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A Comparison of Cultural Practices in Primary School Mathematics Education between Indonesia and the Philippines

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Research Article

Keywords: Culture, Indonesia, Mathematics, Philippines, Primary school

Posted Date: July 14th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10019999/v1

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Additional Declarations: No competing interests reported.

Abstract

The aim of this study is to compare cultural practices in primary school mathematics education between Indonesia and the Philippines. The aspects examined in this comparative study of the two countries are policy and curriculum, cultural concepts, cultural characteristics, the scope of culture, and implementation in primary school mathematics education. This study employs a qualitative research method with a comparative study approach to describe and analyse the similarities and differences between the cultural practices of the two countries. The study began with a literature review covering educational literature in both countries, interviews with education experts, and an analysis of curriculum documents through official sources. The sampling technique used in this study was purposive sampling. The research procedure began with the stages of data collection, reduction, presentation, and drawing of conclusions. The findings indicate that Indonesia and the Philippines share similarities and differences in the aspects studied. The similarities between Indonesia and the Philippines lie in the concepts, scope, and implementation of cultural practices in mathematics education, whilst the differences between the two countries lie in policy and curriculum aspects and cultural characteristics.

1. Introduction

Mathematics education in primary schools does not merely focus on the mastery of concepts and computational skills, but also plays a role in shaping students' ways of thinking and their attitudes towards mathematics (Dwi Ersi Destari et al., 2026). In a global context, mathematics teaching is increasingly being directed towards more contextual and meaningful approaches, one of which involves the integration of culture into the learning process. Mathematics is not a discipline that is entirely neutral and universal, but is also bound to the social and cultural context in which learning takes place[1, 2] Recognising the cultural diversity of students is becoming increasingly important for creating learning that is inclusive and responsive to their backgrounds [3, 4]. Cultural practices in mathematics learning are believed to help students understand concepts more concretely because they are linked to everyday life experiences that are close to their environment.

Mathematics is viewed as a social practice that cannot be separated from its cultural context; therefore, teaching must take into account students' cultural backgrounds as an integral part of the knowledge-construction process [5, 6]. This approach aligns with the view that mathematical knowledge is constructed through social interaction and meaningful contextual experiences, rather than merely through procedural memorisation [7, 8].

Indonesia and the Philippines are two ASEAN member states that share close historical and cultural ties [9]. Indonesia and the Philippines are both situated in the same region, namely Southeast Asia. Geographically, Indonesia and the Philippines are very close to one another. Both countries are archipelagos with large populations. Indonesian and Filipino societies share similar cultural overlaps, each with their own distinctive characteristics and unique features [10]. These diverse and rich cultures hold great potential for integration into mathematics learning in primary schools.

Mathematics education in Indonesian primary schools continues to face challenges. Teaching practices in Indonesia tend to focus on procedures and rote learning, leaving little scope for students to construct knowledge in a contextual and meaningful way [11, 12]. Nevertheless, Indonesia possesses a wealth of local culture with great potential for integration into mathematics learning [13, 14]. The use of cultural contexts such as batik, traditional games, and local economic activities can significantly enhance students' understanding of mathematical concepts [15, 16]. However, the implementation of cultural integration in mathematics education remains suboptimal and tends to be sporadic, depending on the initiative of individual teachers [17]. Therefore, a more systematic approach is required to integrate cultural practices into mathematics education in Indonesia effectively and sustainably.

Meanwhile, in the Philippines, mathematics teaching in primary schools is evolving towards the integration of local contexts and contextual approaches into the learning process. The Philippine education curriculum emphasises the importance of linking learning materials to students' daily lives, including the use of local culture as a learning resource [18, 19]. Teachers in the Philippines are relatively more active in linking mathematical concepts to students' social and cultural practices, such as the use of community contexts, local economic activities, and traditional games in learning [20, 21]. This approach has been shown to increase student engagement and strengthen their conceptual understanding of mathematical content [22]. The Philippines demonstrates a more systematic tendency to integrate culture into mathematics learning, although it still faces challenges regarding the equitable quality of implementation across different regions [23, 24].

Empirical studies show that students who learn through familiar cultural contexts tend to have better problem-solving skills than those who learn through purely abstract approaches [25]. However, the implementation of culture-based approaches still faces challenges in terms of teacher readiness, limited learning resources, and the demands of standardised curricula [26, 27]. Therefore, further exploration is needed into how cultural practices can be systematically integrated into mathematics learning to improve the quality of primary education globally.

The integration of cultural practices into mathematics learning has been shown to increase student engagement, strengthen conceptual understanding, and foster the development of a positive mathematical identity [28]. Nevertheless, the implementation of culture-based approaches still faces various challenges, particularly within an educational system that tends to emphasise uniform curriculum standards [26, 27]. Therefore, more in-depth research is needed to understand how cultural practices can be effectively integrated into mathematics learning, particularly through a cross-national comparative approach involving countries with distinct cultural characteristics.

Differences in education systems, curriculum policies and socio-cultural backgrounds between Indonesia and the Philippines may influence how cultural practices are integrated into mathematics teaching. This raises questions about how each country utilises culture as a resource for learning mathematics, and to what extent such practices are effective in enhancing students' understanding and

engagement. A comparative study is therefore essential to identify the strengths and weaknesses of the respective practices implemented.

The aim of this study is to compare cultural practices in primary school mathematics education between Indonesia and the Philippines. The aspects examined in this comparative study of the two countries are policy and curriculum, cultural concepts, cultural characteristics, the scope of culture, and implementation in primary school mathematics education.

2. Methods

This study aims to compare cultural practices in primary school mathematics education between Indonesia and the Philippines. It employs a qualitative research method using a comparative study approach to describe and analyse the differences between the cultural practices of the two countries [29]. The aspects examined in the comparative study of the two countries are policy and curriculum, cultural concepts, cultural characteristics, the scope of culture, and implementation in primary school mathematics education. This study began with a literature review covering educational literature in both countries, interviews with education experts, and an analysis of curriculum documents through official sources.

The sampling technique used in this study was purposive sampling to compare cultural practices in both countries. The data collected were then analysed using a descriptive comparative approach, focusing on differences in cultural practices between Indonesia and the Philippines. Data validity in this study was tested using triangulation, whereby data from the same source were examined in different ways. The research procedure began with the stages of data collection, reduction, presentation, and drawing of conclusions [30]. The data analysis used in this study employed the Miles and Huberman method [31]. The first stage, data collection, was carried out by examining official curriculum documents and conducting in-depth interviews with expert informants in education in both countries. The second stage involved data reduction, where the researcher grouped and summarised the results of the interviews and document studies according to the aspects discussed in this study. The next stage was data presentation, where the data was described qualitatively and examined in relation to theory and previous research. The final step was drawing conclusions.

3. Findings

The study examined five aspects: policy and curriculum, the concept of culture, cultural characteristics, the scope of culture, and implementation in primary school mathematics teaching.

3.1 Policies and Curriculum

Table 1
Comparison of policies and curricula in the two countries

Component	Indonesia	Filipina
The responsible institution	Ministry of Primary and Secondary Education (Kemendikdasmen)	Department of Education (DepEd)
Curriculum	The Merdeka Curriculum	K-12 Curriculum
Curriculum structure	6 years of primary school, 3 years of lower secondary school, 3 years of upper secondary school	6 years of primary school, 4 years of lower secondary school, 2 years of upper secondary school
Language of Instruction	Indonesian	In the early years, the mother tongue is used as the primary language of instruction; in the upper years, English and Filipino become the primary languages of instruction
Subjects	Bahasa Indonesia, Matematika, IPAS, PPKn, Agama, PJOK, SBdP	Mother Tongue, Filipino, English, Mathematics, Science, Social Studies (Araling Panlipunan), Character Education (EsP), Seni dan Olahraga (MAPEH), Keterampilan hidup dan teknologi (EPP/TLE)
Skills	Critical Thinking, Creative Thinking, Communication, Collaboration	Communication, Learning and Innovation, Technology, Life and Career
Learning focus	Development of skills and character, flexibility, focus on core content	Basic literacy and numeracy, character and values development, gradual mastery of academic concepts, readiness for the next stage of education
Objectives of mathematics learning	1. mathematical understanding and procedural skills; 2. mathematical reasoning and proof 3. mathematical problem-solving 4. mathematical communication and representation 5. mathematical connections 6. mathematical disposition	1. Mastering basic mathematical concepts 2. Developing logical thinking skills 3. Understanding patterns and relationships between numbers 4. Solving simple problems 5. Preparing students for more advanced mathematical concepts

*Adapted from the curriculum documents of both countries

The curriculum in the Philippines emphasises contextualisation, localisation and a learner-centred approach. It encourages teachers to link lessons to the cultural background and social realities of their

students.

The Philippine Department of Education has specific policies that support the use of local cultural contexts in education, including: (1) Localisation and Contextualisation; this policy encourages teachers to adapt the curriculum to reflect the local environment, culture and experiences of learners. Lesson content, examples, and teaching materials are modified to make learning more relevant and meaningful to students' daily lives. This ensures that education is not uniform, but responsive to the community context; (2) Mother-Tongue-Based Multilingual Education (MTB-MLE), which encourages the use of students' first language as the medium of instruction, particularly in the early years. By using their mother tongue, students can better understand concepts, express ideas more clearly, and connect their learning to their cultural identity. This policy also supports a smoother transition to additional languages such as Filipino and English. These policies aim to integrate local culture and languages into teaching, making education more inclusive, effective, and culturally responsive.

Curriculum policies generally support cultural integration by promoting flexibility, contextualisation and localisation, as emphasised by the Department of Education in the K-12 Basic Education Curriculum. These policies guide teachers to incorporate local culture, practices and real-life experiences into the teaching and learning process, and encourage the use of Philippine contexts rather than relying solely on examples from abroad. However, these policies may also present certain limitations. Challenges include a lack of sufficiently localised teaching materials, resource constraints, and pressure from standardised assessment, which can limit teachers' flexibility. Furthermore, not all teachers receive adequate training to fully implement a culturally responsive approach. Overall, whilst curriculum policies in principle strongly support cultural integration, their effectiveness in practice depends on the availability of resources, teacher readiness, and institutional support.

Meanwhile, education policy in Indonesia has generally provided scope for the integration of culture into learning, including in mathematics lessons in primary schools. The Merdeka Curriculum emphasises the importance of contextual, meaningful learning that is oriented towards character building through the Pancasila Student Profile. In this context, local culture plays a vital role as a source of values and a learning context. Project-based learning, differentiated instruction, and experiential learning provide opportunities for teachers to integrate cultural elements into teaching and learning activities.

However, these policies have not yet explicitly regulated the integration of culture into school subjects, including mathematics. The lack of detailed technical guidelines means that implementation in the classroom relies heavily on teachers' interpretation and creativity. Some teachers have attempted to link mathematics content to local culture, whilst others continue to focus on conventional, abstract approaches. This highlights a gap between general policy and implementation practices that remain uneven.

3.2 Concept of Culture

In the context of education in the Philippines, culture refers to the beliefs, values, traditions, language and everyday practices shared by the Filipino community, which influence the way learners think, behave and interact. Culture is a broad system encompassing beliefs, traditions and ways of life. Local values, on the other hand, are guiding principles (for example, bayanihan, respect, hospitality).

Culture in education means integrating our own beliefs, traditions and practices into the teaching and learning process. This shapes both the teaching approach and the learning experience, and enables learners to better understand and appreciate their Filipino identity and heritage. In an era of globalisation where learners are frequently exposed to foreign influences, this approach helps them remain rooted in their own culture whilst remaining open to other cultures. In this way, education becomes a tool not only for acquiring knowledge, but also for strengthening Filipino identity.

The curriculum in the Philippines supports cultural integration in mathematics education by encouraging contextualisation and localisation. Teachers are encouraged to link mathematical concepts to real-life experiences, community practices and the cultural backgrounds of their students. This is achieved through the use of practical activities, problem-solving tasks based on everyday situations, and examples drawn from local contexts. Such an approach makes mathematics more meaningful, relevant and engaging for learners, whilst fostering an appreciation of their own culture.

In the context of mathematics education in Indonesia, culture is understood as the totality of values, norms, customs, language and life experiences that students possess as part of their social identity. Culture is not merely a background factor, but a key element that influences how students think, understand, and respond to learning. Culture is seen as a means of bridging students' understanding of abstract mathematical concepts. By linking learning materials to familiar cultural contexts, students find it easier to grasp concepts and see the relevance of mathematics in real life.

3.3 Cultural Characteristics

Cultural characteristics of Filipino society that are relevant to education include strong family ties, respect for authority, communal cooperation (bayanihan), piety, and adaptability. These values shape students' behaviour, participation and relationships with teachers, particularly in primary school settings.

Based on the programme "A Moral Recovery Programme: Building a People, Building a Nation", several Filipino character strengths have been identified that are highly relevant to education. These include: pakikipagkapwa-tao (a sense of shared identity and concern for others), a strong family orientation, cheerfulness and humour, flexibility, adaptability and creativity, hard work and perseverance, faith and religiosity, and the ability to survive.

In an educational context, these characteristics influence the way students interact, collaborate and respond to learning. For example, 'pakikipagkapwa-tao' encourages cooperation amongst students, whilst respect for authority promotes order in the classroom. On the other hand, traits such as adaptability and resilience help students overcome challenges in their learning.

Indonesian culture is highly diverse, context-specific and rich in local values. This diversity is reflected in the cultural differences between regions, such as batik patterns in Java, woodcarvings in Bali, traditional houses in Sumatra, and various traditional games throughout Indonesia. These cultural characteristics offer great potential for mathematics learning as they provide a variety of real-world contexts that can be used to explain mathematical concepts such as patterns, symmetry, geometric shapes, and measurement.

In addition to its diversity, Indonesian culture is also characterised by a collective spirit and is rich in social values, such as mutual assistance, cooperation and solidarity. These values support the implementation of collaborative learning in mathematics, where students can learn through social interaction and group discussions.

3.4 The Scope of Culture

The cultural values that most influence the learning process in the Philippine context include pakikipagkapwa-tao, family orientation, respect for authority, bayanihan (community cooperation), faith and religion, and adaptability. According to “A Moral Recovery Program: Building a People, Building a Nation”, these values are among the core strengths of the Filipino character and play a vital role in education. Pakikipagkapwa-tao fosters cooperation and positive interpersonal relationships, whilst family orientation shapes students’ motivation and support systems. Respect for authority influences classroom discipline and students’ responsiveness to teachers.

Furthermore, bayanihan encourages collaborative learning, and religious beliefs often serve as a guide for students’ values and behaviour. Adaptability and resilience help students overcome academic challenges and navigate an ever-changing learning environment. Overall, these cultural values shape the way students participate, interact and engage in the learning process.

Diversity significantly shapes cultural concepts in education in the Philippines, making it pluralistic and inclusive. Given the country’s linguistic and ethnic diversity, the culture of education is not monolithic but comprises a variety of identities, traditions and perspectives. This diversity influences the way the teaching and learning process is carried out. Teachers need to adapt their teaching to different languages, cultural backgrounds and socio-economic contexts. This influences how teaching materials are designed, the examples used in lessons, and the opportunities provided to learners.

Although diversity presents both challenges and benefits, it ultimately enriches the teaching and learning process. Diversity helps to hone students’ skills, shape their mindset, and prepare them to adapt to a multicultural society. By recognising diversity, education becomes more responsive, inclusive and meaningful for all learners.

The cultural materials used in learning are drawn from textbooks and teacher’s guides, the experiences of the local community, materials and examples from indigenous communities, learners’ prior knowledge, and real-life scenarios from the community. Mathematical topics that can be integrated with culture include: basic operations (using market situations), measurement (using local tools or practices),

and geometry (patterns in weaving and handicrafts). These topics are easier to understand because they are naturally linked to everyday life and observable cultural practices.

In Indonesia, the scope of culture that can be integrated into mathematics teaching in primary schools is vast and encompasses various aspects of community life. This scope includes arts and crafts (such as batik, weaving and basketry), traditional games, economic activities such as buying and selling at markets, traditional measurement systems, and even traditional architecture. Each of these aspects contains mathematical concepts that can be explored in the classroom.

3.5 Implementation in mathematics teaching

Certain cultural aspects can be integrated into mathematics teaching at primary school level, particularly within the framework of the K-12 Basic Education Curriculum, which emphasises contextualisation and localisation. These aspects include: (1) Language, using local dialects to explain mathematical concepts to enhance understanding; (2) Everyday customs, incorporating real-life activities such as buying and selling into word problems; (3) Local traditions, using examples from celebrations, handicrafts, and community practices; (4) Traditional games, applying counting, patterns, and basic operations through games, (5) Economic activities, integrating contexts such as farming and fishing to teach measurement, quantity, and problem-solving.

These cultural aspects are integrated through practical activities, real-life problem-solving tasks, and examples drawn from the students' immediate surroundings. By linking mathematics to students' everyday experiences and cultural backgrounds, teachers make learning more meaningful, relevant and engaging. At the same time, this approach helps students appreciate their own culture whilst developing essential mathematical skills.

Everyday cultural practices are often used as a context in mathematics learning, particularly through the contextual learning approach recommended in the K-12 Primary Education Curriculum. Teachers are encouraged to draw on students' everyday experiences as examples to make lessons more relevant and easier to understand. For example, market scenarios are often used to teach addition, subtraction and problem-solving. Activities such as buying and selling help students apply mathematical concepts in real-life situations. These familiar contexts make learning more meaningful and engaging, and greatly support students in developing their problem-solving skills.

Teachers are encouraged to integrate cultural elements into the learning process through several mechanisms provided by the Department of Education: (1) Curriculum guidelines. These guidelines outline competencies and encourage the use of examples that are contextualised and adapted to the culture and environment of the learners, (2) Teacher handbooks. These provide examples of activities, lesson plans and strategies that incorporate real-life and cultural contexts, (3) DepEd training and seminars. Teachers undergo continuous professional development, including training on culturally responsive and contextual teaching approaches. Even prior to and during the implementation of the K-12 Basic Education Curriculum, teachers were provided with reskilling and upskilling programmes to help

them adapt to these changes, (4) Teaching supervision: Headteachers and supervisors monitor and support teachers in applying culturally relevant strategies within the classroom. These mechanisms emphasise contextual and culturally responsive teaching, ensuring that lessons are meaningful, inclusive, and connected to learners' cultural backgrounds.

The implementation of cultural elements in mathematics teaching in primary schools in Indonesia is generally still limited and has not yet been systematically integrated into lesson planning. Teachers no longer simply present mathematical concepts in the abstract, but strive to link them to real-life experiences that are relevant to the students' daily lives. In practice, teachers use everyday contexts such as buying and selling activities in the local community, family routines, and social interactions within the community as part of the learning process.

Mathematical topics that can be integrated with cultural contexts include: geometry can be linked to the shapes of buildings or objects in the students' surroundings, whilst patterns and sequences can be found in various arrangements or regularities that they observe in everyday life. To teach line symmetry and rotational symmetry, for example, teachers use batik patterns. Traditional games are used to introduce the concepts of numbers and arithmetic operations. Number concepts and arithmetic operations can also be linked to social activities such as buying and selling or sharing within the family. Measurement topics can be linked to students' habits of estimating length, time, or quantity in daily activities. Furthermore, fractions can be understood through the experience of dividing something fairly, and simple statistics can be developed through observation of habits or conditions in the surrounding environment. Thus, almost all mathematical content has the potential to be integrated with local culture if teachers are able to link it to students' real-life experiences, thereby making learning more relevant, inclusive, and easy to understand.

Mathematics education is no longer viewed merely as a process of transferring cognitive knowledge, but rather as a means of developing higher-order thinking skills that are adaptable to the complexities of modern life [32]. In line with this, learning approaches that emphasise conceptual understanding and real-life connections are increasingly recognised as effective practices for improving the quality of mathematics learning at primary school level [33].

Cultural practices, including language, values and the daily activities of communities, play a significant role in shaping students' mathematical thinking and the strategies they use to solve problems [34, 35]. The cultural diversity of students is becoming increasingly important for creating inclusive learning that is responsive to their backgrounds [3, 4]. Furthermore, the integration of cultural practices into mathematics learning has been shown to increase student engagement, strengthen conceptual understanding, and foster the development of a positive mathematical identity [28].

Mathematics is viewed as a social practice that cannot be separated from its cultural context; therefore, teaching must take into account students' cultural backgrounds as an integral part of the knowledge-construction process [5, 6]. Mathematical knowledge is constructed through meaningful social interaction and contextual experiences, not merely through procedural memorisation [7, 8]. Culture plays

a significant role in shaping how students interpret symbols, understand concepts, and develop problem-solving strategies relevant to their environment [36].

The integration of cultural practices into mathematics teaching can enhance students' cognitive and affective engagement, as the material taught is more closely aligned with their lived experiences [37]. Furthermore, recognition of students' cultural practices also contributes to the creation of inclusive and equitable learning, particularly in the context of multicultural classrooms [38].

The use of batik patterns in geometry lessons, buying and selling activities in traditional markets to understand arithmetic concepts, and traditional games as a medium for exploring mathematical concepts have proven effective in enhancing students' conceptual understanding [39]. Furthermore, the language and symbols used within specific communities also influence how students interpret mathematical concepts, meaning that teaching approaches need to be adapted to the linguistic and cultural context of the students [40, 41].

Indonesia possesses a wealth of local culture that holds great potential for integration into mathematics education through an ethnomathematics approach [13, 14]. The use of cultural contexts such as batik, traditional games, and local economic activities can significantly improve students' understanding of mathematical concepts [15, 16]. Students who learn through familiar cultural contexts tend to have better problem-solving skills compared to students who learn through abstract approaches alone [25].

The education curriculum in the Philippines emphasises the importance of linking learning content to students' daily lives, including the use of local culture as a learning resource [18, 19]. Teachers in the Philippines are relatively more active in linking mathematical concepts to students' social and cultural practices, such as the use of community contexts, local economic activities, and traditional games in learning [20, 21]. This approach has been shown to increase student engagement and strengthen their conceptual understanding of mathematical content [22].

The uniqueness of the approach in the Philippines lies in its emphasis on community-based contextual learning that directly links mathematics to students' real-life experiences [42, 43]. Nevertheless, as is the case in Indonesia, the Philippines also continues to face challenges in improving the overall quality of mathematics education, particularly in consistently developing students' critical thinking and problem-solving skills [44, 45].

4. Conclusion

Overall, cultural practices in mathematics education in primary schools in Indonesia and the Philippines reveal both common ground and complementary differences. The similarities between the two countries are evident in the concepts, scope and implementation of cultural practices in mathematics education in primary schools. Culture is viewed as an important part of the students' learning experience, used to make learning more contextual, relevant and meaningful. In both Indonesia and the Philippines, teachers are beginning to link mathematics content to students' daily lives and utilise the social and cultural

environment as a learning resource. However, differences emerge in terms of policy and curriculum, as well as cultural characteristics. Indonesia tends to provide implicit and flexible space for cultural integration, whilst the Philippines is relatively more directed in accommodating cultural diversity within its educational policies. Furthermore, Indonesia's highly diverse and heterogeneous cultural characteristics offer a wide range of contextual opportunities, whereas the Philippines has a different pattern of diversity, which influences how culture is integrated into learning. This comparison thus shows that, although both countries share a similar practical foundation in utilising culture as a context for mathematics learning, differences in policy and cultural characteristics lend a distinct character to its implementation in each country.

Declarations

The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Competing interests

The authors declare no competing interests

Ethics approval

All research procedures involving participants were reviewed and approved by the Research Ethics Committee of Universitas Negeri Surabaya. All experiments were performed in accordance with relevant guidelines and regulations and complied with the ethical standards for research involving human participants. Prior to participation, all participants and/or their legal guardians (where applicable) were provided with adequate information regarding the aims, procedures, benefits, and potential risks of the study, and gave their voluntary informed consent to participate. The rights, dignity, privacy, and confidentiality of all participants were protected throughout the research.

Consent to participate

All research procedures and experiments were performed in accordance with relevant guidelines and regulations. Prior to participation, all expert informants were provided with adequate information regarding the purpose, procedures, and intended use of the research. Informed consent was obtained verbally from all informants before the interviews were conducted. Participation was entirely voluntary, and the informants agreed to the use of their responses for academic research purposes. No written consent form was obtained, as the interviews were conducted with informants in their professional capacity as education experts rather than as research subjects involving sensitive or identifiable personal information.

Consent to publish

Not Applicable

Funding

This research was funded by the Research and Innovation for Advanced Indonesia (RIIM) Grant, managed by the Lembaga Pengelola Dana Pendidikan (LPDP), Ministry of Finance of the Republic of Indonesia, in collaboration with the National Research and Innovation Agency (Badan Riset dan Inovasi Nasional/BRIN). The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Author Contribution

V.A.N: Writing – review & editing, Writing – original draft, Conceptualization. W: Writing – review & editing. R.E: Writing – review & editing, Validation, Resources, Data curation. S: Writing – review & editing, Supervision, Resources, Data curation. N.M: Writing – review & editing, Supervision, Conceptualization. All authors reviewed the manuscript.

Acknowledgments

This research was supported by the RIIM LPDP Grant and the National Research and Innovation Agency (BRIN). The authors gratefully acknowledge this financial support, which made this study possible.

Data availability

The datasets used and/or analysed during this study are available from the relevant authors upon reasonable request.

References

1. Müller D. The Ethical Turn in Mathematics Education.
2. Marshall SA. But What Does it Look Like in Maths? A Framework for Culturally Sustaining Pedagogy in Mathematics The Foundations of Culturally Sustaining Pedagogies Conceptualizing Culture A Framework for Culturally Sustaining Pedagogies in Mathematics Conclusion Acknowledgements Notes References Author Contact. Int J Multicultural Educ. 2023.
3. Fitriadi F, Sinaga RM, Muhammad RR. A Literature Review on the Cultural Perspective Study in Elementary School Education in Indonesia. J Innov Educational Cult Res. 2024;5(1):51–61. 10.46843/jiecr.v5i1.848.

4. Schwarzenthal M, Schachner MK, Juang LP, van de Vijver FJR. Reaping the benefits of cultural diversity: Classroom cultural diversity climate and students' intercultural competence. Eur J Soc Psychol. 2020;50(2):323–46. 10.1002/ejsp.2617.
5. Darmayanti R, Widodo J. Filsafat dan Teori Pendidikan Pembelajaran Matematika untuk Berfkir Kritis dan Kreatif. Penerbit Adab; 2024.
6. Sartika D, Suastra IW, Tika IN, Atmaja AWT, Syarifuddin S. Filsafat Postmodern dalam Pembelajaran Matematika: Paradigma Kultural, Pedagogik, dan Teknologi. JagoMIPA: Jurnal Pendidikan Matematika dan IPA. 2025;5(4):1581–91. 10.53299/jagomipa.v5i4.3507.
7. Schaathun HG. On Understanding in Mathematics. Teach Math its Appl. 2022;41(4):318–28. 10.1093/teamat/hrac016.
8. Siregar T. Effectiveness of the Problem-Based Learning Model in Improving Students' Mathematical Communication Skills and Learning Motivation [Internet]. 2025. Available from: https://www.preprints.org/manuscript/202510.1562/v1 10.20944/preprints202510.1562.v1
9. Satrio Ramadhan. Diplomasi Indonesia-Filipina dalam Memperkuat Kesatuan ASEAN dan Tantangan Politik Regional. Desentralisasi: Jurnal Hukum, Kebijakan Publik, dan Pemerintahan. 2025;2(4):70–6. 10.62383/desentralisasi.v2i4.1203
10. Azis MNI, Saptaningrum I, Fawaid I, Setiawan AM. Mencari Identitas: Dinamika Masyarakat Perbatasan Indonesia-Filipina, 1975–2014. Jurnal Ilmu Sosial dan Humaniora. 2024;13(1):175–90. 10.23887/jish.v13i1.74945.
11. Apriva Hidayana R, Lianingsih N. Contextual Learning as a Means to Improve Elementary School Students' Mathematical Literacy Skills. Int J Ethno-Sciences Educ Res. 2025;5(2):46–50.
12. Khasanah BA, Prahmana RCI, Adiputra S, Arnal-Palacián M. The beauty of mathematics in Indonesian culture: An impactful and meaningful context in number patterns learning. JRAMathEdu (Journal of Research and Advances in Mathematics Education). 2025 Apr 30. 10.23917/jramathedu.v10i2.10441
13. Hartoyo A, Fitriawan D, Siregar N, Ganda Putra F. Connecting cultural roots with mathematical thinking: A comprehensive meta-analysis of ethnomathematics practices in indonesian classrooms. Al-Jabar: Jurnal Pendidikan Matematika. 2025;16(2):673–89. 10.24042/ajpm.v16i2.28734.
14. Susanti RM, Gunansyah G, Nasution N. Integrating Local Culture into Mathematics Learning: Ethnomathematics Approach Using Udeng Pacul Gowang in Elementary Schools. J Innov Res Prim Educ. 2025;4(3):947–57. 10.56916/jirpe.v4i3.1472.
15. Lidinillah DAM, Rahman, Wahyudin, Aryanto S, INTEGRATING SUNDANESE ETHNOMATHEMATICS INTO MATHEMATICS CURRICULUM. AND TEACHING: A SYSTEMATIC REVIEW FROM 2013 TO 2020. Infinity J. 2022;11(1):33–54. 10.22460/infinity.v11i1.p33-54.
16. Solihin A, Mariana N, Rahmawati I, Abidin Z. Cultural Exploration as Realistic Context in Mathematics Learning: An Ethnomathematics Perspective in Indonesian Elementary Education. Glocal Praxis in Elementary Education. 2025.

17. Alam A, Mohanty A. Cultural beliefs and equity in educational institutions: exploring the social and philosophical notions of ability groupings in teaching and learning of mathematics. International Journal of Adolescence and Youth. Routledge; 2023. 10.1080/02673843.2023.2270662
18. Castro-Caliboso J, Bagalay BD, Santiago MGA, Bayan RT, Aguinaldo IA, Belo JA. Literary Texts as Cultural Tools: A Study on Contextualized Learning Strategies in Philippine Higher Education. Int J Cult History Relig. 2025;7(SI2):340–55. 10.63931/ijchr.v7iSI2.205.
19. Gadaza AC, Manera AB, Santos SD, Alih CB, Caban RM, Tulawie AU. Reviving the Past, Teaching the Future: The Role of Philippine Cultural Heritage in Curriculum Development of Teacher Education Programs Focus. Int J Cult History Relig. 2025;7(SI2):80–97. 10.63931/ijchr.v7iSI2.169.
20. Luzano JF. Multifaceted structures of mathematics education in the Philippines: a case analysis. Diversitas J. 2024;9(3). 10.48017/dj.v9i3.3062.
21. Repuya CR, Gabia CL, Ballaran CL, Mayores FN, Bronzal MKVE, Noora NV, et al. Integrating Traditional Games (TG) in Mathematics to Enhance Students' Conceptual Understanding, Social Skills, and Attitudes. Participatory Educational Res. 2025;12(4):62–81. 10.17275/per.25.49.12.4.
22. Gebremeskel AA, Ayele MA, Wondimuneh TE. Student engagement, conceptual-understanding, and problem-solving ability in learning plane geometry through an integrated instructional approach. Eurasia J Math Sci Technol Educ. 2025;21(5). 10.29333/ejmste/16391.
23. Espinosa AA, Elipane LE. Cultural and Linguistic Factors in the Effective Use of Lesson Study with Mathematics and Science Teachers in the Philippines. Int J Innov Sci Math Educ. 2025.
24. Payadnya IPAA, Wulandari IGAPA, Puspadewi KR, Saelee S. The significance of ethnomathematics learning: a cross-cultural perspectives between Indonesian and Thailand educators. J Multicultural Educ. 2024;18(4):508–22. 10.1108/JME-05-2024-0049.
25. Amalia L, El Hakim L, Learning Design. To Improve Mathematical Problem-Solving Skills Using a Contextual Approach [Internet]. Available from: http://Jiip.stkipyapisdompu.ac.id
26. Patras YE, Juliani A, Nurhasanah N, Maksum A, Hidayat R. A Review of Culture-Based Learning at Primary Level In Indonesia. AL-ISHLAH: Jurnal Pendidikan. 2023;15(3). 10.35445/alishlah.v15i3.3525
27. Rasidi R, Istiningsih G. Education based on local wisdom: An alternative model for the integration of cultural values in the school curriculum in Indonesia. BIS Educ. 2025;1:V125027. 10.31603/bised.175.
28. Firdaus M, Nasution AA, INTEGRATING MATHEMATICS COMMUNITY, CULTURE PLACE. A CONCEPTUAL FRAMEWORK FOR INSTRUCTIONAL DESIGN. Journal of Education, Teaching, and Learning. 2023;8:249–60.
29. Cahya AI, Elizar E, Badawi B, Masitoh M, Rachmatia M, Apriza B. Primary Education in Southeast Asia: A Comparative Analysis between Indonesia and Philippines School Curriculum. AL-ISHLAH: Jurnal Pendidikan. 2024;16(2). 10.35445/alishlah.v16i2.4817
30. Lester JN, Cho Y, Lochmiller CR. Learning to Do Qualitative Data Analysis: A Starting Point. Hum Resour Dev Rev. 2020;19(1):94–106. 10.1177/1534484320903890.

31. Huberman M, Miles MB. The qualitative researcher's companion. Sage; 2022.
32. Gradini E, Firmansyah BFB, Noviani J, Ulya K. Fostering Higher-Order Thinking Skills in Mathematics Education: Strategies, Challenges, and Classroom Practices. Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram. 2025;13(2):135. 10.33394/j-ps.v13i2.15099
33. Saleh Haji. NCTM's Principles and Standards for Developing Conceptual Understanding in Mathematics. J Res Math Trends Technol. 2019;1(2):56–65. 10.32734/jormtt.v1i2.2836.
34. Agbata BC, Obeng-Denteh W, Kwabi PA, Abraham S, Okpako SO, Arivi SS, et al. Everyday uses of mathematics and the roles of a mathematics teacher. Sci World J. 2024;19(3):819–27. 10.4314/swj.v19i3.29.
35. Hiltrimartin C, Afifah A, Scristia, Pratiwi WD, Handrianto C, Rahman MA, ANALYZING STUDENTS' THINKING IN MATHEMATICAL PROBLEM SOLVING USING VYGOTSKIAN SOCIOCULTURAL THEORY. Revista de Gestao Social e Ambiental. 2024;18(1). 10.24857/rgsa.v18n1-105.
36. Boakye-Yiadom F, Donkor EK, Mensah RO. Exploring the role of project-based learning in higher education to promote indigenous knowledge through sculpture students' engagement with Ghanaian Adinkra symbols. Discover Global Soc. 2025;3(1). 10.1007/s44282-024-00135-8.
37. Gabales WL. The Influence of Integrating Interdisciplinary Tasks on Mathematics Cognitive Development and Student Engagement. Pakistan J Life Social Sci (PJLSS). 2024;22(2). 10.57239/pjlss-2024-22.2.001429.
38. Markey DK, O' Brien DB, Kouta DC, Okantey C, O' Donnell DC. Embracing classroom cultural diversity: Innovations for nurturing inclusive intercultural learning and culturally responsive teaching. Teaching and Learning in Nursing. Elsevier Inc.; 2021. pp. 258–62. 10.1016/j.teln.2021.01.008.
39. Fitriyah N, Wiryanto, Ekawati R, Mariana N, Siswono TYE. Ethnomathematics in Sidoarjo Batik Motifs: An Ethnographic Study of Mathematical Concepts in Local Cultural Artifacts. J Innov Res Prim Educ. 2025;4(3):1251–60. 10.56916/jirpe.v4i3.1531.
40. Al-Tarawneh A. Bridging Languages and Numbers: Exploring the Intersection of Translation Studies and Mathematics. Appl Math Inform Sci. 2024;18(3):513–9. 10.18576/amis/180303.
41. Maanu V, Asare B. Linguistics and mathematics meaning. Front Educ Front Media SA. 2025. 10.3389/feduc.2025.1657529.
42. Dankunprasert S, Cojorn K, Sonsupap K, Choompunuch B, Ranmechai S, Nonsuwan A, et al. Bridging knowledge and community: Innovative community-based learning to strengthen mathematic pre-service teachers' problem-solving competency. Eurasia J Math Sci Technol Educ. 2025;21(10). 10.29333/ejmste/17179.
43. Quimat RM, Picardal M. Context-Based Teaching through Education for Sustainable Development in Philippine Secondary Schools: A Meta-analysis. Recoletos Multidisciplinary Res J. 2024;12(1):25–40. 10.32871/rmrj2412.01.03.
44. Kevin A, Artuz J, Roble B. Developing Students' Critical Thinking Skills in Mathematics Using Online-Process Oriented Guided Inquiry Learning (O-POGIL). Am J Educ Res. 2021;9(7):404–9. 10.12691/education-9-7-2.

45. MASJUDIN M. STRENGTHENING 21ST CENTURY SKILLS THROUGH AN INDEPENDENT CURRICULUM IN MATHEMATICS EDUCATION IN INDONESIA. CHALLENGES, POTENTIAL, AND STRATEGIES. Int J Appl Sci Sustainable Dev (IJASSD). 2024;6(2):92–113. 10.36733/ijassd.v6i2.9087.