

The Impact of Cultural Context and Ethnomathematics on Mathematics Education

Abu Qouder Fouze, Miriam Amit

Faculty of Humanities and Social Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Email: abuceoud@gmail.com, amit@bgu.ac.il

How to cite this paper: Fouze, A. Q., & Amit, M. (2025). The Impact of Cultural Context and Ethnomathematics on Mathematics Education. *Creative Education*, 16, 2140-2155. <https://doi.org/10.4236/ce.2025.1612129>

Received: October 13, 2025

Accepted: December 21, 2025

Published: December 24, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution-NonCommercial International License (CC BY-NC 4.0).

<http://creativecommons.org/licenses/by-nc/4.0/>



Open Access

Abstract

The present article explores the complex relationship between culture and mathematics education, emphasizing how culturally grounded perspectives can enrich learners' understanding of mathematical ideas. It argues that mathematical concepts, reasoning patterns, and problem-solving strategies are shaped by the social, linguistic, and cultural environments in which learners live. From this standpoint, effective mathematics education must recognize the cultural dimension of learning and create meaningful connections between students' lived experiences and the formal structures of mathematical knowledge. The discussion highlights the principles of ethnomathematics and its potential to support culturally responsive pedagogy. This approach values the mathematical practices embedded in diverse communities and demonstrates how they can serve as powerful resources for enhancing comprehension, motivation, and engagement. Particular attention is given to multilingual and multicultural education settings, where culturally aligned instruction can reduce learning barriers and strengthen students' confidence and sense of identity. The article concludes by proposing a conceptual framework for integrating cultural knowledge, values, and practices into mathematics education. Such integration is presented as a pathway toward more equitable, relevant, and inclusive learning environments, where mathematics becomes not only a cognitive discipline but also a meaningful social and cultural experience.

Keywords

Ethnomathematics, Academic Achievements, Bedouin Culture, Bedouin Students

1. Introduction

Mathematics is widely regarded as one of the cornerstones of modern education and a key gateway to higher education, science, and the labor market. However,

growing recognition in recent decades has revealed that mathematical learning does not occur in a vacuum but is deeply rooted in cultural, linguistic, and social contexts. Patterns of reasoning, problem-solving strategies, and even the meanings attributed to numbers and shapes reflect systems of values and local knowledge (Bishop, 1988; Barton, 2009). As Bishop (1988) observes: “Every culture has developed its own mathematical ideas, practices, and symbols as part of its attempt to make sense of the world.”

Traditional approaches to mathematics education have often portrayed mathematical knowledge as universal, objective, and culturally neutral. While such an approach aims to promote equality, in practice it may perpetuate disparities and foster alienation among students whose cultures are not represented in curricular content or classroom discourse. Consequently, many education systems—including that of Israel—have begun to adopt culturally responsive pedagogies that recognize the cultural dimension of learning and respect the learner’s identity (Gay, 2010; Ladson-Billings, 1995).

One of the leading frameworks in this field is ethnomathematics, which views mathematics not merely as an abstract scientific discipline but as a form of socio-cultural knowledge. D’Ambrosio (2001), the founder of the field, asserted that “mathematics is an inseparable part of human culture and should therefore be taught in relation to the cultural structures within which it was created and functions.” This view challenges the hierarchy between “Western mathematics” and local systems of reasoning, recognizing the plurality of mathematical understandings that exist across cultures (Gerdes, 1996).

In Israel—a society characterized by broad linguistic and cultural diversity—this issue holds particular significance. Students from Arab, Druze, and Bedouin communities often learn mathematics in a language that is not their mother tongue and through curricular materials that do not reflect their lived experiences or conceptual worlds (Blass, 2021; Ministry of Education, 2022). These gaps are not merely linguistic but also cultural, influencing students’ sense of efficacy and identification with the subject. Integrating cultural elements—such as traditional art forms, symbolic systems, or local measurement practices—can thus serve as a meaningful bridge between the students’ world and mathematical knowledge.

The purpose of this article is to theoretically examine the contribution of the ethnomathematical approach to understanding mathematical learning processes and to developing culturally responsive pedagogy. The discussion focuses on theoretical, research-based, and educational aspects while highlighting the relevance of cultural context within the Israeli education system.

2. Theoretical Literature Review

To clarify terminology used throughout this paper, ethnomathematics is understood as the application of culturally responsive pedagogy specifically within the domain of mathematics—that is, a framework that translates the broader principles of culturally responsive teaching into mathematical contexts, practices, and learning experiences.

2.1. Definition and Development of Ethnomathematics

The term ethnomathematics, introduced by D'Ambrosio (1985), refers to the mathematical ideas, practices, and problem-solving strategies that arise within specific cultural groups. According to D'Ambrosio (1990), the concept is grounded in three components: **ethno**, representing the cultural context—including language, symbols, traditions, and forms of reasoning; **mathema**, referring to the human activities of explaining, understanding, classifying, measuring, and modeling reality; and **tics**, denoting the techniques and tools used in these processes.

From this perspective, mathematics is not a culturally neutral discipline but a set of practices shaped by the daily challenges and experiences of particular communities. Rosa and Orey (2003, 2007) argue that mathematical concepts develop in response to culturally defined problems and that each culture constructs unique methods for dealing with quantitative, relational, and spatial situations. Thus, mathematical thinking is universal but expressed differently across societies.

D'Ambrosio (1993, 2006) emphasized that the aim of ethnomathematics is to acknowledge and legitimize these diverse mathematical traditions. While many culturally grounded mathematical practices have been viewed as informal or non-systematic, ethnomathematics demonstrates that they reflect coherent forms of reasoning that may differ from, but are not inferior to, academic mathematics. Because cultures encounter distinct types of problems, the solutions, methods, and theories they develop inevitably vary—a reminder that what counts as a mathematical problem or solution in one culture may hold entirely different meanings in another.

2.2. The Relationship between Culture and Mathematical Learning

Bishop (1988) identified six “universal mathematical activities” that appear across all cultures: counting, measuring, locating, designing, playing, and explaining. Yet the specific ways these activities are realized differ from one culture to another. For example, traditional systems of measurement among Indigenous African communities, geometric patterns in Arabic embroidery, or counting methods in Semitic languages all illustrate culturally embedded expressions of mathematical thought (Gerdes, 1996). As Gerdes (1996) explains:

“Ethnomathematics allows us to see mathematics not as the product of one civilization but as a universal human activity expressed in culturally diverse ways.” This perspective broadens the notion of mathematical knowledge beyond the boundaries of formal schooling, emphasizing learning as a socially situated process. When students recognize meaningful connections between their cultural worlds and the subject matter, they develop greater relevance, curiosity, and motivation toward mathematics (Rosa & Orey, 2011).

2.3. Ethnomathematics and Culturally Responsive Education

Culturally responsive pedagogy focuses on teaching that views students' cultural

backgrounds as assets rather than barriers to learning. Gay (2010) defines it as *“instruction that uses the cultural knowledge, experiences, and learning styles of diverse students to make learning more appropriate and effective.”*

In this sense, ethnomathematics serves as the mathematical embodiment of culturally responsive pedagogy. According to Barton (2009), integrating culture into mathematics education “is not about simplifying the content but about deepening understanding by bridging different knowledge frameworks.” Such teaching allows students to “be mathematicians within their own culture,” rather than merely learning a Western, universal form of mathematics.

2.4. The Contribution of Cultural Context to Mathematical Understanding

The comprehension of mathematical concepts is not a purely technical process but a cognitive-cultural one that occurs within specific social contexts. As Bishop (1988) argues, *“Mathematics is not only a system of symbols and rules; it is also a system of meanings created by humans to cope with reality.”* In other words, the meaning of mathematical ideas arises not solely from formal definitions but from the cultural fabric in which they are taught, learned, and applied.

2.4.1. Meaningful Learning through Cultural Context

Meaningful mathematical learning requires connecting the learner’s lived experiences with abstract mathematical ideas. When students perceive that mathematical concepts relate to their personal, linguistic, and cultural realities, learning becomes relevant, accessible, and engaging. As Gay (2010) notes:

“When cultural experiences are embedded into instruction, mathematics ceases to be an abstract discipline and becomes a living practice of reasoning and sense-making.”

Empirical studies show that culturally responsive teaching enables students to build deeper conceptual understanding because it provides a concrete reference framework for abstraction. For instance, studies on teaching geometry through traditional ethnic patterns reveal that students naturally recognize relationships among shapes, symmetry, and repetition before encountering formal definitions (Gerdes, 1996; Awuah & Dorwu, 2023).

2.4.2. Cognitive Enrichment through Language and Culture

Cultural context also serves as a linguistic and cognitive bridge. Mathematics is often taught in a language that is not the learner’s mother tongue, which can obscure conceptual meaning. Integrating cultural and linguistic context allows for the semantic translation of mathematical concepts into the student’s world, reducing cognitive load and increasing clarity. Nasir, Rosebery, and Lee (2006) assert that “culture is not merely a backdrop to learning, but a mechanism through which concepts are constructed.” When familiar symbols, stories, and language are used in teaching, students approach mathematics with greater confidence and ownership.

In this light, Barton (2009) conceptualizes mathematical language as an “inter-cultural space,” where each learner navigates between their native language and the academic register of mathematics. When such mediation is intentional and explicit, it leads to deeper conceptual understanding not through rote memorization, but through meaning-making.

2.4.3. Empirical Findings: Culture as a Lever for Understanding and Motivation

Large-scale studies in South Africa and Indonesia (Rosa & Orey, 2016; Zayyadi et al., 2024) found that students exposed to ethnomathematical content demonstrated substantial gains in conceptual understanding, explanatory ability, and learning motivation. A meta-analysis by Zayyadi et al. (2024) reported an effect size of 1.16 in favor of culturally based instruction—evidence of the strong impact of cultural context on developing mathematical literacy. According to the meta-analysis, the strongest gains were observed in conceptual understanding and problem-solving abilities, with moderate improvements in mathematical reasoning and procedural fluency.

Other studies highlight how cultural integration fosters critical and creative thinking. Anderson-Pence (2015) notes that when students solve problems rooted in their social and cultural environment such as analyzing local art patterns or traditional measurement systems they develop mental flexibility and greater capacity to transfer mathematical reasoning to new situations.

2.4.4. Applications in the Israeli Context

In Israel, similar findings have been observed among Arab and Bedouin students. Blass (2021) found that integrating examples from students’ cultures such as geometric motifs in local architecture, traditional units of measurement, or math exercises based on Bedouin folklore enhanced self-efficacy and learning outcomes. Students reported a sense of “*authentic and meaningful learning*” compared with conventional lessons.

The Israeli Ministry of Education (2022) stated in its policy on equitable education that “*learning which enables students to bring their cultural world into the classroom strengthens their identity, fosters belonging, and forms a foundation for deeper learning across all disciplines.*” Thus, cultural and linguistic integration in mathematics is not merely an innovative pedagogical approach—it is also a structural mechanism for social transformation.

2.4.5. Culture, Emotions, and Self-Efficacy

Another crucial aspect of the cultural contribution involves the emotional dimension of mathematics learning. Students from minority backgrounds often experience alienation or anxiety toward mathematics due to the disconnect between their cultural identity and the language or imagery used in instruction (Op’t Eynde & Turner, 2006). Culturally responsive teaching counteracts this by positioning students as “cultural experts,” allowing them to experience recognition and success. As Rosa and Orey (2011) emphasize:

“When mathematics becomes culturally familiar, students begin to see themselves as capable mathematicians rather than outsiders to the discipline.”

This transformation fundamentally reshapes students’ mathematical identities—they cease to view mathematics as a foreign language and begin to experience it as part of their personal and collective identity.

2.4.6. Summary of Subsection

The contribution of cultural context to mathematical understanding can be summarized through three key mechanisms:

Conceptual Meaning-Making—Connecting learners’ cultural worlds with abstract mathematical ideas.

Reduction of Linguistic and Cognitive Barriers—Translating mathematical ideas into familiar experiential language.

Emotional and Identity Empowerment—Strengthening students’ sense of belonging and capability.

Through these mechanisms, mathematics learning becomes not only more effective but also more equitable, relevant, and value-laden.

2.5. Identity, Belonging, and Empowerment in Mathematics Learning

A central contribution of the ethnomathematical perspective lies in fostering a positive mathematical identity. Nasir (2002) notes that mathematical identity is shaped by the intersection of knowledge, language, and culture—*“the way students understand who they are within the space of mathematics depends on whether their cultural worlds are recognized or marginalized.”* Integrating ethnomathematics promotes belonging, confidence, and empowerment, particularly among marginalized groups that have been historically excluded from mainstream education.

In the Israeli context, this approach holds potential to reduce structural disparities between Hebrew-speaking and Arabic-speaking students, creating a sense of inclusion and cultural recognition. As articulated by the Ministry of Education (2022): *“A culturally responsive education system is the key to building an equitable and just society in which every student feels their culture is represented and respected.”*

2.6. Interim Summary

The literature review indicates that ethnomathematics provides both a theoretical and ethical framework for viewing mathematics not solely as a scientific field but as a cultural and social space. Incorporating its principles into instruction enables the development of pedagogy that promotes equality, inclusion, and positive cultural identity. Both international and Israeli evidence suggests that connecting culture with mathematics has the potential to transform learning—making it more relevant, meaningful, and empowering for all students.

2.7. Comparative Models of Ethnomathematics Integration Worldwide

One of the central insights emerging from the evolution of ethnomathematics is that there is no single universal model for its implementation. Instead, each approach is shaped by the unique social, linguistic, and cultural realities of a given country or education system. A comparative analysis of several international frameworks helps illuminate how culture is translated into diverse pedagogical practices and what conditions best support culturally responsive mathematics education.

a) Brazil—The Community Roots Model

Brazil is widely recognized as the birthplace of the ethnomathematics movement, led by Ubiratan D'Ambrosio. This model emphasizes the recognition of “*community mathematics*”—local mathematical practices developed among Indigenous peoples, farmers, fishers, and artisans. In rural schools, for example, traditional agricultural measurement systems—such as land division, crop estimation, or weaving patterns—are used to explain principles of proportion, area, and volume (Rosa & Orey, 2016).

As Orey (2010) states, “*Ethnomathematical education in Brazil does not seek to replace formal mathematics but to build a bridge between it and the learner’s lived knowledge.*” The Brazilian model integrates experiential, hands-on learning, intergenerational knowledge transfer through meetings with community elders, and the development of curricular materials grounded in local epistemologies. In this way, students become co-creators of mathematical knowledge, rather than passive recipients of abstract information.

b) New Zealand—The Māori Indigenous Model

Among the Māori—the Indigenous people of New Zealand—ethnomathematics has been adopted as a tool for **cultural revitalization through education**. National programs such as *Te Marautanga o Aotearoa* (New Zealand Ministry of Education, 2017) have incorporated Māori mathematical knowledge into the national curriculum, using the Māori language and traditional cultural frameworks. These include applications such as oceanic navigation calculations, geometric constructions in traditional architecture, and symmetry in *kapa* and *tukutuku* art forms.

Barton (2009), who extensively studied the Māori model, argues that “*when students learn mathematics in their own language and through the symbols of their culture, they develop a sense of ownership over knowledge—mathematics becomes not the language of others but their own.*” This model operates simultaneously on pedagogical and identity levels: it seeks to reclaim the legitimacy of Indigenous knowledge systems within formal education and to restore cultural pride.

c) Israel—An Emerging Multicultural Model

In Israel, ethnomathematics is still in a formative stage, but its presence in both research and policy is steadily increasing. Israeli society is highly multicultural

and multilingual, and the gaps in mathematics achievement between Jewish, Arab, and Bedouin students remain particularly significant (Ministry of Education, 2022). As a result, awareness of the importance of integrating cultural identities into learning has grown.

Research in schools across southern Israel has shown that mathematics instruction incorporating examples from local cultural heritage—such as geometric patterns in Bedouin architecture, family-based land division models for understanding ratios, or traditional measurement units—improves student engagement and academic outcomes (Blass, 2021; Abu-Rabia-Queder, 2019; Amit & Abu Qouder, 2017).

A salient illustration of Bedouin local mathematics can be found in the geometric weaving patterns embedded in traditional tents (*bayt al-sha‘r*). These designs—constructed from systematically repeated triangles, rhombuses, and symmetrical linear bands—provide a culturally authentic foundation for formal instruction in geometry. Through these patterns, students can explore mathematical ideas such as line and rotational symmetry, geometric transformations, tessellations, and relationships among areas of polygons. Likewise, long-established Bedouin systems of land division, in which communal and familial plots are allocated according to proportional shares, offer an accessible cultural lens for the teaching of fractions, ratios, and proportional reasoning. Integrating such locally meaningful examples demonstrates the continuity between students’ cultural knowledge and the conceptual structures of the formal curriculum.

The findings of our study indicate that the incorporation of ethnomathematical cultural values—specifically traditional Bedouin measurement units, geometric embroidery motifs, and community-based problem-solving approaches—exerts a direct and measurable influence on both cognitive and affective dimensions of mathematics learning. The data show that when students engage with mathematical concepts embedded in their cultural practices, their conceptual understanding becomes more robust, their problem-solving strategies more adaptable and precise, and their overall achievement levels substantially higher. Moreover, this culturally grounded approach contributed to reduced mathematics anxiety and strengthened students’ motivation, confidence, and sense of belonging within the learning environment. These outcomes suggest that ethnomathematical knowledge functions not merely as a contextual support but as a powerful cognitive resource that enables learners to construct meaning, connect abstract concepts to lived experiences, and perceive mathematics as personally relevant and culturally affirming.

Quantitative and qualitative analyses of the experimental group ($N = 186$) revealed statistically significant improvements across nearly all measured variables between the pre- and post-implementation stages of the intervention. The results demonstrate consistent gains in comprehension, academic self-concept, achievement, problem-solving strategies, motivation, self-confidence, attitudes toward mathematics and instructional methods, and students’ sense of respect toward the

school and community. Collectively, these findings provide strong evidence that the educational program produced meaningful academic, cognitive, and socio-emotional benefits for participating students. (Abu Qouder, & Amit, 2024).

This model focuses not only on curricular content but also on pedagogical practice: instruction in students' familiar language, intercultural dialogue, and teacher training in cultural sensitivity. As stated in the Israeli Ministry of Education's policy report (2022):

“Culturally responsive mathematics education contributes to making scientific knowledge accessible to all populations and serves as a cornerstone for equitable and inclusive education.”

d) Cross-Cultural Comparison and Lessons Learned

A comparative analysis of these three models reveals a shared core principle: mathematics is not culturally neutral but emerges from human experience within specific social contexts. Nevertheless, each country emphasizes different dimensions:

- **Brazil** focuses on *community-based and restorative education*;
- **New Zealand** prioritizes *linguistic and identity reconstruction*;
- **Israel** emphasizes *educational equity and social inclusion*.

In all cases, integrating culture into mathematics instruction does not diminish academic rigor—on the contrary, it enhances depth and understanding. As Gerdes (2013) asserts:

“Cultural mathematics does not dilute academic rigor; it deepens it by rooting abstraction in lived human experience.”

The overarching conclusion is that the impact of cultural context on mathematical understanding is not a local phenomenon but a universal principle of learning. When mathematics education successfully connects formal knowledge with cultural identity, it produces knowledge that is meaningful, enduring, and cognitively robust.

3. Theoretical Discussion

3.1. Pedagogical Dimensions of Integrating Culture into Mathematics Education

The pedagogical dimension represents perhaps the most significant contribution of ethnomathematics to education. Culturally responsive mathematics instruction requires a profound shift in how both teaching and learning are conceptualized. Rather than adhering to a hierarchical model in which knowledge is transmitted *from teacher to student*, ethnomathematical pedagogy promotes a dialogical learning space where students' cultural knowledge is recognized as a legitimate and valuable source of understanding. As Gay (2010) emphasizes:

An essential component of implementing ethnomathematics effectively lies in the preparation and professional development of teachers. Educators must develop specific pedagogical skills, including the ability to identify culturally rooted mathematical practices, design tasks that connect local knowledge with formal

mathematical concepts, and facilitate dialogical learning environments where students' cultural insights are valued. Additionally, teachers must cultivate cultural sensitivity, adapt instruction to multilingual contexts, and develop the capacity to translate cultural experiences into mathematically rigorous learning opportunities. Without these competencies, the integration of ethnomathematics risks remaining superficial, highlighting the need for teacher education to play a central role in ensuring authentic and effective implementation.

“Teachers who value students’ cultural backgrounds create classrooms where learning becomes a reciprocal process rather than a one-way transmission.”

Within this framework, mathematics instruction becomes a space where culture functions as a means of learning, not merely as a subject of study. When teachers draw on examples derived from students' everyday cultural practices, they provide natural contexts for conceptual understanding. For instance, using geometric patterns from local art, traditional building techniques, or indigenous systems of measurement creates cognitive bridges that move learners from the concrete to the abstract in an intuitive way.

Culturally grounded instruction also encourages active learning, inquiry, and creativity. According to Barton (2009), meaningful mathematical learning occurs when *“students create new mathematics from within their own world, rather than simply reproducing existing knowledge.”* In this sense, ethnomathematics functions as a meta-cognitive tool, prompting learners to reflect on their reasoning processes, compare strategies, and cultivate critical and flexible thinking.

From a didactic perspective, implementing ethnomathematical pedagogy demands teacher adaptability and mediation skills. Teachers must understand their students' cultural backgrounds, their linguistic repertoires, and their social worlds in order to connect formal mathematical structures with students' existing conceptual frameworks. Studies show that educators who work this way report higher classroom participation, increased motivation, and greater confidence among students from diverse communities (Rosa & Orey, 2016).

In summary, ethnomathematics represents a transformative pedagogical paradigm: it redefines classroom power dynamics, positions students as co-constructors of knowledge, and strengthens meaningful learning through the integration of culture and language.

3.2. Ethical and Philosophical Dimensions

At the ethical level, the ethnomathematical approach embodies the principles of educational justice and inclusion. As D'Ambrosio (2001) argues, *“Mathematics without cultural context risks becoming a tool of exclusion; culturally responsive mathematics is an expression of equality and human dignity.”*

The philosophical foundation of ethnomathematics rests on the understanding that scientific knowledge is never value-neutral—it reflects cultural, political, and historical frameworks. Therefore, any education system that aspires to universality must recognize and honor multiple ways of knowing. Bishop (1991) intro-

duced the concept of “*mathematical enculturation*” to describe the process by which learners become members of a mathematical community through the acquisition of its norms and values. In culturally responsive instruction, this process occurs without erasing one’s cultural identity, but through mutual recognition.

This ethical orientation reframes mathematics not only as a cognitive discipline but also as a moral practice. When mathematics is taught without regard to cultural relevance, it can inadvertently reproduce hierarchies of power and perpetuate the marginalization of minority groups. Conversely, when instruction integrates cultural values, it creates genuine opportunities for equity and recognition.

Thus, ethnomathematics is not solely a pedagogical framework—it is also a moral project. It calls upon education systems to acknowledge marginalized forms of knowledge, appreciate traditional wisdom, and legitimize local practices that have long been dismissed as “non-scientific.” As Vithal (1998) observes, “*Recognizing multiple mathematics is an act of correction—not only educational but also historical.*”

Consequently, integrating culture into mathematics teaching serves a dual purpose: it deepens conceptual understanding while simultaneously promoting ethical responsibility, cultural respect, and social justice.

3.3. Summary of Chapter 4

The theoretical discussion reveals that the integration of culture into mathematics education carries multiple, interrelated meanings—pedagogical, ethical, and social. It frames mathematics as a human, cultural, and value-laden endeavor, rather than a purely technical exercise of calculation or proof.

Through this lens, culturally responsive mathematics education fosters inclusive and equitable learning, cultivates critical and reflective thinking, and deepens conceptual understanding by situating abstraction within cultural meaning.

Ethnomathematics thus transforms mathematics from a static system of universal rules into a living human language—one capable of connecting knowledge, identity, and community within the pursuit of educational justice.

Despite its considerable pedagogical and social benefits, the implementation of ethnomathematics also presents several challenges that merit attention. One key difficulty concerns the need for extensive teacher preparation and professional development. Many teachers lack sufficient knowledge of students’ cultural practices or feel uncertain about how to translate these practices into mathematically rigorous classroom activities. Without structured training, teachers may unintentionally simplify cultural content or fail to maintain high academic standards. Additionally, potential tensions may arise between culturally grounded instruction and standardized national curricula, which often emphasize uniform assessment, fixed benchmarks, and a narrow conception of mathematical competence. These structural constraints can limit teachers’ flexibility to integrate culturally based tasks or to adapt lessons to local contexts. Furthermore, some critics argue that ethnomathematical approaches risk over-romanticizing culture or creating essen-

tialized representations of communities if not implemented carefully. Addressing these challenges requires systemic support, curriculum alignment, and sustained teacher training to ensure that ethnomathematics strengthens—rather than competes with—formal mathematical learning.

3.4. Social and Identity Dimensions

This dimension addresses how the integration of culture in mathematics learning shapes learners' identities and influences the broader relationship between education and society. Nasir (2002) explains that mathematical identity is formed through the intersection of knowledge, practice, and cultural recognition—*“the way students perceive themselves as mathematical thinkers depends on whether their cultural experiences are validated or ignored.”*

When mathematics instruction reflects unfamiliar cultural references, minority students may experience what Bourdieu (1991) termed *“symbolic violence”*—a subtle exclusion from the forms of knowledge deemed legitimate. In contrast, culturally responsive education reverses this dynamic: students become active contributors to knowledge creation, and the classroom transforms into a site of intercultural dialogue rather than assimilation. As Rosa and Orey (2011) note: *“When mathematics recognizes the learner’s culture, it becomes a space of empowerment rather than assimilation.”*

At a broader societal level, ethnomathematical education promotes social equity and democratic participation. In multicultural contexts such as Israel, this approach facilitates a shift from uniformity toward recognition of multiple identities. Integrating local mathematical heritage within Bedouin or Arab communities, for instance, bridges traditional knowledge with academic discourse, fostering cultural pride alongside academic excellence (Blass, 2021).

Furthermore, the communal aspect of ethnomathematics expands learning beyond the classroom. In many countries, including New Zealand and Brazil, schools invite community elders or artisans to share traditional mathematical practices with students (Rosa & Orey, 2016). Such engagement strengthens learners' sense of belonging and reinforces the connection between school and community.

In the Israeli context, this model can promote intercultural understanding and social cohesion among different population groups. As Levy (2019) writes: *“Mathematics education is not merely the transmission of knowledge; it is education for human understanding. Recognizing the culture of the Other is the first step toward it.”*

4. Conclusions

The theoretical and empirical findings reviewed in this article demonstrate that the relationship between culture and mathematics education is profound, multi-dimensional, and potentially transformative for educational systems. As shown throughout the discussion, mathematics is not merely a universal set of symbols, formulas, and rules; it is a human language—multifaceted, evolving, and deeply

embedded in cultural, historical, and linguistic contexts.

Ethnomathematics provides an alternative conceptual framework for understanding mathematical learning. It challenges the separation between “scientific” and “cultural” knowledge and promotes a dialogical relationship between them. As D’Ambrosio (2001) famously noted, “*The real challenge of education is to transform mathematics from the language of a few into the language of all humanity.*” Implementing this principle within education systems allows students to become active participants in the construction of knowledge rather than passive consumers of a supposedly universal truth imposed from outside.

4.1. Pedagogical Contribution

From a pedagogical standpoint, the evidence indicates that culturally responsive instruction enhances students’ comprehension of mathematics and increases both emotional and cognitive engagement. Such teaching bridges learners’ lived experiences and abstract mathematical concepts, creating learning that is meaningful, durable, and memorable.

Teachers who implement ethnomathematical approaches report improvements in student motivation, classroom collaboration, and self-efficacy, particularly among learners from marginalized communities (Rosa & Orey, 2016; Blass, 2021). By validating students’ cultural knowledge and connecting it to formal mathematics, instruction becomes a process of *conceptual translation* rather than mechanical transmission.

Ultimately, ethnomathematics serves as a pedagogical bridge—linking language, culture, and cognition in ways that promote deeper understanding and long-term retention.

4.2. Ethical and Social Contribution

At the ethical and social levels, integrating ethnomathematical values into education constitutes a tangible expression of educational justice and inclusion. A school system that acknowledges the legitimacy of multiple cultures does more than teach mathematics—it cultivates tolerance, mutual respect, and intercultural understanding.

Where students’ cultures have historically been marginalized, mathematics can symbolize exclusion; yet when it is taught in culturally responsive ways, it becomes a symbol of empowerment and recognition. Thus, the classroom shifts from being a site of alienation to a space of belonging and identity affirmation.

Ethnomathematics transforms mathematics from an instrument of hierarchy into a medium of equity and solidarity, contributing not only to academic achievement but also to the moral fabric of education.

4.3. Theoretical and Research Contribution

From a theoretical and research perspective, further inquiry is needed to clarify the psychological and educational mechanisms through which cultural context enhances mathematical understanding. Preliminary studies highlight the key roles

of language, emotion, and belonging, yet long-term longitudinal research is required to examine how ethnomathematical approaches influence achievement over time.

Another crucial area for future research concerns teacher education. Developing teachers' cultural sensitivity, their ability to design context-based materials, and their capacity to employ interdisciplinary strategies are vital for embedding ethnomathematics in everyday instruction. As Gay (2010) emphasizes, "*Culturally responsive teachers are not merely transmitters of content—they are mediators between worlds.*"

Such work would expand the theoretical foundations of ethnomathematics and provide actionable frameworks for its practical implementation in diverse classrooms worldwide.

4.4. Implications for the Israeli Education System

Within Israel's multicultural and multilingual educational landscape, ethnomathematics carries both educational and social significance. Incorporating cultural knowledge and values into mathematics learning can help reduce disparities between Hebrew-speaking and Arabic- or Bedouin-speaking students, increase their sense of belonging, and improve achievement levels.

In Bedouin society in particular—where mathematics is often taught in a second language and within curricula detached from local traditions—culturally grounded pedagogy is of special importance. Geometric designs in traditional crafts, indigenous measurement practices, and community heritage stories can serve as natural cognitive bridges between local knowledge and formal mathematics.

The Israeli Ministry of Education (2022) affirms this approach: "*Learning that stems from the learner's cultural world and accords it respect forms the foundation for equitable education.*" Ethnomathematics thus aligns directly with national goals of equity, inclusion, and cultural recognition in education.

4.5. Looking Ahead: The Future of Ethnomathematics

As presented in this study, ethnomathematics is not merely a didactic method but a comprehensive educational philosophy—one that views mathematical learning as a dialogue between culture and knowledge. The central question, therefore, is not only "*How can we teach mathematics more effectively?*" but rather "*How can we teach mathematics in ways that reflect the humanity of the learner?*"

Future progress in this field will depend on developing community-based curricula, culturally sensitive teacher training programs, and deeper research into how identity and culture shape mathematical reasoning. As education systems increasingly acknowledge mathematics as part of a rich cultural tapestry, they will foster a generation of learners who not only *know how to calculate* but also *understand the human meaning of mathematics*.

Ethnomathematics, in this sense, offers a vision of education that unites excellence with equity, knowledge with identity, and science with humanity.

4.6. Overall Summary

In conclusion, this article positions culture not as an external variable in learning but as an inherent dimension of the educational process. Integrating ethnomathematical values into mathematics teaching enables the creation of an education system that combines academic rigor with moral purpose, and intellectual precision with social consciousness.

Through ethnomathematics, mathematics ceases to represent cold objectivity and becomes a space of recognition, inclusion, and hope—a humanistic discipline capable of fostering both understanding and belonging.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Abu Qouder, F. A., & A. Amit, M. (2024). The Impact of Integrating Ethnomathematical Cultural Values on Mathematics Learning among Bedouin Students. *Journal of Mathematics Education and Culture*, 18, 55-57.
- Abu-Rabia-Queder, S. (2019). *Bedouin Women in Education and Society: Identity, Education, and Social Change*. Ben-Gurion University of the Negev Press.
- Amit, M., & Abu Qouder, F. A. (2017). “Weaving Culture and Mathematics in the Classroom: The Case of Bedouin Ethnomathematics”. In M. Rosa et al. (Eds.), *Ethnomathematics and Its Diverse Approaches for Mathematics Education* (pp. 23-50). Springer. https://doi.org/10.1007/978-3-319-59220-6_2
- Anderson-Pence, K. L. (2015). Ethnomathematics: The Role of Culture in the Teaching and Learning of Mathematics. *Journal of Mathematics Education*, 8, 45-58.
- Awuah, F. K., & Dorwu, E. (2023). Integration of Ethnomathematics in Teaching Geometry: A Systematic Review. *Journal of Urban Mathematics Education*, 16, 22-39.
- Barton, B. (2009). *The Language of Mathematics: Telling Mathematical Tales from a Multicultural Perspective*. Springer.
- Bishop, A. J. (1988). *Mathematical Enculturation: A Cultural Perspective on Mathematics Education*. Kluwer Academic Publishers. <https://doi.org/10.1007/978-94-009-2657-8>
- Bishop, A. J. (1991). *Mathematical Enculturation: A Cultural Perspective on Mathematics Education*. Kluwer Academic Publishers.
- Blass, N. (2021). *Educational Disparities in the Israeli Education System: Between Achievement and Excellence*. Israel Democracy Institute.
- Bourdieu, P. (1991). *Language and Symbolic Power*. Harvard University Press.
- D'Ambrosio, U. (1985). Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, 5, 44-48.
- D'Ambrosio, U. (1990). *Etnomatemática*. Editora Ática.
- D'Ambrosio, U. (1993). Etnomatemática: Um Programa. *A Educação Matemática Em Revista*, 1, 5-11.
- D'Ambrosio, U. (2001). Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, 21, 44-48.
- D'Ambrosio, U. (2006). The Program Ethnomathematics: A Theoretical Basis of Mathematics Education. *Acta Scientiae*, 8, 7-14.

- Gay, G. (2010). *Culturally Responsive Teaching: Theory, Research, and Practice* (2nd Ed.). Teachers College Press.
- Gerdes, P. (1996). Ethnomathematics and Mathematics Education. *Educational Studies in Mathematics*, 31, 149-178. <https://doi.org/10.1007/BF00305894>
- Gerdes, P. (2013). *Exploration of Culture and Mathematics in Africa*. Springer.
- Ladson-Billings, G. (1995). Toward a Theory of Culturally Relevant Pedagogy. *American Educational Research Journal*, 32, 465-491.
- Levy, S. (2019). *Multicultural Mathematics Education in Israel: Between Identity and Language*. Ben-Gurion University of the Negev.
- Ministry of Education (2022). *Policy Framework for Education toward Equality and Inclusion: Guidelines for Developing Culturally Responsive Programs*. Pedagogical Administration.
- Nasir, N. S. (2002). Identity, Goals, and Learning: Mathematics in Cultural Practice. *Mathematical Thinking and Learning*, 4, 213-247. https://doi.org/10.1207/S15327833MTL04023_6
- Nasir, N. S., Rosebery, A. S., & Lee, C. D. (2006). Learning as a Cultural Process: Achieving Equity Through Diversity. In P. A. Alexander, & P. H. Winne (Eds.), *Handbook of Educational Psychology* (2nd Ed., pp. 489-508). Routledge. <https://doi.org/10.1017/CBO9780511816833.030>
- New Zealand Ministry of Education (2017). *Te Marautanga o Aotearoa: Curriculum for Māori-Medium Education*. Ministry of Education.
- Op't Eynde, P., & Turner, J. C. (2006). Students' Emotions in Mathematics: A Socioconstructivist Perspective. In J. L. Meece & J. S. Eccles (Eds.), *Handbook of Research on Schools, schooling, and Human Development* (pp. 361-376). Routledge.
- Orey, D. C. (2010). Ethnomathematics: Challenging Eurocentrism in Mathematics Education. *Journal of Mathematics and Culture*, 5, 1-16.
- Rosa, M., & Orey, D. C. (2003). Wine and Cheese: Ethnomathematics and Modelling! *BOLEMA*, 16, 1-16.
- Rosa, M., & Orey, D. C. (2007). Cultural Assertions and Challenges towards Pedagogical Action of an Ethnomathematics Program. *For the Learning of Mathematics*, 27, 10-16.
- Rosa, M., & Orey, D. C. (2011). Ethnomathematics: The Cultural Aspects of Mathematics. *Revista Latinoamericana de Etnomatemática*, 4, 32-54.
- Rosa, M., & Orey, D. C. (2016). Ethnomathematics and the Pedagogical Process of Learning Mathematics. *Journal of Mathematics and Culture*, 10, 59-78.
- Vithal, R. (1998). Situating Ethnomathematics: A Critical Review. *Educational Studies in Mathematics*, 36, 79-100.
- Zayyadi, M., Rahmawati, D., & Prabowo, A. (2024). Effectiveness of Ethnomathematics-Based Learning on Students' Mathematical Literacy: A Meta-Analysis Study. *Springer-plus*, 13, 1-16.