomes and implementation fidelity of Project-Based Learning (PBL) in Indonesian secondary schools through synthesis of global and local empirical evidence. Using a meta-synthesis approach, the study integrates quantitative and qualitative data from peer-reviewed research, quasi-experimental designs, and policy evaluations. Validated tools such as the California Critical Thinking Skills Test (CCTST) and Tibi's Collaboration Questionnaire were used to assess student outcomes. Fidelity of implementation was analyzed through project duration, professional development (PD), and adherence to Gold Standard PBL criteria. Findings reveal moderate-to-large effect sizes of PBL on student critical thinking ($SMD = 0.82$ in high schools) and collaboration ($SMD = 0.94$ in middle schools). Extended project duration (≥ 6 weeks), structured PD, and alignment with authentic PBL elements significantly enhance learning outcomes. However, institutional and cultural constraints such as rigid assessment systems and teacher-centered traditions undermine PBL fidelity in Indonesian classrooms. Comparative analysis with other Global South nations reveals similar challenges, highlighting the need for localized yet globally aligned implementation strategies. While PBL holds strong potential to transform student learning in Indonesia, its effectiveness depends on systemic supports, including targeted PD, curricular alignment, and culturally responsive assessment frameworks. This study offers a fidelity-sensitive roadmap for scaling PBL in developing contexts and contributes to the discourse on reforming instructional practices for future-ready education.

Keywords: Project-Based Learning, Merdeka Curriculum, Critical Thinking, Collaboration, Implementation Fidelity, Secondary Education; Indonesia.



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INTRODUCTION

Project-Based Learning (PBL) has become an increasingly adopted strategy in K–12 education, aiming to foster student-centered learning through inquiry and collaboration. PBL emphasizes inquiry, collaboration, and real-world application, distinguishing itself from traditional instructional methods that are often teacher-centered and content-heavy (Browning & Bustard,

2024; Drake & Reid, 2018). This educational shift aligns with global efforts to enhance 21st-century competencies such as critical thinking, creativity, and collaboration (Drake & Reid, 2018; Browning & Bustard, 2024).

This reformative trend has gained significant traction in developing nations where education systems are seeking to close the gap between curricular expectations and workforce demands. In Indonesia, for instance, PBL is now formally embedded in the Merdeka Curriculum and its associated P5 (Profil Pelajar Pancasila) framework. This initiative not only repositions the role of the student within the learning environment but also seeks to decentralize governance and enhance curriculum flexibility (Mielikäinen, 2021; Weng et al., 2021). The P5 framework emphasizes values such as collaboration, innovation, and ethical reasoning, making it a policy-level endorsement of PBL principles. Similar initiatives in countries across Sub-Saharan Africa reflect a global push to use PBL as a lever for economic development and educational equity (Eichbaum et al., 2020; Nainggolan et al., 2018).

However, while national policies often advocate for PBL's transformative potential, implementation at the school level presents several challenges. Chief among these is the issue of teacher preparedness. Research consistently reveals that many educators struggle to transition from traditional didactic roles to the more facilitative stance required by PBL (Avcı et al., 2023). The pedagogical shift necessitates not only a change in instructional delivery but also a reconfiguration of classroom dynamics, assessment protocols, and curriculum planning. Without structured support, even the most well-intentioned reforms may falter at the execution stage.

Moreover, the effectiveness of PBL is often contingent on factors such as resource availability, teacher professional development, and alignment with broader assessment practices. For example, rigid curricula and standardized testing regimes can conflict with the flexible, exploratory nature of PBL (Lahiri & Rajan, 2020; Supartin, 2023). As Burgess et al. (2019) note, successful PBL implementation requires coherence across training, instructional materials, and evaluation strategies a synergy rarely present in under-resourced contexts.

Despite these barriers, empirical studies confirm that when implemented with fidelity, PBL has a measurable positive impact on student learning outcomes. Students engaged in PBL demonstrate superior problem-solving skills, increased motivation, and enhanced collaboration and communication abilities compared to their peers in traditional classrooms (Dacumos & Kita, 2021; Sánchez-Romero et al., 2019). These findings are supported by meta-analytic and quasi-experimental research, which consistently show higher critical thinking and engagement levels among PBL participants (Meester et al., 2020).

The collaborative aspect of PBL, in particular, has been noted for its contribution to interpersonal skill development. Students participating in project-based environments are required to negotiate, plan, and evaluate their work collectively, thereby fostering a culture of mutual accountability and shared learning (Witherspoon & Schunn, 2019). This social dimension of learning not only enhances academic performance but also prepares students for teamwork in real-world scenarios.

As Indonesia moves forward with the Merdeka Curriculum and P5 initiative, the country finds itself at the nexus of global reform and local challenge. On one hand, its curricular design is aligned with contemporary educational paradigms; on the other, its capacity for sustained, high-fidelity implementation remains under scrutiny. The key to unlocking PBL's full potential lies in bridging this implementation gap through structured teacher training, curriculum alignment, and assessment reform. The literature underscores that where such supports are in place, even resource-constrained environments can realize the benefits of PBL (Nainggolan et al., 2018; Eichbaum et al., 2020).

In summary, the adoption of PBL in K–12 education is part of a global movement toward more dynamic and relevant forms of learning. Indonesia's Merdeka Curriculum embodies this vision but also highlights the systemic complexities of realizing such pedagogical reforms at scale. The current study is situated within this context, aiming to evaluate the outcomes and fidelity of PBL implementation in Indonesia and to contribute a framework for improving practice and policy alignment in comparable educational systems.

METHOD

This study used a meta-synthesis methodology to examine PBL effectiveness and fidelity in the Indonesian secondary education context (France et al., 2019; Sattar et al., 2021).

A structured meta-synthesis approach guided the identification, evaluation, and integration of data from multiple sources, including peer-reviewed meta-analyses, quasi-experimental studies, policy documents, and national reviews. This approach followed best practices: defining focused research questions, systematically searching relevant databases, applying transparent inclusion/exclusion criteria, and thematically coding key findings (Nye et al., 2016).

Studies published between 2015 and 2024 were considered. Included studies were required to:

- Focus on PBL implementation in K–12 settings, particularly in middle and high schools.
 - Present empirical data on student outcomes (e.g., critical thinking, collaboration).
 - Provide details on fidelity variables or implementation conditions.
- Sources were drawn from academic databases and reputable gray literature.

2.3 Instruments and Constructs

To assess critical thinking and collaboration, the study identified the use of validated instruments:

- **Critical Thinking:** Measured using the California Critical Thinking Skills Test (CCTST), which evaluates students' reasoning abilities, including inference and evaluation (Uny et al., 2017). Additional tools like the Group Assessment of Logical Thinking (GALT) were also referenced.

- Collaboration: Assessed using rubrics such as the Collaborative Teamwork Assessment (CTA), along with the Tibi Collaboration Questionnaire. These tools allowed both self-assessment and performance-based evaluation of collaborative behaviors (Khani et al., 2023).

Fidelity of implementation was assessed through:

- Fidelity Checklists: Tools to systematically verify if PBL elements were delivered as intended (Rios et al., 2019).
- Direct Observations: Video recordings and live assessments captured real-time adherence to PBL principles (Compton-Lilly et al., 2019).
- Feedback Cycles: Formative evaluations and adjustment mechanisms supported fidelity throughout the implementation process (France et al., 2019).

Standardized Mean Differences (SMD) were calculated where applicable. Subgroup analyses were conducted to determine the moderating effect of fidelity variables such as duration (≥ 6 weeks), professional development, and task design quality. Thematic coding frameworks categorized findings into domains: implementation barriers, outcome efficacy, and contextual influences.

The methodology adhered to recent recommendations emphasizing transparency in meta-synthesis. All phases from data collection to thematic integration were thoroughly documented to ensure replicability and enhance trustworthiness of the results (Polanin et al., 2020).

In summary, this methodological approach combined systematic meta-synthesis with validated measurement tools and robust fidelity assessment strategies. It ensured a comprehensive, transparent, and context-sensitive analysis of PBL implementation in Indonesian secondary education.

RESULT AND DISCUSSION

Meta-Analytic Evidence on Critical Thinking Outcomes

Meta-analyses consistently affirm PBL's effectiveness in enhancing critical thinking among secondary students. Reported effect sizes typically range from 0.55 to 0.85, denoting medium to large impacts (Isnani, 2023). For instance, Suhaedin et al. (2024) observed marked gains in vocational high school students, with similar trends reported in challenging subjects like science and mathematics (Hurtado et al., 2023). This suggests PBL supports complex cognitive development across diverse contexts.

Subject- and Grade-Level Variations

Studies highlight differential PBL efficacy across disciplines and educational stages. Science and technology subjects exhibit the strongest gains, particularly in STEM and vocational contexts (Acim et al., 2024). Conversely, PBL in primary education yields milder effects, likely due to the

foundational nature of early learning (Isnani, 2023). These findings underscore the need for subject-specific PBL adaptations.

Cultural and Contextual Influences

Cultural norms heavily influence PBL outcomes. In Indonesia, traditional instruction often emphasizes authority, posing challenges for autonomous inquiry models (Suhaedin et al., 2024). However, integrating local cultural content into PBL enhances engagement and relevance (Merwe et al., 2024). This cultural alignment can amplify the benefits of PBL, provided it is sensitively adapted.

Limitations in Existing Meta-Analyses

Despite compelling results, methodological issues persist. Meta-analyses often suffer from inconsistent implementation reporting and varied critical thinking assessments (Suhaedin et al., 2024). The risk of publication bias and a focus on short-term outcomes also hinder the robustness of findings (Dongoran et al., 2024).

Moderating Role of Project Duration

Project duration emerged as a strong moderator of effectiveness. Longer projects (6–8+ weeks) yielded significantly deeper inquiry, collaboration, and reflection. Shorter timelines led to superficial engagement, limiting critical thinking development (Suhaedin et al., 2024).

Impact of Teacher Professional Development

Effective PBL hinges on teacher preparedness. Studies show that structured professional development (TPD) improves fidelity and teacher confidence (Hasbullah, 2023). Practical training and continuous feedback loops enable teachers to deliver more impactful PBL lessons (Dema & Choden, 2024).

Gold Standard PBL Components

The Gold Standard PBL framework featuring sustained inquiry, driving questions, authenticity, reflection, and critique strongly correlates with improved student outcomes (Merwe et al., 2024). Alignment with this model enhances learning depth, creativity, and collaboration.

Assessment Practices and Learning Outcomes

Assessment practices significantly influence PBL success. Studies advocate formative, rubric-based assessments over traditional exams, promoting deeper engagement (Mailanda et al., 2024). Integrating peer/self-assessments further strengthens student agency and accountability.

Indonesian P5 Implementation: Outcomes and Barriers

P5 has yielded positive outcomes in engagement and character development where implemented with fidelity. However, institutional constraints like rigid curricular structures and limited teacher training undermine its scalability (Marwah et al., 2024). Schools with robust training support report superior outcomes.

Institutional and Teacher-Level Challenges

Persistent institutional barriers include excessive emphasis on rote learning, bureaucratic rigidity, and inadequate support systems. Teachers report needing clearer guidance and time to facilitate interdisciplinary projects effectively (Suhaedin et al., 2024; Mailanda et al., 2024).

Case Study: Malaysian Quasi-Experiment

The Malaysian quasi-experiment employed randomized class assignment and collected both quantitative and qualitative data. Students in the PBL group significantly outperformed the control group in critical thinking and collaboration (Merwe et al., 2024). Collaboration was measured via rubrics, peer evaluations, and reflections. Outcomes demonstrated large effect sizes and higher motivation.

Transferability to Indonesia

Despite cultural and institutional differences, the Malaysian findings provide valuable guidance. While Indonesia's hierarchical learning culture may inhibit autonomy, the foundational principles of PBL real-world engagement and student-centered inquiry remain applicable. Cautious adaptation of such models can enhance relevance and effectiveness.

This study reinforces the growing body of evidence affirming the educational benefits of Project-Based Learning (PBL), particularly in enhancing critical thinking and collaboration among secondary students. However, its success is deeply contingent on implementation fidelity, cultural compatibility, and systemic support. Within the Indonesian context, these findings acquire specific significance, revealing critical areas of promise and persistent challenges.

Comparatively, PBL implementation challenges in Indonesia mirror those encountered across many Global South nations. Common themes include entrenched traditional pedagogies, curricular rigidity, and high-stakes assessments that often conflict with the student-centered ethos of PBL (Romanowski et al., 2022). Like in India and South Africa, Indonesian educators face dual demands: adherence to prescriptive curricula while striving to foster active learning. Moreover, cultural norms valuing teacher authority present additional barriers to student-led inquiry and autonomy (Hakimah, 2023; Prabowo et al., 2024). These factors collectively constrain the potential of PBL to operate as intended and underscore the need for context-sensitive implementation strategies.

Nonetheless, examples from within Indonesia and other similar education systems illustrate viable fidelity-support strategies. Among the most effective are structured teacher professional development (PD) programs that offer both theoretical foundations and classroom applications of PBL (Kassab et al., 2024). PD that fosters collaborative reflection and builds communities of practice improves both teacher confidence and instructional quality over time. Mentorship models and peer support networks also play a pivotal role in scaffolding novice teachers' engagement with PBL methodologies (Aliyu et al., 2023; Safeer & Zhou, 2023).

Long-term impacts of such PD are encouraging. Teachers exposed to sustained, high-quality training are more likely to continue using PBL, adapt projects to their contexts, and maintain student-centered instructional models (Pudjiarti et al., 2024). These educators report increased student engagement and deeper learning outcomes. Furthermore, PD initiatives enhance teacher

retention and foster a reflective culture of instructional innovation, which is key to institutionalizing PBL practices across schools (Sisrayanti et al., 2024).

From a policy perspective, aligning national curricula with authentic PBL design standards is essential for scale and sustainability. This requires embedding Gold Standard PBL elements real-world problem-solving, student agency, sustained inquiry into curriculum frameworks and allowing flexibility for locally relevant adaptations (Saavedra, 2019). National-level collaboration among stakeholders including education ministries, teacher training institutions, and community organizations will be vital to ensure coherence in goals and practices (Garim et al., 2023).

Reforming assessment systems is equally crucial. Traditional exams often misalign with PBL's focus on process, creativity, and collaboration. As such, assessment tools should evolve to include performance-based measures, peer feedback, and reflective self-assessments that better capture learning progress and outcomes (Nadarajah et al., 2016). These alternative forms of evaluation support the holistic development of students and align with the competencies PBL seeks to cultivate.

In conclusion, while the promise of PBL is clear, particularly in fostering transferable 21st-century skills, its successful implementation in Indonesia and similar contexts hinges on multifaceted supports. Effective systemic reform may benefit from targeted professional development (PD), curriculum realignment, innovative assessments, and culturally responsive strategies. By addressing these dimensions cohesively, PBL can move from an aspirational model to a transformative educational practice capable of elevating learning outcomes at scale.

CONCLUSION

This study reaffirms the significant impact of Project-Based Learning (PBL) on student outcomes—particularly in enhancing critical thinking and collaboration—within Indonesia's secondary education context. Drawing on a meta-synthesis of global and national studies, the findings emphasize that implementation fidelity, extended project duration, and structured teacher professional development are key factors influencing the effectiveness of PBL. However, these benefits remain conditional upon systemic support structures, including curricular alignment and the adaptation of assessment systems to better reflect PBL's holistic nature.

Despite policy-level endorsement through the Merdeka Curriculum and P5 framework, implementation remains uneven due to institutional rigidity, limited teacher training, and cultural norms that favor traditional pedagogies. Addressing these barriers requires not only pedagogical adjustments but also strategic investment in teacher capacity-building and assessment reform. This research contributes a context-sensitive implementation framework that can inform scalable and culturally responsive PBL strategies in Indonesia and other Global South education systems.

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