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Meta-Synthesis: Ethnomathematics in Educational and Cultural Contexts Over the Last Decade

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Abstrak

Penelitian ini bertujuan untuk mengidentifikasi, menganalisis, dan mensintesis hasil-hasil penelitian tentang etnomatematika dalam berbagai konteks selama satu dekade terakhir. Melalui pendekatan meta-sintesis, studi ini mengeksplorasi bagaimana konsep etnomatematika diterapkan dalam beragam budaya, lingkungan pendidikan, dan masyarakat untuk menghubungkan matematika dengan nilai-nilai budaya lokal. Fokus utama penelitian mencakup aplikasi etnomatematika dalam pembelajaran, kontribusi terhadap pemahaman matematika siswa, dan peran dalam pelestarian budaya. Penelitian ini menggunakan pendekatan meta-sintesis dengan melakukan tinjauan sistematis dan analisis terhadap studi-studi yang diterbitkan antara tahun 2020–2024 dari basis data yang yang relevan menggunakan NVIVO 12. Metode yang digunakan meliputi pengumpulan artikel relevan, penerapan kriteria inklusi dan eksklusi, pengkodean tema, dan sintesis temuan dari berbagai studi. Hasil analisis menunjukkan bahwa etnomatematika tidak hanya berfungsi sebagai alat pedagogis yang efektif, tetapi juga sebagai sarana untuk mendukung inklusivitas dan relevansi pendidikan matematika di berbagai latar belakang budaya. Studi ini memberikan wawasan penting bagi pengembangan kurikulum yang kontekstual, berbasis budaya, dan mendukung keberagaman dalam pendidikan matematika.
Kata Kunci: Meta analisis; Etnomatematika; konteks profesional; pendidikan

Abstract

This study aims to identify, analyze and synthesize research results on ethnomathematics in various contexts over the past decade. Through a meta-synthesis approach, this study explores how ethnomathematics concepts are applied in diverse cultures, educational settings and communities to connect mathematics with local cultural values. The main focus of the study includes the application of ethnomathematics in learning, the contribution to students' mathematical understanding, and the role in cultural preservation. This study used a meta-synthesis approach by conducting a systematic review and analysis of studies published between 2020 and 2024 from relevant databases using NVIVO 12. The methods used included collecting relevant articles, applying inclusion and exclusion criteria, coding themes, and synthesizing findings from various studies. The results of the analysis show that ethnomathematics not only serves as an effective pedagogical tool, but also as a means to support the inclusivity and relevance of mathematics education across different cultural backgrounds. This study provides important insights for the development of contextualized, culturally-based and diversity-supportive curricula in mathematics education.
Keywords: Meta-analysis; Ethnomathematics; professional contexts; education

I. INTRODUCTION

Ethnomathematics is an approach that integrates mathematical concepts with the cultural contexts and social practices of various ethnic groups. This concept was pioneered by Ubiratan D'Ambrosio in the early 1980s, with the aim of exploring and understanding how people from different cultural backgrounds interact with mathematics in their daily lives (d'Ambrosio, 1985). In a professional context, ethnomathematics offers a rich and deep perspective on how individuals and groups apply mathematical principles in their cultural and social contexts, and how this can enrich professional practice in various fields.

Ethnomathematics, as an educational approach that integrates local cultural contexts into mathematics learning, is gaining attention in various circles, including in professional contexts (Riadi, Turmudi, & Juandi, 2024). According to d'Ambrosio (1985), ethnomathematics refers to mathematical practices and knowledge that arise from specific cultures, providing a broader perspective on how mathematics can be understood and applied in everyday life. This approach is not only relevant for students in school, but also important in professional contexts, where the understanding and application of mathematical concepts can be influenced by an individual's cultural background (Astria & Kusno, 2023; Pramasdyasari, Aini, & Setyawati, 2024).

In the professional world, the ability to understand and apply mathematical concepts in a cultural context can enhance cross-disciplinary collaboration and support innovation. This is in line with the view Burton (2009) that emphasizes the importance of connections between mathematics, culture, and professional practice in learning. Ethnomathematics also has significant implications for the development of STEM (science, technology, engineering, and mathematics) skills required in various professional fields. By understanding traditional ways of solving mathematical problems, individuals can develop more creative and innovative approaches to facing challenges in the workplace (Wibawa, Nurhikmayati, & Kania, 2024). For example, research by Nuryadi and Kholifa (2020) shows that integrating ethnomathematics into education can strengthen students' understanding of mathematical concepts, which can then be applied in professional contexts.

The importance of ethnomathematics in a professional context can be seen from its role in education, particularly in creating an inclusive and relevant learning environment. In a study by Nasir et al. (2008), it was stated that mathematics is not only a universal discipline, but is also influenced by cultural context. The ethnomathematics approach allows educators to recognize and appreciate cultural differences among students, thereby creating a more meaningful learning experience. This is in line with the goals of modern education, which seeks to develop students' critical and creative skills in facing global challenges (Ernest, 2012; Musliana et al., 2024). In addition, ethnomathematics also plays an important role in the professional context in the fields of architecture, design, and engineering. In these professions, a deep understanding of the local cultural context can contribute

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significantly to innovation and sustainability. For example, applying ethnomathematics principles in building design can lead to more efficient and environmentally friendly solutions that take into account local traditions and community needs (D'Ambrosio & Rosa, 2017; Salsabiela & Nursanti, 2024). In this case, ethnomathematics not only serves as a tool for learning mathematical concepts, but also as a foundation for creating practical solutions that are appropriate to the cultural context (Zhang & Zhang, 2023; Aulia & Wahyuni, 2024).

Furthermore, research by Cimen (2014) shows that ethnomathematics can be used to bridge the gap between theory and practice. By understanding traditional and local ways of solving mathematical problems, professionals can develop more innovative and relevant approaches (Devita, Puspitasari, & Afriansyah, 2025). For example, in many indigenous communities, traditional agricultural practices involve complex measurements and calculations that are often not recognized in conventional mathematics curricula. By integrating this knowledge into education and professional practice, we can create a more holistic and inclusive approach to mathematics education.

Overall, ethnomathematics in a professional context offers a new perspective on how mathematics learning can be more relevant and meaningful. By linking mathematics education to culture and professional practices, ethnomathematics creates a bridge between theory and application, preparing individuals to face challenges in the workplace with a deeper understanding of mathematical concepts in a cultural context. Based on the above explanation, this study aims to explore the application of ethnomathematics in a professional context. Thus, ethnomathematics can be an effective bridge in developing mathematical skills that are relevant to local culture, while meeting professional demands in an increasingly complex and interconnected world.

II. METHOD

The research method used was a literature review, which is a systematic approach to collecting, analyzing, and interpreting information from various written sources related to ethnomathematics in a professional context. Data collection was carried out by searching for literature from various types of sources, including relevant national and international journal articles using NVIVO 12 with the keywords “ethnomathematics” AND “daily activities,” resulting in 138 articles. These sources were then assessed based on their relevance and quality, with criteria including recency, author credibility, and relevance to the topic under study. After analysis, the 138 articles were narrowed down to 11 that met the criteria. The selected data will then be analyzed through a coding process to identify the main themes, which will then be synthesized to present a comprehensive overview of the application of ethnomathematics. The results of this analysis will be compiled in a research report that includes an introduction,

literature review, results and discussion, as well as conclusions and recommendations.

III. RESULT AND DISCUSSION

A literature review analysis was conducted to explore the application of ethnomathematics in a professional context, involving eleven relevant studies. The research questions (RQs) are as follows:

RQ 1. What activities were carried out?

RQ 2. What topics were integrated into the research?

RQ 3. Where was the research conducted/what was the demographic?

Table 1 presents the results of the analysis of the literature studied, providing an overview of the main findings related to ethnomathematics and its implications in various professional fields. The data collected includes various perspectives, showing how the concept of ethnomathematics is applied in practice, the challenges faced, and the benefits gained. This analysis aims to summarize the available information and provide a deeper understanding of the relationship between ethnomathematics and professional contexts. The literature review analysis can be seen in Table 1 below.

Table 1.

Results of Literature Analysis (N=11) for 2020-2024

Title, Author, Link	Aimm	Method	Subject	Result
Why Weaving? Teaching Heritage, Mathematics, Science and the Self (Balabuch & Rasoarifetra, 2023) Link: https://link.springer.com/article/10.1007/s10437-023-09541-w	The purpose of this study is to explore weaving practices as a way to teach students about cultural heritage and the importance of weaving in various African contexts.	Case study	Educators in Canada, Ghana, and Madagascar	Weaving education provides many benefits, including developing connections with local practices throughout Africa and the world. This approach helps students develop important skills and understand material and technological innovations in fabric and basket production. Weaving also teaches mathematical and scientific values, as well as principles of sustainability through the use of local resources. In addition, weaving education shapes students' character by teaching patience, resilience, and calmness. Through the theory and practice of weaving, students can understand their past and present, providing skills and inspiration for the future.
The Relationship Between Musical Intelligence And The Enhancement Of Mathematical Connection Ability Using Ethnomathematics	This study aims to find the relationship between musical intelligence and improved mathematical	quasi-experimental nonequivalent control group	Data collection was conducted in two seventh-grade classes at SMPN Bojongsoang 1, Bandung Regency, each consisting of 30 students.	The conclusion of this study is that there is a relationship between musical intelligence and improved mathematical connection skills, and that students become more motivated to learn mathematics. The implications

Title, Author, Link	Aimm	Method	Subject	Result
And The Mozart Effect. (Kusuma & Dwipriyoko, 2021) Link: https://www.researchgate.net/publication/352328612_THE_RELATIONSHIP_BETWEEN_MUSICAL_INTELLIGENCE_AND_THE_ENHANCEMENT_OF_MATHEMATICAL_CONNECTION_ABILITY_USING_ETHNOMATHEMATICS_AND_THE_MOZART_EFFECT	connection skills by applying Ethnomathematics and the Mozart Effect to increase student motivation in learning mathematics.			of this study for future research and learning practices are that students' mathematical connection abilities can be explored and improved in various ways, one of which is by applying Ethnomathematics and the Mozart Effect in mathematics learning, which can also be influenced by various factors, including musical intelligence. Therefore, in future research, it is recommended to study the relationship between musical intelligence and other improvements in mathematical abilities using Ethnomathematics and the Mozart Effect.
The Geometrical Patterns and Philosophical Value of Javanese Traditional Mosque Architecture for Mathematics Learning in Primary School: An Ethnomathematic Study. (Zuliana et al., 2023) Link: https://jecs.pl/index.php/jecs/article/view/1575	This research is an ethnomathematics study that aims to describe and interpret the philosophical values and geometric patterns of the architecture and famous ornaments of traditional Indonesian mosques.	ethnographic method	The subjects of this study were a cultural practitioner and a group of educators consisting of five elementary school teachers.	Results. First, from the data analysis, it was found that there are several philosophical values contained in the architecture and ornamentation of traditional Javanese mosques, such as the relationship that must always exist between humans and God and fellow humans, as well as Islamic values, faith, ihsan, openness, honesty, obedience, and humility. Second, the study shows the relationship between the architecture and ornamentation of traditional Indonesian mosques and geometric patterns (cubes and cylinders), symmetrical patterns, and geometric transformations (rotations) used as learning resources and starting points in the mathematics learning process.
Characteristics of junior high school teachers' beliefs in developing students' numeracy skills through ethnomathematics-based numeracy. (Astuti et al., 2024a)	This study aims to investigate the characteristics of teachers' beliefs in developing students' numeracy skills through	A survey research study	This study involved 151 mathematics teachers from public and private junior high schools in three districts in Central Java.	Research findings indicate that most teachers believe that the development of students' numeracy skills can be achieved through the application of ethnomathematics-based numeracy learning, which falls under the semi-realistic-mechanistic (SRM) category. Further analysis reveals that

Title, Author, Link	Aimm	Method	Subject	Result
Link: https://files.eric.ed.gov/fulltext/EJ1417782.pdf	ethnomathematics-based numeracy learning.			longer teaching experience does not necessarily mean that a teacher has a realistic view. Teachers with less than five years of teaching experience (new teachers) and between five and ten years (junior teachers) tend to have semi-realistic-mechanistic (SRM) views. Most teachers with between ten and fifteen years of teaching experience (semi-senior teachers) have dominant realistic (DR) views. Meanwhile, teachers with more than fifteen years of teaching experience (senior teachers) have semi-realistic-mechanistic (SRM) and dominant realistic (DR) views. Teachers' positive beliefs are likely to improve students' numeracy skills in general, particularly based on teaching experience in the dominant realistic (DR) and realistic (R) categories related to ethnomathematics-based numeracy learning
Teachers' Belief in Ethnomathematics-Based Numeracy Learning Scale: A Rasch Model Analysis. (Astuti et al., 2024c) Link: https://www.researchgate.net/publication/380987671_Teachers'_Belief_in_Ethnomathematics-Based_Numeracy_Learning_Scale_A_Rasch_Model_Analysis	This study aims to evaluate teachers' beliefs about the ethnomathematics-based numeracy learning scale.	Rasch Model Analysis	The subjects of this study involved 75 mathematics teachers from junior high schools in Central Java.	The results showed that 17 questions had adequate strength, validity, and reliability, making them suitable for assessing teachers' beliefs about ethnomathematics-based numeracy learning.
Ethnomathematical Aspects of Learning Geometry and Values Related To The Motifs Used By The Dayak Ngaju Tribe In Central Kalimantan. (Mairing et al., 2024)	This study aims to describe these motifs based on geometric mathematical objects and concepts, as well as values	qualitative approach	This study involved two subjects, namely a 67-year-old Dayak Ngaju craftsman and a 53-year-old Hindu Kaharingan basir.	These motifs contain several mathematical objects and concepts. The mathematical objects created include circles, batang garing and jata motifs, and hexagonal shapes in the tanduk muang motif. The concepts used are geometric transformations, namely axis

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Link: https://repo.uum.edu.my/id/eprint/30354/	seen from an ethnomathematics perspective.			reflections in the mdandang tingang and tanduk muang motifs, axis reflections in the tingang, batang garing, tanduk muang, and pohon taya motifs. Rotations at point (0,0) are seen in the buntut kakupu gajah and pohon taya motifs, as well as translations in the jata motif.
Games as STEAM learning enhancers. Application of traditional Jamaican games in Early Childhood and Primary Intercultural Education. (Espigares-Gámez, Fernández-Oliveras, & Oliveras, 2020) Link: https://www.researchgate.net/publication/343287432_Games_as_STEAM_learning_enhancers_Application_of_traditional_Jamaican_games_in_Early_Childhood_and_Primary_Intercultural_Education	This study proposes promoting STEAM skills through game-based learning.	Micro Play Project (MPL)	The research subject was conducted at a school in Spain with a small group of students from preschool and elementary school levels, involving three sessions for each of the four games.	Results: Various artistic, scientific, and mathematical skills are demonstrated during play, such as: musical sense, detection of similarities, ability to rotate, shape identification, distance estimation, hypothesis formulation, and establishing relationships based on criteria. These skills confirm the didactic potential of these games in an intercultural ethnomathematics educational environment.
Analysis of Riau traditional game-based ethnomathematics in developing mathematical connection skills of elementary school students. (Fendrikfendrik et al., 2020) Link: https://www.researchgate.net/publication/342179900_Analysis_of_Riau_traditional_game-based_ethnomathematics_in_developing_	This study aims to analyze traditional Riau games based on ethnomathematics in developing elementary school students' mathematical connection skills through the Pacu Jalur game.	qualitative research	The subjects of this study involved 64 fifth-grade elementary school students.	The results show that the Pacu Jalur game can be used in mathematics learning by teachers as agents of learning and culture to develop the mathematical connection skills of elementary school students. This is because ethnomathematics learning becomes more interesting and meaningful for students, especially in the concept of cylindrical geometry.

Title, Author, Link	Aimm	Method	Subject	Result
mathematical connection skills of elementary school students				
Learning Sets Theory Using Shadow Puppet: A Study of Javanese Ethnomathematics. (Prahmana & Istiandaru, 2021) Link: https://www.mdpi.com/2227-7390/9/22/2938	This study aims to explore other elements of mathematics that can potentially be found in Javanese shadow puppetry, which in this example is set theory.	ethnographic approach	Data was collected by conducting literature reviews and photographic documentation to explore ethnomathematical elements in the culture of wayang kulit.	Ethnomathematical exploration in Javanese shadow puppet culture has revealed many basic set concepts, such as the definition of a set, universal sets, and set combinations, which can be seen in the arrangement of puppets on the screen. Learning mathematics from cultural phenomena can reduce the gap between formal mathematics and the context understood by students, making it more interesting. Wayang kulit culture is also rich in philosophical and moral values that are useful in character education. These findings open up opportunities for further research on the application of mathematical concepts in other cultures and the development of student character.
Ethnomathematics: Pranatamangsa System and the Birth-Death Ceremonial in Yogyakarta. (Prahmana et al., 2021) Link: https://ejournal.unsri.ac.id/index.php/jme/article/view/11745	This study aims to explore the culture of Yogyakarta in a context that can be used in mathematics learning. This study is an ethnographic study with ethnomodelling.	ethnographic method	In this study, data was collected through field observations, literature reviews, documentation, and interviews with Mr. Gasiman and Mr. Slamet Riyadi.	This study shows that Yogyakarta culture contains important mathematical modeling, such as the pranatamangsa system for determining seasons and birth-death ceremonies. The community uses a system of one to ten seasons to predict fish catches and planting times. Mourning rituals and birthday celebrations also involve mathematical modeling with modulo 5 and 7. These findings can be used as a reference for educators to improve students' understanding of the relationship between mathematics, culture, and everyday life.
Ethnomathematics in Intermediate Phase: Reflections on the Morabaraba Game as Indigenous Mathematical knowledge.	This article reflects on the experiences of five project members who observed the implementation	qualitative case study e	This study focused on observing lessons in ten schools in rural and semi-rural areas of KwaZulu–Natal, South Africa. Observations were	The results of the study show that Morabaraba, as a traditional game, can improve mathematics learning in intermediate classes by enabling the emergence of mathematical knowledge and

Title, Author, Link	Aimm	Method	Subject	Result
(Meeran et al., 2024) Link: https://www.tandfonline.com/doi/full/10.1080/18117295.2024.2340095	of Morabaraba, a traditional game rich in mathematical relevance.		made in Intermediate Phase mathematics classes (Grades 4–6) with ten teachers.	the identification of specific mathematical concepts. The integration of Morabaraba into the mathematics curriculum related to CAPS has proven to be conducive, and teachers have shown innovation and creativity in adapting the rules of the game to incorporate traditional knowledge systems into formal teaching. This study provides evidence that ethnomathematics can contribute significantly to the decolonization of mathematics teaching. Furthermore, the use of ethnomathematics games such as Morabaraba is recommended as an effective strategy to improve mathematics learning and students' cognitive development. Future research is expected to preserve the use of traditional games in mathematics teaching and explore other traditional games to support more innovative teaching methods.

Research by (Balabuch & Rasoarifetra, 2023) highlights the importance of weaving practices as a tool for teaching cultural heritage and mathematical and scientific concepts to students in various contexts in Africa. This study uses a case study method involving educators in Canada, Ghana, and Madagascar, demonstrating the global relevance of this educational approach. Weaving practices not only teach technical skills but also help students develop deeper connections with their local culture and history. This is in line with contextual learning theory, which states that better understanding can be achieved when learning is related to the cultural and social context of students (Perez-Alvarez et al., 2013). By learning weaving techniques, students not only learn about their cultural heritage, but also develop critical skills that can be applied in various aspects of life. Furthermore, this research shows that weaving education integrates principles of mathematics and science. Concepts such as patterns, symmetry, and measurement are essential in the weaving process and can be used to teach mathematical concepts in a practical way. This is in line with the opinion (Guha, 2011) that real-world experiences can strengthen students' understanding of mathematics. By linking mathematical concepts to weaving practices, students can see the real-world applications of the theories they learn in class.

In terms of science, weaving involves understanding the materials and technologies used in the production of fabrics and baskets. This reflects an interdisciplinary approach that combines science, technology, engineering, and mathematics (STEM) in education. According to (Beers, 2011), the STEM approach can increase student engagement and prepare them for future challenges. Thus, weaving is a concrete example of how an integrated educational approach can provide a holistic learning experience. Weaving education also builds character in students by teaching values such as patience, resilience, and calmness. These values are essential in developing a balanced character, in line with the principles of character education proposed by (Lickona, 1992). Learning that prioritizes character development can prepare students to become individuals who are not only academically intelligent but also have strong moral values. Overall, this shows that weaving education is not just a practical skill, but also a means of teaching students about their cultural identity, mathematical and scientific concepts, and character development. This approach underscores the importance of education that is relevant to the cultural context and needs of students, as well as creating a bridge between their past and future.

Research by (Kusuma & Dwipriyoko, 2021) investigated the relationship between musical intelligence and improved mathematical connection skills through the application of Ethnomathematics and the Mozart Effect. Using a non-equivalent control group quasi-experimental design, this study involved two classes of 7th grade students at SMPN Bojongsoang 1, Bandung Regency, each consisting of 30 students. The findings showed a positive relationship between musical intelligence and improvements in students' mathematical connection abilities, as well as an increase in their motivation to learn mathematics. Musical intelligence, as described by (Gardner, 1983) in his theory of multiple intelligences, is a form of intelligence that includes the ability to understand, create, and appreciate music. This study supports the argument that students with higher musical intelligence tend to be better at making mathematical connections. This is in line with the findings by (Vitz & Titus, 2022), which show that the skills of listening to and processing rhythms in music can improve students' cognitive abilities, including mathematical understanding. The application of ethnomathematics in the context of mathematics learning shows how local culture can be used to enrich students' understanding of mathematical concepts. Ethnomathematics, as described by (d'Ambrosio, 1985), emphasizes the importance of cultural context in mathematics learning, which helps students relate mathematical concepts to their own lives.

By using relevant ethnomathematics examples, students can develop a deeper and more meaningful understanding of mathematics, thereby improving their mathematical connection skills. The Mozart Effect, proposed by (Rauscher & Others, 1994), states that listening to classical music, especially Mozart's works, can improve cognitive abilities and academic achievement. In the context of this study, researchers successfully demonstrated that

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the use of music in mathematics learning can increase student motivation. Music not only creates a pleasant learning atmosphere, but it can also improve student concentration and focus, which are important for understanding complex mathematical concepts. The implications of this study are very significant for future educational practices. Educators may consider integrating elements of music and ethnomathematics into mathematics teaching to increase student motivation and mathematical connection skills. This also opens up opportunities for further research on the relationship between musical intelligence and other aspects of mathematics learning, such as problem solving and creativity.

Research by (Zuliana et al., 2023) focuses on ethnomathematics studies that describe philosophical values and geometric patterns in the architecture and ornamentation of traditional Javanese mosques. Using ethnographic methods, this study involved a cultural practitioner and five elementary school teachers as research subjects. The findings of this study provide deep insights into the relationship between culture, religion, and mathematics learning in elementary schools. The results show that traditional Javanese mosque architecture not only functions as a place of worship but also contains profound philosophical values. Values such as the relationship between humans and God and fellow humans, as well as Islamic principles such as faith, ihsan, openness, honesty, obedience, and humility, provide a moral and ethical context for students. This concept is in line with the view (d'Ambrosio, 1985) that emphasizes the importance of culture in mathematics learning. By linking these values to learning, teachers can create a more meaningful and relevant learning experience for students. In the context of mathematics, this study identifies various geometric patterns found in the architecture and ornamentation of mosques, including cuboid and cylindrical shapes, symmetrical patterns, and geometric transformations such as rotation. These patterns not only enrich students' understanding of geometry, but also provide concrete examples of the application of mathematical concepts.

The importance of this research lies in its ability to bridge the gap between formal mathematics learning and the local cultural context. By using mosque architecture as a learning resource, teachers can integrate ethical and moral values into the mathematics curriculum, making learning more holistic. This is also in line with the thinking expressed by (Hasanah & Retnawati, 2022) regarding the need for a contextual approach in mathematics education to increase student motivation and understanding. Going forward, this research could pave the way for further exploration of how other cultural elements can be integrated into mathematics learning. Delving deeper into ethnomathematics could provide teachers with tools and resources to approach the material in a more innovative and relevant way for students, thereby increasing engagement and learning outcomes.

Research by (Astuti et al., 2024d) investigated the characteristics of teachers' beliefs in developing students' numeracy

skills through ethnomathematics-based learning. Involving 151 mathematics teachers from various schools in Central Java, the findings showed that the majority of teachers believed that numeracy skills could be improved with this approach. However, teachers' beliefs varied based on teaching experience: new and junior teachers had a semi-realistic-mechanistic (SRM) view, while semi-senior teachers leaned more toward a dominant realistic (DR) view. These results reflect the importance of experience in shaping teachers' beliefs, which influence their teaching practices. Teachers with a dominant realistic view tend to be more positive about the application of ethnomathematics, so training programs that focus on developing beliefs can improve learning effectiveness. This study highlights the need for ongoing professional support for all levels of teacher experience to improve students' overall numeracy skills. The study (Astuti et al., 2024b) focused on evaluating teachers' beliefs about the ethnomathematics-based numeracy learning scale using Rasch model analysis. Involving 75 mathematics teachers from junior high schools in Central Java, this study aimed to assess the strength, validity, and reliability of the instrument used. The results showed that 17 questions in the scale

The research by (Mairing et al., 2024) aims to describe the geometric motifs used by the Dayak Ngaju tribe in Central Kalimantan, as well as the ethnomathematical values contained therein. A qualitative approach was used in this study, involving two subjects: a 67-year-old Dayak Ngaju craftsman and a 53-year-old Hindu Kaharingan basir. The results of the study show that these motifs include various mathematical objects and concepts, such as circles, batang garing motifs, jata, and hexagonal shapes in the tanduk muang motif. The identified geometric transformation concepts include reflection, rotation, and translation, which are seen in various motifs. For example, axis reflection is observed in the mdandang tingang and tanduk muang motifs, rotation at point (0,0) is seen in the buntut kakupu gajah motif, and translation is seen in the jata motif. These findings show that geometry learning can be enriched by understanding the cultural context and values contained in ethnomathematical motifs. This provides important insights into how an ethnomathematics-based approach can improve students' geometric understanding and connect mathematics with local culture.

Research by (Espigares-Gámez, Fernández-Oliveras, & Oliveras Contreras, 2020) explores the use of traditional Jamaican games as a reinforcement for STEAM (Science, Technology, Engineering, Arts, and Mathematics) learning in intercultural education at the preschool and elementary school levels. This project, called the Micro Play Project (MPL), was conducted at a school in Spain and involved small groups of students in three sessions for each of the four selected games. The results of the study show that these games develop various important skills in the fields of art, science, and mathematics. The skills observed include the ability to listen to music, detect similarities, rotate objects, identify shapes, estimate distances, formulate hypotheses, and establish relationships based on specific criteria.

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These findings confirm the didactic potential of traditional games in creating an intercultural learning environment that supports the development of STEAM skills. By integrating games into the curriculum, this study shows that a game-based approach can increase student motivation and provide a more engaging and relevant context for them. Intercultural education can enrich students' learning experiences through the use of different cultural practices, facilitating a deeper understanding of STEAM concepts.

Research conducted by (Fendrikfendrik et al., 2020) explored the use of a traditional Riau game, Pacu Jalur, as a tool for developing elementary school students' mathematical connection skills through an ethnomathematics approach. In this study, 64 fifth-grade elementary school students were involved to assess the effectiveness of the game in the context of mathematics learning. The results of the study show that the Pacu Jalur game not only functions as a learning agent but also as a cultural medium that enhances students' learning experiences. By integrating cultural elements into learning, ethnomathematics provides a more interesting and meaningful context for students, especially in understanding the concept of cylindrical geometry. Through play activities, students not only learn mathematical concepts but also build connections between mathematical knowledge and their cultural experiences, which can strengthen their understanding of the material. Thus, this study emphasizes the importance of incorporating traditional games into the mathematics curriculum, which not only enriches learning but also helps students see the relevance of mathematics in their daily lives. This approach offers an innovative model for teachers to design more dynamic and contextual learning experiences, encouraging students to actively participate and develop their mathematical skills in a fun and interactive way.

Research by (Prahmana & Istiandaru, 2021) examines the potential of mathematical elements contained in Javanese shadow puppet culture with a focus on set theory. Using an ethnographic approach, researchers conducted a literature review and photographic documentation to identify mathematical concepts that can be explored through shadow puppet performances. The results of the study show that wayang kulit is not only a form of art and entertainment, but also contains many basic concepts of set theory, including the definition of sets, universal sets, and set unions, which can be observed from the arrangement of wayang characters on the screen. By starting mathematics learning from cultural phenomena familiar to students, this approach reduces the gap between formal mathematics and contexts understood by students, making learning more interesting and relevant. Furthermore, the culture of wayang kulit is also rich in philosophical and moral values that have the potential to be utilized in character education. These findings show that integrating culture into mathematics learning not only enriches students' understanding of mathematical concepts but also supports positive character development. This research

opens up opportunities for further exploration of the application of mathematical concepts in other cultures and contributes to the development of teaching methodologies that combine academic aspects and cultural values.

Research by (Prahmana et al., 2021) examined the pranatamangsa system and birth-death ceremonies in Yogyakarta as part of ethnomathematics, with the aim of exploring cultural aspects that can be used in mathematics learning. Using ethnographic and ethnomodeling methods, data were collected through field observations, literature reviews, documentation, and interviews with key informants. The results of the study show that the culture of Yogyakarta contains significant mathematical modeling. The pranatamangsa system, used to determine the seasons, includes an understanding of time and environmental cycles, where the community relies on a system of one to ten seasons to predict fish catches and planting times. This study also highlights the involvement of mathematics in mourning rituals and birthday celebrations, where mathematical modeling using modulo 5 and 7 is applied. These findings show that there is a close relationship between mathematics, culture, and the daily lives of the people of Yogyakarta. By integrating these cultural elements into mathematics learning, educators can improve students' understanding of mathematical concepts and provide a more relevant and interesting context. This emphasizes the importance of ethnomathematics as a pedagogical approach that not only enriches the learning experience but also respects and preserves local cultural values.

The article by (Meeran et al., 2024) examines the experiences of five project members in observing the implementation of Morabaraba, a traditional game with strong mathematical relevance. This study uses a qualitative case study approach, focusing on observing mathematics lessons in ten schools in rural and semi-rural areas of KwaZulu-Natal, South Africa, involving 10 Intermediate Phase (Grades 4–6) teachers. The results show that the Morabaraba game can improve mathematics learning in Intermediate classes. This game allows for the emergence of mathematical knowledge and the identification of specific mathematical concepts in a cultural context. The integration of Morabaraba into the mathematics curriculum in accordance with the Curriculum and Assessment Policy Statement (CAPS) has proven to be conducive to learning. Teachers also demonstrated innovation and creativity in adapting the rules of the game to incorporate traditional knowledge systems into formal teaching. This study provides evidence that ethnomathematics can contribute significantly to the decolonization of mathematics teaching. In addition, the use of ethnomathematics games such as Morabaraba is recommended as an effective strategy to improve mathematics learning and students' cognitive development. Future research is expected to preserve the use of traditional games in mathematics teaching and explore other traditional games.

Ethnomathematics is an approach that links mathematical concepts to local cultural contexts, showing how cultural practices can improve students' understanding of mathematics. This theory is supported by

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Paulo Freire's view of experience-based education, in which students are encouraged to interact with the world around them. (Freire, 1970) emphasizes the importance of social and cultural context in education, which is in line with the principles of ethnomathematics.

In this context, mathematical concepts can be understood more deeply through cultural practices. D'Ambrosio (1985) explains that ethnomathematics not only covers mathematical skills but also includes the cultural values underlying these practices. This is in line with the theory of contextual learning proposed by (Perez-Alvarez et al., 2013), which states that better understanding can be achieved when learning is related to the cultural and social context of students. On the other hand, the integration of science and technology in mathematics education can also be seen in the context of ethnomathematics. The STEM (Science, Technology, Engineering, and Mathematics) approach plays an important role in providing a comprehensive learning experience. (Beers, 2011) emphasizes that this approach can increase student engagement and prepare them for future challenges by connecting learning with real-world applications. Furthermore, ethnomathematics learning also contributes to the development of students' character. According to (Lickona, 1992), character education is important in shaping individuals who are academically and morally balanced.

By incorporating ethical and moral values into mathematics learning, students not only learn mathematical concepts, but also values that can shape their personalities. The importance of ethnomathematics is also evident in the development of numeracy skills. Based on Gardner's (1983) theory of multiple intelligences, ethnomathematics can facilitate the development of various forms of intelligence, including logical-mathematical and musical intelligence. Musical intelligence, for example, can improve students' ability to make mathematical connections, as shown by Vitz & Titus (2022). The use of musical elements in mathematics learning can create a pleasant learning atmosphere and improve student concentration.

The results of the analysis of Ethnomathematics in a Professional Context from various literature reviews that have been analyzed can be visualized using NVIVO 12, as shown in Figure 1 below:

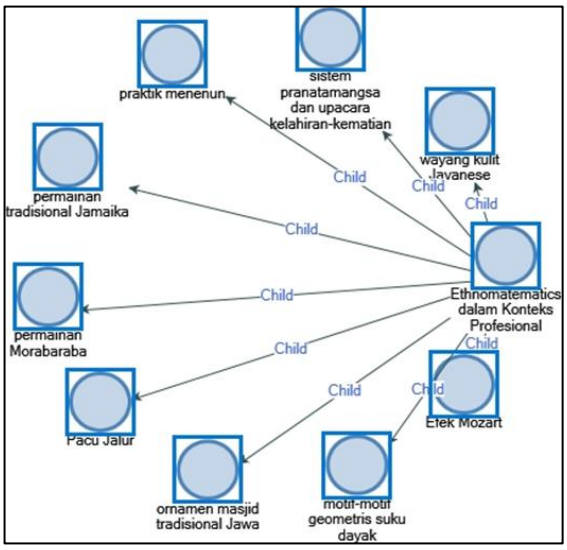

Figure 1. Visualization of NVIVO 12 Result

In the context of ethnomathematics, several traditional games used as tools for learning mathematics include Morabaraba, weaving, and the geometric motifs of the Ngaju Dayak tribe. Morabaraba is a game that originated in South Africa, specifically

among the KwaZulu-Natal people, which contains many mathematical concepts. This game has been proven effective in improving mathematical understanding among intermediate grade students. On the other hand, the practice of weaving not only introduces cultural techniques but also teaches mathematical and scientific concepts, such as patterns, symmetry, and measurement. In addition, the geometric motifs found in the handicrafts of the Dayak Ngaju tribe in Central Kalimantan include various shapes such as circles and hexagons, which provide a cultural context for understanding geometry. This ethnomathematics approach aims to connect cultural elements with mathematics education, thereby enriching students' learning experiences and improving their understanding of mathematical concepts. Overall, ethnomathematics offers a holistic approach to mathematics education. By linking mathematical concepts to the local cultural context, students can understand and appreciate mathematics as part of their life experiences. This approach not only improves mathematical understanding but also encourages the development of character and critical skills necessary in everyday life.

Meanwhile, in the context of mathematics learning materials that can be integrated through weaving practices as a teaching tool. First, the concepts of patterns and symmetry are very important in weaving, where students can learn to identify and create repeating geometric patterns. The concept of measurement is also crucial in determining the size and proportions of the fabric to be woven, allowing students to apply basic mathematical skills. In addition, musical intelligence can improve students' mathematical connection skills, where mathematical concepts can be taught through rhythm and melody. Geometric patterns in traditional Javanese mosque architecture, where students can learn about cuboid and cylindrical shapes and geometric transformations such as rotation and reflection. Geometric motifs in the culture of the Ngaju Dayak tribe contain concepts of geometric transformation, enriching students' understanding of geometry in the context of their culture. The distribution of geometric motifs can be seen in Figure 2 below.

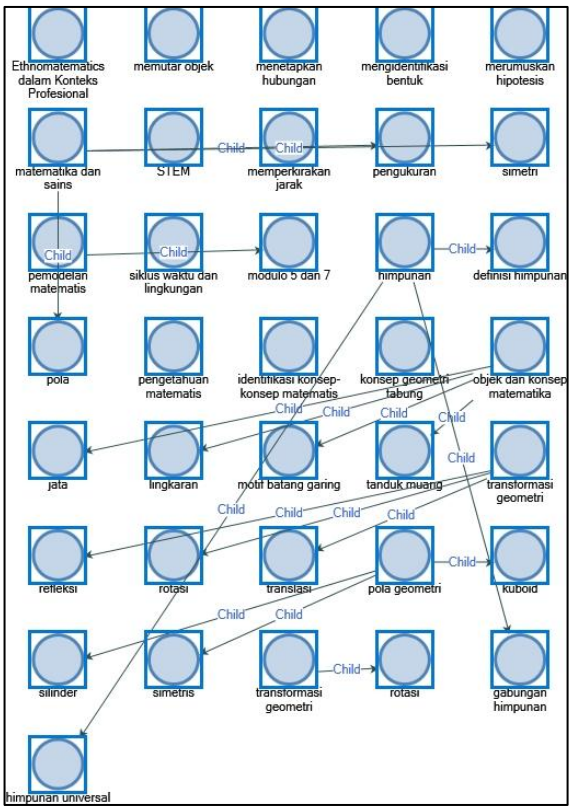

Figure 2. Results of Visualization of Mathematics Learning Materials

Overall, these studies show that mathematics learning can be more effective and meaningful when integrated with

cultural contexts, practical skills, and scientific concepts, thereby creating a holistic and relevant learning experience for students.

IV. CONCLUSION

From the questions asked from the research topic (research question), it can be concluded that from the results of N-VIVO12, a literature review of professions related to ethnomathematics, namely weaving, musical intelligence (the Mozart effect), traditional Jamaican games, traditional Riau games, wayang kulit performances, Pranatamangsa birth-death ceremonies, and Mahabharata games, was conducted to examine the extent to which research has been conducted on professions related to culture in Indonesia. The studies discussed show that by integrating culture into mathematics learning, students can develop a deeper and more meaningful understanding and improve their mathematical connection skills. Therefore, professional ethnomathematics that have not been widely or used for research can be a reference for further research.

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