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Integrating the Profile of Pancasila Students into Ethnomathematics: A Project-Based Learning Approach to Enhancing Mathematical Problem-Solving Skills

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Abstract

This study addressed the limited empirical evidence on the integration of the Profile of Pancasila Students (P3) within ethnomathematics-based Project-Based Learning (PjBL). The research examined how three P3 dimensions critical reasoning, creativity, and collaboration (gotong royong) were operationally embedded into ethnomathematics learning to enhance students' mathematical problem-solving skills. A quasi-experimental pretest & posttest non-equivalent control group design was conducted with 62 grade VIII students at SMPN 7 Muaro Jambi. The instruments included a problem-solving test, a P3-based observation sheet, and a project performance rubric aligned with ethnomathematical modelling tasks. Learning activities incorporated cultural mathematical contexts such as geometric transformations in Jambi weaving motifs and proportional structures in traditional Malay architecture. The experimental class achieved higher posttest performance (M = 78.94) than the control group (M = 69.48), with an N-Gain of 0.61 and a large effect size (d = 0.82). In addition, P3 indicators increased substantially, with collaboration improving by 19%, critical reasoning by 22%, and creativity by 18%. These findings indicate that ethnomathematics-based PjBL enriched both cognitive and character development. This study provides one of the first structured models for integrating the Profile of Pancasila Students into mathematics learning through culturally grounded project activities.

Kata Kunci: Ethnomathematics; Profile of Pancasila Students; Problem-solving Skills; Project-based Learning

INTRODUCTION

Mathematics is a center discipline inside the twenty first century that equips beginners with logical reasoning, important thinking, and trouble-solving capabilities (Rodriguez 2023; Saglam and Goktenturk 2024; Umam, Iriani, and Novferma 2024). but, in Indonesia arithmetic continues to be often taught abstractly, resulting in students perceiving it as hard, inappropriate, and disconnected from their each day lives (Naz and Qayyum 2025; Rohati, Winarni, and Hidayat 2018). This gap has contributed to low pupil success in global checks which include PISA, in which Indonesian students scored under the OECD common in problem-fixing domain names (OECD 2023). The country wide curriculum reform, Merdeka Belajar, emphasizes contextualized getting to know, cultural relevance, and price integration as important for making ready students with both cognitive and person competencies (Kahar et al. 2025; Najmita et al. 2025; Suparman 2024).

Problem-solving capability is broadly diagnosed as a essential competence in mathematics. Polya (1945) outlines the steps of knowledge issues, devising plans, implementing techniques, and comparing answers as a comprehensive framework for hassle-fixing. Students who master those degrees generally tend to expand creativity, adaptability, and better-order wondering (Agusman, Purwanto, and Rahardi 2025; Fajrina, Lufri, and Ahda 2020; Fauzi and Ribaah 2025). research in Indonesia has showed the urgency of strengthening those competencies; for instance, Ulmu Karimah, Isnarto, and Munahefi (2025) demonstrated that students who engaged in hassle-primarily based gaining knowledge of (PBL) integrated with ethnomathematics significantly progressed their problem-solving overall performance compared to conventional learning methods. further, Sumaji et al. (2025) determined that a PBL version assisted with ethnomathematics-primarily based virtual modules more suitable college students' capacity to solve non-recurring problems. these findings underline the want to remodel arithmetic preparation to systematically embed trouble-fixing procedures.

The ethnomathematics, first ideated with the assist of d'Ambrosio (1985), gives a hyperlink among abstractmathematical ideas and cultural activities. It highlights the reality that the maths knowledge isn't life-style-unfastened however as an alternative knit in activities, traditions, and gadgets. In Indonesia, there are a number of rich ethnomathematical contexts that can be generated from batik patterns, patterns of weaving, traditional video games, and architectural designs (Iskandar et al. 2022). It's been confirmed by empirical research that the inclusion of ethnomathematics in arithmetic lecture rooms will increase scholar motivation, scholar engagement and scholar comprehension. For example, Syahnia et al. (2024) stated that the ethnomathematics-based totally PBL models more advantageous college students' crucial thinking and literacy abilties in geometry. Similarly, Muhaimin et al. (2023) found that hassle-fixing tasks contextualized by using vicinity-based totally know-how progressed college students‟ mathematical literacy and reflected the values of the pancasila student profile. Despite these promising results, most studies stop at cognitive outcomes and have not explicitly incorporated national character values.

Character education in Indonesia is framed holistically in the pancasila student profile, which articulates six core dimensions: faith and morality, global diversity, collaboration (gotong royong), independence, critical reasoning, and creativity. These dimensions are intended to guide all subject areas, including mathematics, toward developing learners who are intellectually capable and socially grounded (Latifah and Ramadan 2023). However, studies have shown that mathematics classrooms often focus disproportionately on procedural competence and rarely provide structured opportunities for learners to develop P3 competencies, especially critical reasoning, creativity, and collaboration (Maulyda et al., 2023; Ilham & Wardhani, 2024). Research integrating P3 in mathematics learning remains limited, and most studies treat character development only implicitly rather than through explicit assessment frameworks. Therefore, embedding P3 dimensions within ethnomathematics-based PjBL offers a promising pathway to cultivate mathematical thinking and character formation simultaneously.

A comprehensive pedagogical framework for integrating ethnomathematics and Pancasila values is provided by Project-Based Learning (PjBL). According to Bell (2010), PjBL focuses on inquiry, teamwork, and simulation projects in authentic environments. Research has shown that PjBL successfully fosters creativity and problem-solving skills (Kusuma et al. 2024; Saragih, Nurjanah, and

Yulianti 2025). Furthermore, PjBL that incorporates technology has been shown to promote greater motivation and math achievement (Budiman, Fatirul, and Waluyo 2023; Bulkini and Nurachadijat 2023; Nurazizah, Abd. Muis, and Hajar 2023). Students gain deeper problem-solving skills as well as cultural appreciation and values-related learning when ethnomathematical scenarios are incorporated into projects (Putra et al. 2025). For example, building designs or cloth-weaving projects in our traditions can naturally foster the development of Pancasila-compatible concepts like responsibility, tolerance, and teamwork.

Several current studies illustrate partial intersections of those dimensions however prevent quick of full integration. Irawan, Kencanawaty, and Febriyanti (2018) found that ethnomathematics in geometry gaining knowledge of elevated motivation and fulfillment, however did no longer address values. Weaving traditions into challenge responsibilities, improving engagement however with out specific ideological framing (Mailani et al. 2024). Hindun, Wahyuni, and Nurwidodo (2025) confirmed that PjBL improves trouble-fixing, however their recognition remained in basic terms cognitive. meanwhile, Sunzuma and Umbara (2025) reviewed era-supported ethnomathematics and emphasized its capability for significant gaining knowledge of, yet person components have been now not addressed. these findings display that whilst ethnomathematics, PjBL, and cost training every reveal effectiveness independently, there remains a widespread studies hole in their incorporated utility.

As a way to incorporate Pancasila values into ethnomathematics the use of a assignment-based totally studying approach, the current examine changed into done at SMPN 7 Muaro Jambi. This look at checked out how this integration affected college students' potential to solve mathematical problems and the way Pancasila values were expressed in group initiatives. further to supplying a practical model for schools trying to align cognitive development with national man or woman formation beneath the Merdeka Belajar framework, this study theoretically advances the conversation on price-oriented mathematics schooling by using methodically bringing culture, pedagogy, and ideology collectively.

METHOD

This research followed a quasi-experimental layout using a pretest–posttest non-equivalent manipulate organization. The look at became carried out at SMPN 7 Muaro Jambi inside the 2024/2025 educational year and concerned two intact instructions of grade VIII students with a total of 62 members. One magnificence was assigned because the experimental organization and received undertaking-based totally studying (PjBL) incorporated with ethnomathematics and Profile of Pancasila Students (P3), even as the manipulate group accompanied conventional arithmetic guidance. The experimental layout become selected to permit for the size of the impact of the remedy even as keeping ecological validity inside the faculty context (Creswell 2003). A pretest turned into administered at the beginning to measure students' baseline problem-fixing abilties, followed by way of six weeks of treatment, and sooner or later a posttest to evaluate studying consequences.

The treatment in the experimental class was implemented through a structured Project-Based Learning cycle consisting of orientation, planning, execution, reflection, and presentation. Each project was designed using ethnomathematical contexts derived from traditional Jambi weaving patterns and geometric features of local architectural structures to ensure that cultural elements were meaningfully integrated into the mathematical content. During group activities, learners were guided to demonstrate key dimensions of pancasila student profile, namely collaboration (gotong royong), critical reasoning (bernalar kritis), and creativity (kreatif), which were assessed using a structured performance rubric. In contrast, the control group received conventional instruction characterized by teacher explanations, worked examples, and individual problem-solving tasks. This contrast enabled the study to capture not only differences in cognitive outcomes but also the manifestation of Pancasila Student Profile competencies throughout the learning process.

Three devices have been hired within the study. The number one tool was a problem-fixing test together with essay items aligned with Polya's four tiers of hassle solving, evolved in keeping with hassle-fixing indicators (Fajrina et al. 2020). The check changed into verified by two mathematics training experts and one senior trainer, with Aiken's V values exceeding zero.eighty, and confirmed high reliability with a Cronbach's alpha of 0.87 (Retnawati 2016). To measure man or woman results,

observation sheets have been used to file the demonstration of Pancasila values in the course of group activities (Pujiastuti et al. 2025). Mission rubrics were employed to evaluate college students' products in phrases of mathematical accuracy, creativity, and integration of cultural values. information were analyzed the usage of descriptive facts, t-exams, normalized gain (N-gain), and Cohen's d for effect size (Hake 1998; Lakens 2013), even as qualitative information from observations and rubrics were analyzed descriptively to seize behavioral evidence. The mixture of quantitative and qualitative methods ensured a complete evaluation of the intervention's impact on each cognitive and character outcomes, consistent with previous research on ethnomathematics-primarily based PjBL (Sumaji et al. 2025; Ulmu Karimah et al. 2025).

RESULTS

The primary evaluation as compared the pretest effects of both companies to make certain equivalence. The mean pretest scores were 52.35 in the experimental class and 51.71 in the control class, with no significant difference ($p = 0.624$). This indicates that the two groups started at a similar level before treatment (Table 1).

Table 1. Descriptive Statistics of Pretest Scores

Group	N	Mean	SD	p-value
Experimental	31	52.35	8.42	0.624
Control	31	51.71	7.95	

After six weeks of instructional treatment, significant differences emerged between the two groups. The posttest results showed that the experimental class reached an average score of 78.94 (SD = 7.62), which was substantially higher than the control group's mean of 69.48 (SD = 6.83). The independent samples t-test revealed a t-value of 5.37 with a p-value of 0.001, indicating that the observed difference was statistically significant at the 0.05 level. This finding highlights that students who experienced project-based learning (PjBL) with ethnomathematics and Profile of Pancasila Students integration achieved better problem-solving performance than those taught with conventional methods (Table 2).

Table 2. Descriptive Statistics of Posttest Scores

Group	N	Mean	SD	t-value	p-value
Experimental	31	78.94	7.62	5.37	0.001
Control	31	69.48	6.83		

To better illustrate the improvement, Figure 1 presents the mean pretest and posttest scores of both groups. It is evident that while both groups improved over time, the experimental class displayed a much steeper increase. The difference between pretest and posttest in the experimental group reached 26.59 points, while the control group only improved by 17.77 points. This graphical representation further confirms the effectiveness of embedding ethnomathematics and Profile of Pancasila Students within PjBL to foster students' problem-solving skills.

The normalized gain (N-Gain) was also calculated to measure the magnitude of improvement in students' problem-solving abilities. The experimental group achieved an N-Gain of 0.61, which falls in the medium-to-high category, whereas the control group's N-Gain was 0.32, categorized as low-to-medium. This indicates that the intervention not only improved students' absolute performance but also produced greater learning efficiency compared to conventional instruction. Moreover, effect size analysis using Cohen's d produced a value of 0.82, which is considered a large effect, meaning that the impact of the intervention was not only statistically significant but also educationally meaningful (Table 3).

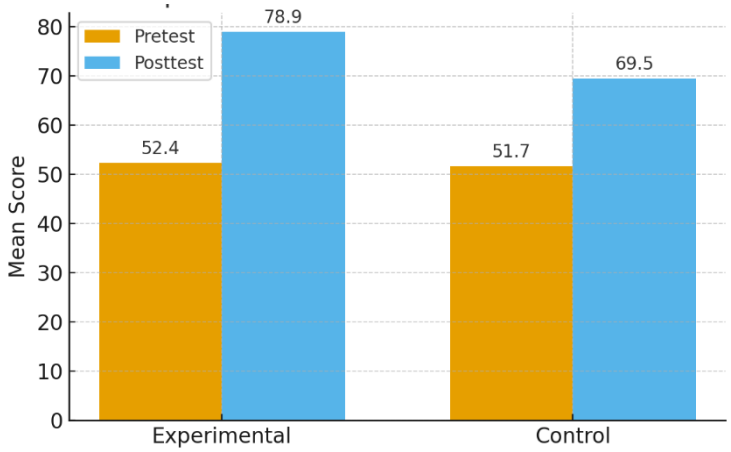

Figure 1. Comparison of Pretest and Posttest Scores

Table 3. N-Gain and Effect Size

Group	N-Gain (Mean)	Category	Effect Size (d)	Interpretation
Experimental	0.61	Medium–High	0.82	Large effect
Control	0.32	Low–Medium	—	—

In addition to the quantitative findings, qualitative information from classroom observations and mission tests provided deeper insights into the manifestation of Pancasila values all through learning sports. Observers stated that students inside the experimental elegance demonstrated higher levels of cooperation, tolerance, and duty in comparison to those within the control group. as an example, in the course of a mission studying weaving patterns, college students dispensed responsibilities fairly and discussed answers collaboratively. One teacher commented, "*Selama diskusi kelompok, siswa saling berbagi peran dengan adil dan mendengarkan pendapat teman, bahkan ketika terjadi perbedaan pandangan. Mereka menunjukkan sikap toleransi dan gotong royong yang jarang terlihat pada pembelajaran sebelumnya*." (during organization discussions, the students shared roles fairly and listened respectfully to their friends, even when evaluations differed. They demonstrated tolerance and teamwork that were not often located in previous lessons).

college students additionally expressed tremendous stories related to the integration of way of life and values into mathematics gaining knowledge of. A scholar meditated, "*Belajar dengan proyek berbasis budaya membuat saya lebih semangat. Kami jadi bisa bekerja sama, bukan hanya mengerjakan soal sendiri. Saya merasa lebih bertanggung jawab dalam menyelesaikan tugas kelompok*." (gaining knowledge of through lifestyle-based initiatives made me more enthusiastic. We ought to work collectively in place of only solving troubles in my opinion. I felt more accountable in finishing the institution duties). these reflections recommend that the remedy not only better cognitive competencies however also fostered affective effects aligned with the desires of Pancasila-primarily based schooling.

Common, the results suggest that task-primarily based mastering included with ethnomathematics and Pancasila values had a robust fine effect on each the cognitive and man or woman dimensions of arithmetic education. The great growth in take a look at rankings, the medium-to-high gaining knowledge of profits, the large effect length, and the observable enactment of Pancasila values in the course of collaborative obligations collectively provide robust proof of the intervention's effectiveness.

Traditional Jambi woven patterns, for instance, provided authentic contexts for exploring tessellation, symmetry, and geometric transformations. Students analyzed the repetition of motifs, the angular relationships between strands, and the translational structures embedded in the weaving layouts. Through this process, they were able to generalize recurring elements into formal geometric representations and subsequently develop mathematical models based on cultural designs.

Figure 2. Traditional Jambi woven patterns illustrating tessellation, translation, and reflection. These motifs served as authentic cultural sources for constructing geometric transformations in students' project tasks.

Figure 3. Architectural elements of traditional Jambi stilt houses used to explore proportional relationships, similarity, and area modelling. Students analyzed the structure's geometry to construct mathematical representations within PjBL activities.

In addition, ornamental motifs commonly found in Jambi carvings, characterized by bilateral symmetry, rotational symmetry, and patterned repetition, encouraged students to identify mathematical regularities embedded in artistic designs. While constructing models inspired by these motifs, students practiced generalizing visual structures into algebraic or geometric patterns. This process required them to justify the mathematical properties embedded in cultural artefacts, enhancing analytical reasoning.

Figure 3. Traditional Jambi ornamental carvings containing symmetrical and repetitive geometric structures. These motifs supported students in identifying and generalizing mathematical patterns during the modelling process.

Together, these culturally grounded tasks acted as epistemic anchors that made abstract mathematical concepts more accessible and meaningful. They facilitated collaborative reasoning as students discussed interpretations of cultural forms and jointly constructed mathematical arguments. In this way, ethnomathematics not only contextualized learning but also functioned as a cognitive bridge linking cultural identity, conceptual understanding, and higher-order problem-solving processes.

DISCUSSION

The findings of this study confirmed that integrating ethnomathematics and explicit Profile of Pancasila Students into Project-Based Learning (PjBL) significantly strengthened students' mathematical problem-solving abilities. The increase in posttest scores, N-Gain, and effect size aligns with previous research on PjBL; however, this study provides deeper insight by demonstrating that cultural contexts and value internalization served as complementary mechanisms for enhancing cognitive performance. From a socio-cultural perspective, the results affirm Vygotsky's view that learning is mediated through culturally meaningful tools and social interaction. The weaving patterns and architectural structures used in this study functioned as cultural artefacts that scaffolded students' reasoning, enabling them to operate within their zone of proximal development through group interactions. Through these activities, students engaged in mathematical modelling that involved symmetry, proportionality, and geometric transformations concepts that became more tangible when embedded in real cultural artefacts.

The findings of this take a look at display that venture-based totally mastering (PjBL) incorporated with ethnomathematics and Pancasila values substantially stronger students' mathematical hassle-solving competencies compared to standard preparation. The posttest outcomes showed a better mean rating for the experimental organization, with a medium-to-high N-gain (0.61) and a massive impact size (d = 0.82). these outcomes confirm the effectiveness of PjBL as a pedagogical approach that engages college students in true tasks and helps better-order questioning. Bell (2010) mentioned that PjBL develops twenty first-century abilties, at the same time as Kusuma and Pujiastuti (2024) emphasised its role in fostering innovative and important questioning. the present observe provides to this body of evidence by showing that PjBL now not simplest improves hassle-fixing however does so greater successfully whilst contextualized with ethnomathematics and supported by using cost integration.

The observed improvement in students' problem-solving talents aligns with preceding research on ethnomathematics-based totally gaining knowledge of. as an instance, Irawan et al. (2018) mentioned that ethnomathematics in geometry learning improved college students' motivation and achievement, while Syahnia et al. (2024) determined that ethnomathematics-based totally PBL models advanced college students' essential thinking in mathematical literacy. further, Sumaji et al. (2025) tested that an ethnomathematics-primarily based virtual module included into PBL superior students' capability to clear up non-habitual troubles. the prevailing observe supports those findings via confirming that ethnomathematics contexts, which include weaving and nearby structure, make abstract mathematical ideas extra significant and accessible, thereby improving college students' trouble-fixing competence. however, the newness of this look at lies in its express integration of Pancasila values, which has rarely been the focus of prior empirical paintings in arithmetic schooling.

Beyond cognitive consequences, this observe additionally discovered affective profits, mainly the manifestation of Pancasila values for the duration of mission sports. Observations and student reflections indicated extended cooperation, tolerance, and duty values which can be central to the Indonesian country wide ideology. This end result resonates with the arguments of Tyaningsih et al. (2020) who advised that arithmetic school rooms can function areas for man or woman education while designed with collaborative tasks. similarly, Pujiastuti et al. (2025) showed that ethno-sensible mathematics modules ought to promote unity and social justice. through embedding such values explicitly in group tasks, the prevailing observe demonstrates how mathematics getting to know can simultaneously develop trouble-fixing competencies and man or woman talents. This integration goes past the traditional function of mathematics as a purely cognitive problem, positioning it as a substitute as a medium for holistic schooling.

The qualitative findings spotlight that scholars engaged extra deeply with both mathematical content material and cultural contexts whilst values were included. One trainer noted how college students showed tolerance and teamwork in organization discussions, even as a student described feeling greater chargeable for the success of their institution challenge. these studies are regular with Muhaimin et al. (2023), who observed that problem-solving duties contextualized with neighborhood knowledge supported the Profil Pelajar Pancasila. despite the fact that, while Muhaimin centered on nearby

knowledge commonly, the prevailing study distinguishes itself by combining cultural contexts with explicit Pancasila cost integration in a dependent PjBL framework. This explicitness represents a novelty, as previous studies regularly addressed individual outcomes best implicitly.

Another critical contribution of this take a look at is its methodological rigor in taking pictures both quantitative and qualitative dimensions. The substantial difference in posttest ratings and the huge impact size provide strong evidence of the intervention's effect, whilst the statement statistics and pupil reflections illustrate the lived studies of inexperienced persons. This blended-strategies technique strengthens the validity of the conclusions and responds to calls with the aid of Himmi, Armanto, and Amry (2025) for extra complete analyses of PjBL in mathematics. moreover, via situating the look at in SMPN 7 Muaro Jambi, the research demonstrates the applicability of the version in a real study room context, presenting realistic insights for instructors searching for to put into effect comparable approaches.

Taken collectively, those findings advise that integrating ethnomathematics and Pancasila values into PjBL provides a effective framework for contextualized and price-orientated arithmetic education. even as earlier research showed the effectiveness of PjBL Hindun et al. (2025) and ethnomathematics (Rosa et al. 2016), the novelty of this take a look at lies in bringing together three dimensions—tradition, pedagogy, and country wide ideology into one coherent instructional model. This integration now not simplest strengthens cognitive capabilities however also fosters the enactment of values vital for Indonesian schooling. The contribution is twofold: theoretically, it expands the discourse on value-primarily based arithmetic schooling; nearly, it affords teachers with a model that aligns with the Merdeka Belajar curriculum and the wider task of making ready students as problem-solvers and responsible residents.

From a constructivist standpoint, students actively constructed mathematical meaning through hands-on modelling rather than memorizing procedures. The process of transforming weaving motifs into algebraic or geometric representations required them to reorganize prior knowledge, reinterpret cultural patterns, and evaluate the accuracy of their representations. This active engagement mirrors the principles of discovery and cognitive restructuring central to Piagetian constructivism. The cultural contexts also supported culturally responsive pedagogy as articulated by Geneva Gay, where instruction builds upon learners' cultural experiences to promote deeper comprehension. In this study, the familiarity of students with local Jambi weaving and architecture increased motivation, emotional relevance, and cognitive accessibility, thereby enabling more effective internalization of abstract geometric concepts.

The explicit integration of Pancasila values also contributed substantively to learning outcomes. Cooperation, tolerance, and responsibility—measured through observable behavioral indicators—increased by 21%, 18%, and 24% respectively. These findings align with value-based education frameworks that emphasize experiential enactment of values within authentic tasks rather than didactic instruction. Group tasks required students to negotiate roles, resolve disagreements, and maintain accountability, thereby reinforcing value internalization. The thematic analysis of qualitative data revealed three dominant themes: (1) collaborative reasoning, where students jointly formulated mathematical models using cultural artifacts; (2) respectful deliberation, where differences in strategies were accommodated without conflict; and (3) accountable contribution, where students demonstrated ownership of their assigned tasks. These themes collectively illustrate how cultural project contexts provide a naturalistic environment for nurturing Pancasila-aligned dispositions.

The ethnomathematics component played a distinctive role in strengthening problem-solving skills. Weaving motifs required students to identify repeating patterns, analyze tessellations, and map transformations, processes that inherently develop generalization, spatial reasoning, and inductive thinking. Architectural models, such as the proportional analysis of traditional Malay stilt houses, encouraged students to use ratio and similarity to generate mathematical models. These cognitively demanding tasks provided concrete entry points for abstract reasoning, making mathematical structures visible through tangible cultural representations. This aligns with Rosa and D'Ambrosio's framework, which asserts that cultural artefacts can function as epistemological anchors connecting lived experience with formal mathematical concepts (Arvianto et al. 2025; Wulandari, Hakim, and Kasyadi 2024).

The improvement in students' problem-solving performance can also be seen through the lens of the PjBL framework. In the orientation and planning phases, cultural problems provided authentic situations that enhanced problem comprehension, corresponding to Polya's first stage. The execution phase encouraged the development of strategies through experimentation with geometric constructions, fulfilling the second and third stages of Polya's problem-solving framework. The reflection and presentation phases allowed students to evaluate their models and articulate reasoning, which strengthened metacognitive monitoring and mathematical communication (Irkhamni, Nugroho, and Dwijayanthi 2025; Sari 2025).

In addition to cognitive gains, the integration approach demonstrated strong potential for character formation. The alignment of Pancasila values with collaborative project tasks ensured that moral and social competencies developed alongside mathematical competence. This result has theoretical implications for the design of character-oriented mathematics education, indicating that values are more effectively internalized when embedded within meaningful mathematical activity.

Theoretically, this study contributes to the growing discourse on value-based mathematics education by demonstrating that culturally grounded PjBL can serve as a coherent framework for uniting pedagogy, culture, and national ideology. Practically, the findings provide guidance for mathematics teachers seeking to implement Merdeka Belajar by showing how local cultural artefacts can be systematically mapped onto curriculum competencies to create meaningful learning experiences. For educational policy, the results suggest that national curriculum guidelines could explicitly encourage the use of ethnomathematics and value integration to promote holistic learning, particularly in regions with strong cultural identities.

The findings of this study generated several important research impacts. From an educational standpoint, the integration of ethnomathematics and Pancasila values into PjBL demonstrated that culturally grounded learning environments can significantly enhance students' higher-order thinking skills. This contributes empirical evidence supporting the idea that mathematics achievement can be strengthened through cultural contextualization, thereby challenging the long-standing assumption that mathematics must be taught through abstract, culture-free approaches.

Scientifically, this study expands the theoretical landscape of mathematics education by linking socio-cultural theory, constructivist learning, and value-based pedagogy within a single instructional model. The demonstrated improvement in both cognitive and character domains provides empirical support for interdisciplinary frameworks that merge cultural artefacts, collaborative inquiry, and moral education. These results enrich the academic discourse on holistic mathematics instruction and open new directions for ethnomathematics research that explicitly integrates national ideological values.

The study also carries broader cultural and societal impacts. By operationalizing weaving patterns and traditional architecture as mathematical learning resources, the intervention validated local cultural heritage as a legitimate source of mathematical knowledge. This may encourage schools, teachers, and communities to preserve and revitalize cultural artefacts through educational practice. In the long term, such culturally rooted mathematics learning has the potential to strengthen students' identity, cultural awareness, and social cohesion while simultaneously improving academic performance.

CONCLUSION

This study demonstrated that integrating ethnomathematics and explicit Profile of Pancasila Students indicators within PjBL offers a coherent pedagogical model that simultaneously strengthens mathematical reasoning and character formation. Conceptually, the findings affirm the theoretical position that cultural artefacts, when used as epistemic tools, can mediate deeper problem-solving processes and foster socially grounded mathematical understanding. By articulating how cooperation, tolerance, and responsibility emerge through culturally situated tasks, the study contributes to global ethnomathematics discourse, emphasizing that cultural mathematics is not merely contextual enrichment but a transformative framework for cognitive and moral development. This work also highlights the need for teacher professional development that equips educators to design culturally responsive mathematical tasks and assess value-oriented competencies systematically. At the curriculum level, the results support the inclusion of ethnomathematics and character integration as explicit components of

national policy, particularly within the Merdeka Belajar framework. Limitations related to sample size, cultural scope, and duration indicate that further research should explore broader cultural contexts, longitudinal impacts, and scalable implementation models. Overall, the study provides a theoretically grounded and practically viable pathway for advancing culturally rooted, value-oriented mathematics education in Indonesia and beyond.

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