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Ethnomathematics in Mathematics Education: An Integrative Literature Review on Strengthening Citizenship within Graduate Profile Dimensions

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ABSTRACT
Ethnomathematics has been widely studied in mathematics education, with most research focusing on the exploration of mathematical concepts within cultural practices or the development of culture-based learning innovations. However, limited studies have specifically addressed how ethnomathematics can be systematically aligned with the Strengthening Graduate Profile Dimensions (SGPD), particularly in supporting the citizenship dimension within the current curriculum framework. Based on the researcher's best search, limited literature has addressed the relevance of ethnomathematics to support the SGPD vision. This study employs an integrative literature review (ILR) to analyze 51 peer-reviewed articles published between 1980 and 2022, primarily sourced from the Scopus and Google Scholar databases, to examine the relevance of ethnomathematics to the SGPD curriculum and its practical applications in mathematics education. The analysis is grounded in theoretical perspectives, including multiculturalism, contextual learning, and culture-based pedagogy. This study develops a theoretical framework integrating constructivism, multiculturalism, RME, CTL, CRT, and CC to explain the role of ethnomathematics in supporting SGPD implementation. Within this framework, culture functions as a contextual and pedagogical foundation for strengthening students' citizenship values. Several examples of specific applications of ethnomathematics discussed in the literature align with the theoretical lens used. It must be acknowledged that there is still room to develop ethnomathematics as an intervention to improve mathematics learning in the establishment of Student Graduate Profiles.
Keywords: Culture, Curriculum, Ethnomathematics, Student Graduate Profile.

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Introduction

The implementation of the National Curriculum, introduced by the Indonesian Ministry of Primary and Secondary Education (Kemendikdasmen), reflects a strategic effort to improve the overall quality of education; however, empirical findings indicate that its implementation remains constrained by several practical challenges, particularly in the context of mathematics instruction (Ambarwati, 2022). One critical issue is teachers' limited capacity to translate the abstract formulation of the Eight Graduate Profiles, as stipulated in the Regulation of the Minister of Primary and Secondary Education Number 10 of 2025 (Kemendikdasmen, 2025), into concrete, measurable classroom practices. These profiles encompass not only cognitive competencies but also complex dispositions such as critical thinking, problem-solving,

and citizenship, which are often difficult to operationalize within conventional mathematics teaching that tends to prioritize procedural knowledge. Consequently, teachers frequently encounter difficulties in designing learning experiences that simultaneously address conceptual understanding and the broader dimensions of Strengthening Graduate Profile Dimensions (SGPD). Although professional development initiatives and the scientific literature are available, existing studies rarely provide explicit guidance on how to effectively align curriculum mandates with contextually meaningful mathematics instruction. This gap highlights the need for pedagogical approaches that can bridge policy expectations with classroom realities, particularly those that situate mathematical learning within relevant and authentic contexts.

The implementation of the National Curriculum, introduced by the Indonesian Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), reflects a strategic effort to enhance the overall quality of education; however, empirical findings indicate that its enactment remains constrained by several practical challenges, particularly in the context of mathematics instruction (Ambarwati, 2022). One critical issue is teachers' limited capacity to translate the abstract formulation of the Eight Graduate Profiles, as stipulated in the Regulation of the Minister of Primary and Secondary Education Number 10 of 2025 (Kemendikdasmen, 2025), into concrete, measurable classroom practices. These profiles encompass not only cognitive competencies but also complex dispositions such as critical thinking, problem-solving, and citizenship, which are often difficult to operationalize within conventional mathematics teaching that tends to prioritize procedural knowledge. Consequently, teachers frequently encounter difficulties in designing learning experiences that simultaneously address conceptual understanding and the broader dimensions of SGPD. Although professional development initiatives and the scientific literature are available, existing studies rarely provide explicit guidance on how to effectively align curriculum mandates with contextually meaningful mathematics instruction. This gap highlights the need for pedagogical approaches that can bridge policy expectations with classroom realities, particularly those that situate mathematical learning within relevant and authentic contexts.

One of the elements in the eight Graduate Profiles emphasizes the citizenship profile. Nationalism is part of this profile, so it is hoped that students will be able to love and maintain their culture and identity as members of the nation (Rohmah et al., 2022). This element serves as the primary foundation for fostering citizenship within a multicultural framework. In this article, nationalism is positioned as part of the eight dimensions of the Graduate Profiles and is discussed as the primary focus of the research.

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Culture and knowledge are interrelated entities and cannot be separated in aspects of citizenship (Vasconcellos & Sobrinho, 2014). Culture is embedded in social processes and reflects the action of producing knowledge (Pottier, 2003). Knowledge is produced from interactions between humans and their environment and is bound by culture (Habermas, 1971). A more complete knowledge of these interactions requires sensitivity to the role of culture in the context of theorizing human behavior, conducting empirical studies, and interpreting observed findings (Tam & Milfont, 2020). Furthermore, discussing aspects of social diversity in the culture-based learning process is relevant to paying closer attention to in the curriculum. This further fosters students' sense of love for their homeland (nationalism), which becomes part of their citizenship

Mathematics, as a subject taught in schools, tends to be taught independently of culture in practice (Rosa & Orey, 2011). In contrast to this, mathematics is knowledge about culture that grows and develops according to human needs (Umbara et al., 2021). Mathematics is a scientific discipline whose use is very close to everyday life. This shows that mathematics will always be used in social life (Pathuddin et al., 2021). Evidence of typical mathematical activities carried out by society, such as counting, sorting, measuring, and weighing, is carried out in very different ways from the material taught in school (Crowell, 2023). Mathematics learning is not directed towards being directly related to culture, so learning is far from reality and the real context (Angraini & Wahyuni, 2020). This is what makes most people think that mathematics is difficult. Students' perception of the complexity of mathematics is indirectly formed.

Ethnomathematics exists as a way in which people use culture in mathematical concepts to deal with relational and spatial aspects of their lives (Borba, 1997). Ethnomathematics approaches reports on the use of mathematics by various cultural groups, to applications in classrooms (Shirley & Palhares, 2013). Other experts define ethnomathematics as the application of learning adapted from mathematical concepts in daily activities (Rubio, 2016).

Mathematics should not only be taught but also practiced, especially those related to socio-cultural values, so that learning mathematics not only acquires knowledge but also increases student participation in social practices (Polman et al., 2021). Mathematical concepts grounded in a cultural perspective enable students to reflect on and appreciate not only their own culture but also others' cultures (d'Entremont, 2015). In this way, mathematics teaching that utilizes culture can develop the Profile

of Graduate Students by fostering appreciation for a noble, positive culture that aligns with the traditions passed down in a multicultural country like Indonesia.

The literature has documented many research results on ethnomathematics. Most ethnomathematics are studied by linking culture and objects, and mathematical activities such as counting, sorting, measuring, and weighing (Purnamasari et al., 2022). Apart from that, researchers have also developed ethnomathematics as a mathematics teaching innovation to optimize students' abilities (Fendrik et al., 2020). Based on the researchers' best research, there are still few ethnomathematics research results directly aimed at promoting the character of the Graduate Students Profile, especially citizenship. Furthermore, this problem is compounded by the many theoretical frameworks that can be applied, making understanding the problem domain more complex without an in-depth literature review. For example, the concept of ethnomathematics teaching with an ethno-metaphorical-humanist theoretical framework (Hendriana et al., 2022). This theory is designed to create a humanist ethnomathematics teaching approach and foster metaphorical thinking in the development of hard and soft skills. Then, ethnomathematics, STEAM education, and a global approach to analyzing mathematical connections in three contexts, namely intra-disciplinary connections, interdisciplinary connections, and relationships between mathematics practiced by cultural groups (Rodríguez-Nieto & Alsina, 2022). Nevertheless, D'Ambrosio must be acknowledged as still being the pioneer of the ethnomathematics program, which is widely developed to this day (D'Ambrosio, 1985). On the other hand, our findings show that ethnomathematics studies specifically aimed at increasing the profile of SGPD within the Indonesian curriculum remain underexplored in the literature. The research conducted in this article is quite novel in addressing this problem.

Building upon the theoretical framework of ethnomathematics and its connection to citizenship within the SGPD, this study aims to formulate contextual and operational definitions of both constructs and to examine their interrelationship. For clarity, the Eight Graduate Profiles, as outlined in the Regulation of the Minister of Primary and Secondary Education Number 10 of 2025 (Kemendikdasmen, 2025), encompass: (1) faith and piety, (2) citizenship, (3) critical reasoning, (4) creativity, (5) collaboration, (6) independence, (7) health, and (8) communication. Within this comprehensive framework, citizenship is positioned as a key dimension that integrates national identity, social responsibility, and cultural awareness. Thus, the research questions are: (1) is ethnomathematics relevant to SGPD, especially aspects of citizenship? and (2) what are the ways/best practices to promote ethnomathematics as a teaching strategy?

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Based on a collection of previous literature, several theoretical frameworks can be approached in answering this research question, namely the theory of multiculturalism, realistic mathematics education (RME), contextual teaching and learning (CTL), and the dualism of social theory, namely culturally responsive teaching (CRT) and cultural capital (CC). Some of these theories were chosen because the multiculturalism theory proposes a concept where mathematics must support students' understanding of other scientific disciplines that occur in an interdisciplinary manner (D'Ambrosio, 1995). More specifically, within the frameworks of RME and CTL-based teaching models, ethnomathematics can be understood as the study of mathematics through real-world contexts drawn from students' lives. According to the RME and CTL framework, students' culture and ethnicity are considered as contexts that can be discussed through ethnomathematics teaching. Teaching that encourages students to approach real contexts empirically can increase student ownership of their learning. In addition, ethnomathematics is understood as a marriage between the dualism of social theory, namely CRT and CC. These two theories support the view that culture is a context worthy of integration through the RME and CTL learning models. The research presented in this article aims to develop a theoretical framework for mathematics teaching approaches that promote SGPD character. The theories mentioned above have never been used in an integrative manner, so this article offers an opportunity to address gaps in the literature in the mathematics education research community.

Prior research in ethnomathematics has largely concentrated on identifying mathematical ideas within cultural contexts and designing culturally oriented instructional practices, without adequately addressing their systematic connection to the Strengthening Graduate Profile Dimensions (SGPD), particularly the citizenship component. Accordingly, this study advances existing scholarship by integrating key theoretical perspectives (constructivism, multiculturalism, RME, CTL, CRT, and CC) into a unified framework that clarifies the role of ethnomathematics in supporting SGPD implementation.

The use of an integrative literature review (ILR) is justified by the need to reconcile a wide range of theoretical viewpoints that remain dispersed across the literature. By employing ILR, this research enables a critical synthesis and reinterpretation of interdisciplinary findings, thereby constructing a more coherent and comprehensive conceptual basis for examining how ethnomathematics contributes to strengthening SGPD.

Aligning with SGPD's objectives, ethnomathematics is reviewed theoretically to provide a learning context that promotes culture and enhances SGPD's profile. A

synthesis of the literature on SGPD and ethnomathematics suggests concrete teaching strategies for future research. It is expected that the results of this research will serve as a theoretical basis for ethnomathematics teaching and for further studies promoting ethnomathematics, particularly for the successful implementation of SGPD teaching. Furthermore, we expect to open up research opportunities through interventions and innovations to improve mathematics learning within the SGPD (National) curriculum.

Methods

This study applies an integrative literature review (ILR) approach grounded in established methodological principles as outlined by Snyder and Torraco (Snyder, 2019; Torraco, 2005), which underscores the importance of systematic synthesis, critical examination, and the generation of theoretical insights from a broad spectrum of scholarly works. By adopting this approach, the research brings together interdisciplinary perspectives to develop a coherent and comprehensive theoretical framework that explains the contribution of ethnomathematics to the implementation of SGPD. In this article, ILR has been used to compare and integrate several social, anthropological, psychological, and educational theories relevant to the essential aspects of ethnomathematics, thereby promoting the vision of multicultural learning in the Indonesian curriculum, namely SGPD. Research results reported by the literature are discussed, studied, and compared.

This study adopts an integrative literature review (ILR) approach based on the framework proposed by Snyder and Torraco (Snyder, 2019; Torraco, 2005), focusing on integrating multiple theoretical perspectives to address the research questions. Specifically, the study synthesizes theories of multiculturalism (D'Ambrosio, 1995), RME (Van Den Heuvel-Panhuizen, 2003), CTL (Kurniati et al., 2015), CRT (Ladson-Billings, 1995), and CC (Bourdieu, 1984) to construct a coherent understanding of ethnomathematics in relation to SGPD.

The ILR implementation procedure comprises four stages: planning, implementation, analysis, and writing up the results. Firstly, at the planning stage, the objectives of the literature review were specified through a gap analysis to address gaps that could not yet be explained by the literature. This research found that the relevance of ethnomathematics had not yet been widely discussed in the Indonesian national curriculum, and that this is being addressed through SGPD-based teaching. Second, the implementation stage began with a literature review carried out using scientific article indexing databases in an international context, namely Scopus and Google Scholar. The literature is limited to 1980-2022, and only peer-reviewed articles are included in this paper's dataset.

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The literature selected for this study spans the period from 1980 to 2022, with the aim of encompassing both the foundational development and the more recent advancements in ethnomathematics. Although SGPD and the current National Curriculum are relatively recent policy initiatives, the inclusion of earlier publications is essential to map the evolution of ethnomathematics as a theoretical and pedagogical construct. By adopting this extended time frame, the study can integrate seminal contributions with up-to-date empirical research, thereby providing a more comprehensive analytical perspective. At the same time, greater emphasis is placed on recent studies to ensure alignment with contemporary educational demands. To preserve the rigor and reliability of the review, only articles published in peer-reviewed journals are included in the dataset.

Peer-reviewed articles were taken from January to February 2023. This aimed to ensure that the information discussed followed scientific methodological standards accepted in the research community. The literature search yielded an initial pool of 142 articles, which was reduced to 105 after removing 37 duplicates. Based on title and abstract screening, 54 articles were excluded for irrelevance, leaving 51 articles assessed for eligibility and included in the final dataset. The selection process is illustrated in a PRISMA flow diagram in Figure 1.

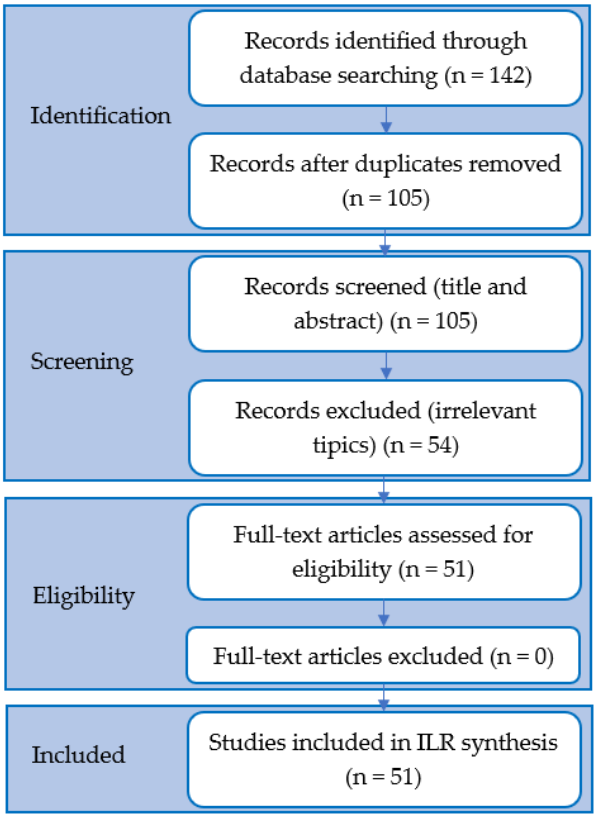

Figure 1: PRISMA flow diagram

In this paper, the focus of the search was specifically to trace the history of the results of studies on the implementation of SGPD and theoretical conceptions of ethnomathematics according to the keywords listed below:

(1) "ethnomathematics" OR "Graduate" AND "Profile"
(2) "realistic" AND "mathematics" AND "education"
(3) "contextual" AND "teaching" AND "learning"
(4) "culturally" AND "relevant" AND "teaching"
(5) "cultural"
(6) "Graduate" AND "student" AND "profile"
(7) "nationalism" AND "education"

After the literature was collected, the third stage of ILR involved conducting a critical analysis of the articles. The analysis aimed to answer the two research questions posed in the introduction: explaining the relevance of SGPD and ethnomathematics-based learning, and discussing best practices for implementing the ethnomathematics vision to support the achievement of the SGPD program as recommended by the curriculum. This process is the stage that took the most time in this research. To answer the first and second questions, a literature review using a thematic analysis approach adapted from qualitative research was used in this analysis process (Braun & Clarke, 2006). Thematic analysis was employed to systematically identify, code, and synthesize recurring patterns across studies, thereby enabling the integration of diverse theoretical perspectives and supporting the development of a coherent theoretical framework. All parts of the article have been included in the dataset, including the abstract, introduction, methods, discussion, and conclusions, selected from a previously collected set of worthy articles. The thematic analysis began by coding the essential points from the literature. Evaluation of the produced codes was carried out iteratively and confirmed through agreement among the three authors. A collection of codes that could intersect with the theory used in this article was then identified as a theme. The themes identified were presented as a theoretical framework to answer the research questions, as shown in Figure 2.

The final stage of ILR was the interpretation of research results, which provided the answers to the two research questions. The next section represented the implementation of this final stage. Answers to the research questions were presented sequentially, along with a synthesis of the literature supporting them, drawn from the identified themes.

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Result and Discussions

Theoretical Synthesis of Ethnomathematics in Supporting the Strengthening of SGPD

The analysis of the reviewed literature indicates that constructivism serves as a foundational paradigm underlying ethnomathematics-based learning, particularly in positioning students as active agents in constructing knowledge through contextual experiences (Elpina et al., 2020; Safriadi, 2016). Across the studies, ethnomathematics is consistently implemented through Contextual Teaching and Learning (CTL) and Realistic Mathematics Education (RME), where cultural contexts function as meaningful learning resources that connect mathematical concepts to students' lived experiences (Julie et al., 2014; Kurniati et al., 2015). Furthermore, the synthesis reveals that integrating cultural values into mathematics instruction not only enhances conceptual understanding but also contributes to the development of students' self-concept and higher-order thinking skills, thereby supporting the objectives of SGPD (Fouze & Amit, 2018; Verner et al., 2013).

Based on the three paragraphs above, constructivism has developed mathematics teaching strategies that can support student development, namely by involving real contexts that students experience. One real context is the culture and traditions students experience. D'Ambrosio first proposed a terminology for ethnomathematics as an innovative and progressive idea that supports the philosophy of constructivism (D'Ambrosio, 1985). According to social theory and anthropology, ethnomathematics can be inspired by a combination of two theories that have been widely implemented, namely CRT (Ladson-Billings, 1995) and CC (Bourdieu, 1984). These two theories are recommended to support ethnomathematics teaching because they take into account the diversity of students' characteristics and abilities in learning. CRT and CC theories suggest that mathematics teachers must be responsive to their students' cultural, lifestyle, and social contexts. These two social theories argue that student culture must be an asset for teachers to understand students, enabling them to design appropriate mathematics instruction. Both CRT and CC explicitly state that they are grounded in students' cultural diversity. These theories confirm that culture is a context that must be integrated through RME and CTL teaching models. Finally, the cultural context integrated with the values of social habits according to these theories can be crystallized as the main idea of ethnomathematics (D'Ambrosio, 1985). The flow of thought in the analysis we have carried out on the presence of constructivism, CTL, RME, CRT, and CC theories yields a theoretical framework as our answer to the first research question, shown in Figure 2.

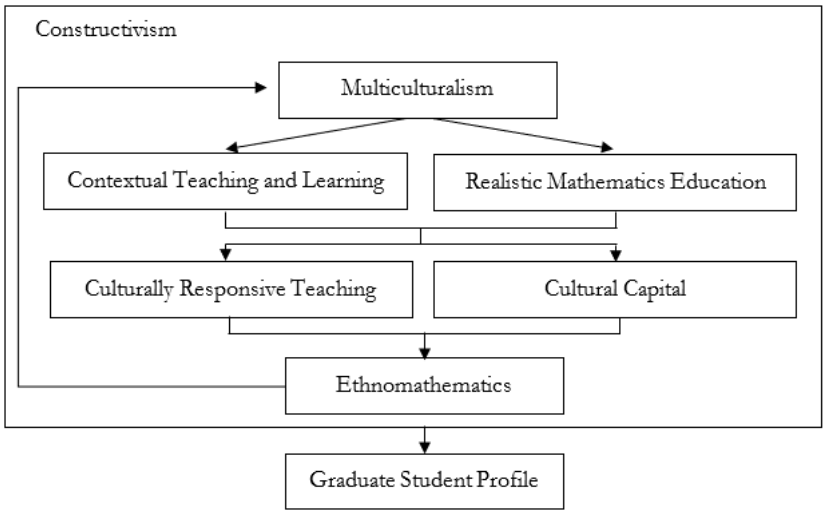

Figure 2: Theoretical framework regarding the relevance of ethnomathematics and the SGPD curriculum

The theoretical framework presented in Figure 2 conceptualizes constructivism as the primary foundation, emphasizing that learners actively construct knowledge through meaningful, contextualized experiences. Within this structure, multiculturalism serves as a key lens that connects learning processes to cultural diversity, which is then implemented through Contextual Teaching and Learning (CTL) and Realistic Mathematics Education (RME) as pedagogical approaches that embed mathematical concepts in real-life, culturally relevant contexts. Furthermore, these approaches are reinforced by Culturally Responsive Teaching (CRT) and Cultural Capital (CC), both of which emphasize the significance of students' cultural backgrounds as essential resources in the learning process.

The relationships among these components form a systematic flow in which constructivist principles underpin culturally oriented teaching strategies, ultimately culminating in ethnomathematics as an integrative instructional approach. Ethnomathematics acts as a connecting bridge between cultural contexts and mathematical understanding, thereby contributing to the development of the Graduate Student Profile. In this way, the framework provides a clear answer to the first research question by demonstrating the theoretical relevance of ethnomathematics to SGPD, particularly in strengthening the citizenship dimension through the integration of cultural awareness, contextual learning, and student-centered instructional practices.

According to the theoretical framework presented in Figure 2, students' cultural appreciation through ethnomathematics teaching aims to support aspects of multiculturalism. Multiculturalism can be understood as the concept of Bhinneka

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Tunggal Ika, as we have interpreted it in light of the essence of Indonesian nationhood. The diversity interpreted in *Bhinneka Tunggal Ika* and the concept of multiculturalism pose potential challenges in mathematics teaching (Hasanah et al., 2022; Zakso et al., 2021). The synthesis of the literature reveals that ethnomathematics-oriented learning contributes to the realization of the SGPD vision by enabling teachers to incorporate students' diverse cultural backgrounds as valuable learning resources within mathematics instruction (Fouze & Amit, 2018; Verner et al., 2013). Across the reviewed studies, it is evident that acknowledging cultural diversity not only increases student engagement but also fosters inclusive learning environments grounded in multicultural principles. In addition, the findings suggest that SGPD offers a structural framework that allows educators to design project-based learning experiences beyond the intracurricular context, thereby providing greater flexibility to implement culturally responsive and ethnomathematics-based teaching strategies that support the objectives of multicultural education.

The analysis of the literature demonstrates that SGPD plays a substantial role in enhancing students' character development, particularly in strengthening self-confidence, collaboration, creativity, and problem-solving abilities (Mery et al., 2022; Rizal et al., 2022; Safitri et al., 2022). Moreover, the findings consistently show that SGPD offers more effective learning experiences than previous curricula, as its flexible design and the provision of dedicated time allocation allow teachers to implement innovative and student-centered project-based learning tailored to students' characteristics (Rachmawati et al., 2022). Overall, these results highlight that SGPD serves as both a structured and adaptable framework that facilitates pedagogical innovation while promoting the holistic development of learners.

The analysis of the reviewed studies demonstrates that ethnomathematics operates as an instructional approach that meaningfully embeds cultural contexts within mathematics learning, thereby supporting the goals of SGPD in the National Curriculum. Across the literature, it is evident that integrating cultural aspects into mathematics instruction promotes the development of multicultural awareness, national identity, and citizenship values, all of which are essential elements of the Graduate Student Profile. In addition, the findings consistently show that ethnomathematics-based learning enhances students' engagement with local cultural knowledge while reinforcing nationalism and cultural appreciation as part of the citizenship dimension. These results provide a conceptual basis for outlining best practices for implementing ethnomathematics, which are presented in the subsequent section.

Promoting SGPD and Ethnomathematics: A Best Practice

The synthesis of the reviewed literature indicates that the National Curriculum reform prioritizes contextual and character-oriented learning as a means to develop students' 21st-century skills, as reflected in the implementation of SGPD (Astuti et al., 2025), Furthermore, the findings consistently show that instructional innovations integrating cultural dimensions play a significant role in shaping students' character in accordance with the Graduate Profile framework. Within this perspective, ethnomathematics is identified as a pertinent instructional approach that enables the incorporation of cultural contexts into mathematics learning, thereby supporting the development of citizenship values.

The results of research on ethnomathematics have been documented in various scientific literature. Cultural dimensions can be utilized to promote SGPD in ethnomathematics teaching. Research found that carpenters in Cape Town, South Africa, were involved in various mathematical activities to solve problems (Millroy, 1992). A group of carpenters in Cape Town has believed for generations in the geometric ideas used to complete their work. In Indonesia, in the traditions of Javanese society, for example, when holding a wedding, they pay attention to the couple's weton through Javanese Primbon. Ethnomathematics contained in Javanese Primbon has been researched, and the study found numerical values such as basic numbers, remainder theorem, modulo, and congruence modulus in formal mathematics, which are associated with matchmaking using Javanese Primbon (Utami et al., 2021). In line with this, in Africa in the same century, the Bamana divination system was introduced, which was rooted in chance procedures, binary systems, and odd or even numbers (Chahine, 2020). Thus, the development of ethnomathematics worldwide began a long time ago, although it has not yet reached the level of formal mathematics. A group's belief about culture indicates that one of the elements of citizenship is fulfilled, namely, maintaining national and local culture and identity as a child of the nation, as mandated in SGPD.

Ethnomathematical activities are reflected in the behavior or traditions of very diverse communities. Research examining this finds that cultural festival activities, cultural traditions, or cultural rituals are correlated with mathematical concepts such as geometry, numbers, and so on (Barros & da Silva, 2022). These results are then used as context in designing ethnomathematics teaching trajectories, making it easier for students to learn mathematical concepts and solve problems while gaining an understanding of their region's local culture. Ethnomathematics is more meaningful and concrete for students studying mathematics because it can be derived from cultural heritage (Kholid et al., 2022; Rahayu et al., 2018). With this study, mathematics teachers can participate in SGPD. The SGPD dimension in community group behavior

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is not only citizenship; cooperation is also evident when the community works together to prepare regional traditional activities.

The analysis of the literature reveals that cultural artifacts serve as significant instructional media in ethnomathematics, allowing mathematical ideas to be contextualized within culturally meaningful practices that support the implementation of SGPD. Across the reviewed studies, it is evident that artifacts such as traditional architecture, including that of the Sasak tribe, not only embody mathematical principles such as measurement, design, and geometric forms but also convey underlying cultural values like cooperation, consistency, and an emphasis on process (Supiyati et al., 2019). In addition, the findings highlight that the incorporation of various cultural artifacts into mathematics instruction enables students to engage with mathematical objects and activities in a more contextualized manner, while simultaneously fostering cultural awareness and supporting the development of citizenship values within the Graduate Profile framework (Khasanah et al., 2022; Prahmana & D'Ambrosio, 2020; Rodríguez-Nieto & Escobar-Ramírez, 2022).

In mathematics instruction grounded in the RME or CTL approach, integrating ethnomathematics derived from students' immediate cultural environment plays a crucial role not only in facilitating conceptual understanding but also in strengthening students' SGPD. By engaging with culturally meaningful contexts, students are encouraged to develop positive attitudes toward problem-solving, such as curiosity, persistence, and flexibility in thinking. The utilization of local cultural artifacts, such as those found in Gedongsongo Temple, provides authentic problem situations that align with the principles of RME and CTL, thereby fostering students' disposition to approach mathematical problems meaningfully and reflectively. As highlighted by Khasanah et al. (2022)Various architectural elements of the temple can be associated with concepts of plane and solid geometry, while other features reflect mathematical ideas related to symmetry and proportion. This contextualization enables students to perceive mathematics as relevant and applicable to real life, thereby fostering their problem-solving disposition. Furthermore, studies emphasize that embedding ethnomathematical contexts within instructional practices enhances students' engagement and supports the cultivation of adaptive behaviors (Fitri et al., 2025; Kumala & Agarica, 2024). Therefore, incorporating ethnomathematics not only enriches mathematical learning experiences but also serves as a strategic means to nurture SGPD through culturally responsive pedagogy.

A synthesis of prior studies indicates that the integration of ethnomathematics into mathematics instruction is not merely beneficial in a general sense, but demonstrates specific and consistent impacts on students' learning processes and outcomes. Across

the reviewed literature, a recurring finding is that ethnomathematics-based teaching enhances students' conceptual understanding by situating abstract mathematical ideas within familiar cultural contexts, thereby reducing cognitive barriers often encountered in conventional instruction (Fendrik et al., 2020; Mauluah & Marsigit, 2019). In addition, these studies reveal that such integration promotes higher levels of student engagement and active participation, as learners are more inclined to connect mathematical tasks with their lived experiences. Another important finding is the development of students' affective and dispositional aspects, including increased motivation, appreciation of mathematics, and a stronger sense of relevance toward the subject. Furthermore, the literature consistently highlights that embedding cultural elements in mathematics learning contributes to character formation, particularly in fostering cultural awareness, identity, and a sense of responsibility to preserve local and national heritage (Patri & Heswari, 2021; Ulya, 2016). This aligns with curriculum expectations that emphasize incorporating cultural values to build well-rounded learners who not only possess mathematical competence but also demonstrate strong national character (Supiyati & Halqi, 2020). Collectively, these findings suggest that ethnomathematics serves as a pedagogical bridge that simultaneously supports cognitive development, affective growth, and cultural identity formation in mathematics education.

A critical synthesis of the literature suggests that ethnomathematics should not be viewed merely as a contextual teaching approach, but as a coherent pedagogical framework that systematically connects cultural knowledge with the development of mathematical understanding and students' dispositions. Previous studies consistently indicate that when cultural practices, local ways of thinking, and students' lived experiences are integrated into mathematical tasks, learners are more likely to construct meaning actively rather than receive knowledge passively. This process fosters deeper conceptual understanding while encouraging students to engage in reflective, flexible thinking. The literature further demonstrates that such culturally grounded learning environments foster positive learning dispositions, including persistence, curiosity, and openness to multiple solution strategies.

These findings establish a clear conceptual linkage between ethnomathematics and the development of SGPD. By situating mathematical problems within meaningful cultural contexts, students are not only cognitively engaged but also emotionally and socially involved in the learning process. This integrated engagement supports the gradual formation of SGPD, as students become more confident in exploring problems, more resilient when facing difficulties, and more adaptive in selecting strategies. Moreover, incorporating ethnomathematics aligns with broader educational goals outlined in the Profile of a Graduate Student, particularly in

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fostering citizenship values. Through continuous exposure to diverse cultural perspectives embedded in mathematical learning, students develop a stronger sense of identity, greater respect for diversity, and a greater responsibility toward cultural preservation.

In this regard, the implication for mathematics learning is that ethnomathematics-based instruction should be implemented in a structured and sustained manner, rather than as an occasional enrichment activity. Such continuity is essential for cultivating not only students' mathematical competencies but also their problem-solving dispositions, as reflected in SGPD. Ultimately, this approach positions mathematics learning as a holistic process that integrates cognitive development, affective growth, and cultural awareness, thereby preparing students to navigate increasingly complex and dynamic societal challenges.

Conclusion

This study demonstrates that ethnomathematics contributes substantially to reinforcing the SGPD by embedding cultural relevance in mathematics instruction. When instructional approaches such as CTL, RME, and culturally responsive pedagogies are applied, learning extends beyond the acquisition of concepts to include the development of key dispositions, including perseverance, flexibility, and a sense of social responsibility. These findings underline the importance of designing learning experiences that are both meaningful and rooted in students' cultural contexts, as such integration supports the simultaneous growth of mathematical proficiency and character formation.

Nevertheless, the scope of this review is bounded by its dependence on selected published sources and a limited set of theoretical frameworks, which may not fully represent the breadth of perspectives in the field. Even so, the synthesis offered in this study establishes a coherent basis for developing mathematics learning designs that connect cognitive advancement with cultural understanding and the cultivation of citizenship values.

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Author's Declaration

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