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A Systematic Review of Ethnomathematics Research (2019–2023): Cultural Integration in Mathematics Teaching and Learning

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Abstract: This systematic literature review (SLR) examines ethnomathematics in the period 2019–2023 using the PRISMA protocol. By analyzing the Scopus and ERIC databases, 24 relevant articles were found. Ethnomathematics is an interdisciplinary field that studies the practices, knowledge, and cultural aspects of mathematics in various societies. This SLR aims to provide an overview of the latest research trends, methodologies, and main findings in ethnomathematics. The review process included analysis of titles, abstracts, and full texts, with data extraction related to the year of publication, authors, research objectives, methodology, and main findings. The data obtained were analyzed to identify research patterns and gaps. The results of the study show an increasing interest in exploring cultural mathematical practices and the impact of cultural factors on mathematics learning. Various methodological approaches were used, such as qualitative, quantitative, ethnographic, and cross-cultural comparison studies. Key findings include the integration of ethnomathematics in education, cultural relevance in the curriculum, and the development of culturally responsive pedagogy. The review also highlights the need for further research, especially related to the representation of underrepresented cultures or regions. Overall, this SLR provides a comprehensive review of recent research in ethnomathematics, identifying trends, methodologies, and key findings. The study contributes to the discussion on cultural diversity and inclusivity in mathematics education, serving as a valuable reference for researchers, educators, and policymakers.

Keywords: ethnomodeling, ethnomathematics, systematic literature review (SLR).

▪ INTRODUCTION

Teaching and learning activities in mathematics subjects often use formal learning processes with normative and dogmatic principles, which are far from the socio-cultural reality of society (Valeeva et al., 2023). The impact felt by students is that students have not been able to fully understand mathematics, so students have not been able to implement mathematical knowledge in solving problems in everyday life. This is the reason for researchers to study ethnomathematics in learning mathematics.

The ethnomathematics approach is an innovation used in learning mathematics that can be applied to teaching and learning activities in mathematics in formal classes (Machaba & Dhlamini, 2021). The application of ethnomathematics is a pedagogical action in learning mathematics to restore a sense of fun and involvement and can increase creativity in implementing mathematics (Prahmana & D'Ambrosio, 2020; Prahmana & Istiandaru, 2021). Applying the principle that mathematics is an expression of the development of culture and human thought can be the basis for teaching and learning activities in mathematics based on ethnomathematics (Fauzi et al., 2022). Learning mathematics does not only learn about external values and rigid academic mathematical knowledge but needs to start with the real sociocultural context and the reality around students (Wahidin et al., 2023). This makes mathematics education considered very

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crucial for contextualizing mathematics with the cultural environment of students because, in essence, science emerges from the needs and expectations of people in a particular culture to be able to respond to the environment and answer various problems faced in their lives.

Several terms in the ethnomathematics perspective have their meaning, including the term literacy, which is defined as the ability that students have to process, write, represent, and count as well as use various kinds of media. Furthermore, the term matheracy is defined as the ability that students have to interpret and analyze signs and codes to propose a model that is useful for finding solutions to problems in everyday life. Then the term technocracy is interpreted as the ability of students to use and combine various technological instruments that can help students to assess the results of reasonableness and contextualization in carrying out daily activities (Cruickshank & Abbinnett, 2019; Friedman, 2020).

Ethnomathematics is an approach to learning mathematics that aims to create meaningful teaching and learning activities (Umbara et al., 2021). The formation of meaningful teaching and learning activities has the potential to create different learning styles and atmospheres in each region, thus allowing for social inequalities due to cultural differences. Nothing can guarantee that each group can accept other cultures outside the culture of a group. Students who do not understand the cultural context used in their surroundings can make students experience difficulties in learning mathematics, moreover, it can damage students' understanding of mathematics. This is in line with the research of Prahmana et al., (2021) which states that "ethnomathematics refers to the methods and techniques (tics) used to study, understand, explain, and deal with the reality (mathematics) faced by the natural, social, political, or different culture (ethnic).

The introduction of the idea of ethnomathematics in schools can act as an exclusion factor, because students who are mostly from the "dominant culture" in an area, will study academic mathematics which has the opportunity to be able to compete in an increasingly mathematical world, but students who come from other cultures will only learn local and basic knowledge that can hardly contribute to its cultural emancipation (Desai et al., 2022). The process of teaching and learning activities by paying attention to students' shared experiences can help create meaningful learning, although mathematics can also be taught effectively and meaningfully without linking it to culture or individual students. If mathematics is considered meaningless, then mathematics cannot be understood, so mathematics is not a popular subject for most students. Therefore the fault lies with educators who are unable to apply the process of teaching and learning activities in mathematics in a meaningful way.

This study uses a systematic literature review (SLR) study, which aims to analyze whether ethnomathematics can be categorized as an approach to learning in mathematics that fulfills elements of truth (ontological, epistemological, and axiological). Research using SLR on ethnomathematics has been carried out by several researchers, but most of the research is limited to the explanation of ethnomathematics in a particular culture, and it is still rare to examine its urgency in cognitive and pedagogical studies in mathematics learning. Therefore, this research can be used as an effort to identify the various cultures that have been studied and focus on 'cultural' boundaries that can be used as contexts in implementing the ethnomathematics approach in learning mathematics. This research has

the potential to add to the literature by providing a complete picture of ethnomathematics in teaching and learning activities in mathematics.

In this study, research questions are designed to guide the analysis of trends, methodologies, and key findings in ethnomathematics research. Here are some of the key questions that are the focus of this study:

1. Who is the distribution of ethnomathematics research in mathematics learning in terms of data sources: students, teachers, Figures, or documents?
2. What cultural context is raised? (there are 3 forms of culture, ideas, artifacts, and activities)
3. Where did the research take place?
4. What research topic is used: ethnomathematics or ethnomodeling?
5. Will the research results be used in mathematics learning content: yes (what material) or no?

▪ METHOD

Research Design

By using ethno-modeling, ethno-mathematical researchers have a great opportunity to find and use mathematical modeling in their research (Umbara et al., 2021).

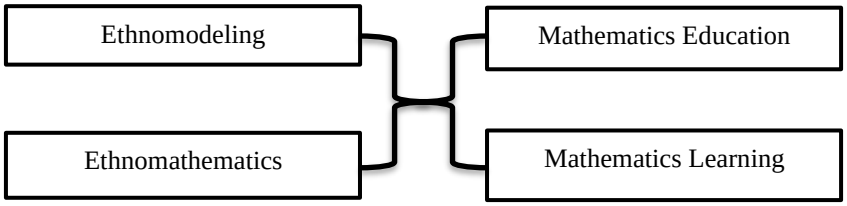

Figure 1. Conceptual framework

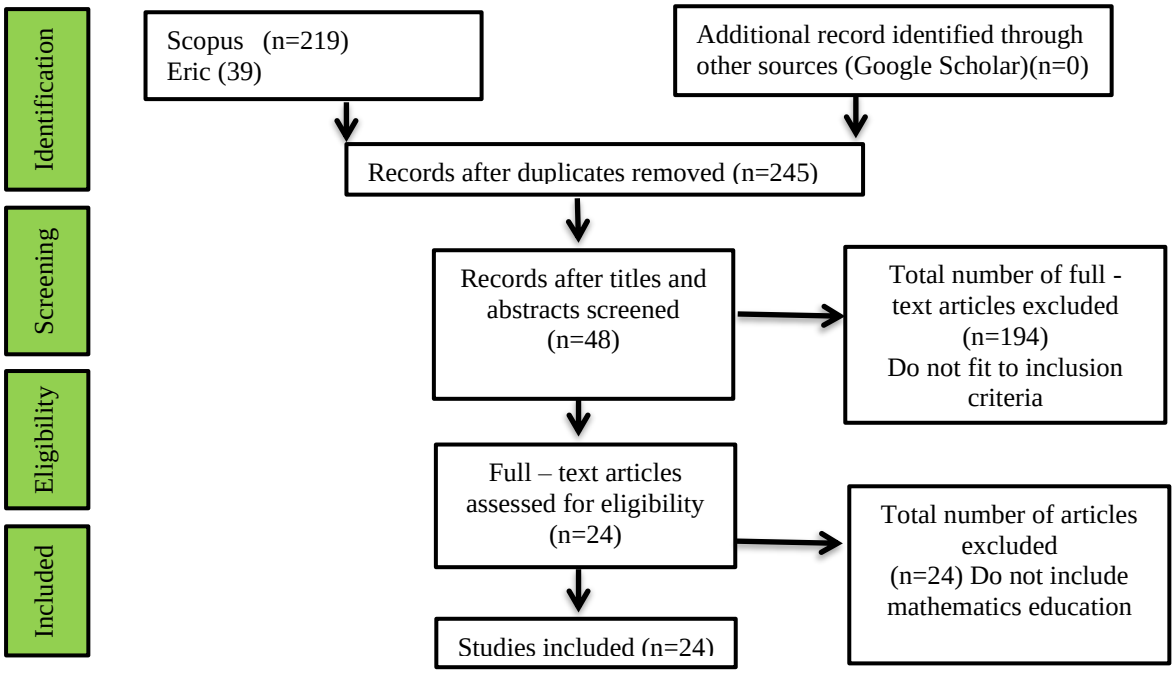

Figure. 2: PRISMA flow diagram

To answer the research question, we undertook a comprehensive Systematic literature review (SLR). SLR is a method for collecting relevant data on certain topics that meet predetermined eligibility criteria (Mengist et al., 2020). Only journal publications published between 2019 and 2023 were considered in this study. Old articles are not included. Recommended Report Elements for a Systematic Review and Meta-Analysis (PRISMA) Approach to Analyzing Journal Article Collections. PRISMA uses a guide checklist to define standardized, peer-reviewed methodologies that contribute to the quality assurance and reproducibility of the revision process (Conde, 2020). PRISMA is based on four steps: Identification, screening, eligibility, and inclusion.

Identification is the first stage. These steps are detailed in the following subsections. This method was chosen because it helps consolidate important journal publications. By following the PRISMA guidelines, we can appropriately explore the ethnomodeling of gamelan music in mathematics education. Figure 2 shows the PRISMA flowchart for this study.

Data Analysis

The search was carried out on Scopus, and Eric. the two main search terms we picked up based on our basic research topic. Ethnomodeling, ethnomathematics, learning mathematics, and mathematics education. We have compiled a list of synonyms and alternative terms based on the most popular search terms (Table 1). Therefore, we broadened our search terms and strategy to find as many potentially relevant studies as possible. Search using Scopus by combining the words contained in (Table 1) as follows: ("ethnomodelling" OR "ethnomathematics") AND ("mathematics education" OR "mathematics"). We identified 219 results using our search strategy and additional articles (n=39) sourced by Eric. As a result, a total of 258 journal articles were classified at this stage of the process.

Search Strategy

The selection process follows the PRISMA principle, as shown in Figure 1 (Aina et al., 2022; Zulhilmi et al., 2022). This approach uses different inclusion and exclusion criteria. The literature selection did not include systematic review books, book chapters, or conference proceedings. In addition, because we focus exclusively on English-language journal articles, we tend to avoid needing complex and obscure translations. Next, we look at articles published in the last five years (2019-2023). There are no exceptions for certain countries or regions. At the final stage of the screening process, we turned our attention to publications that contained at least one mathematical reference. After the screening stage, 181 articles were found not to meet the research criteria, and 13 articles were identified as duplicates. So there are only 48 items.

Inclusion and Exclusion Criteria

Table 1. Synonyms and alternatives terms for main search terms

Artificial intelligence	Math
Ethnomodeling	Math
Ethnomathematics	Math
Mathematics education	Math
Mathematics Learning	Math

Table 2. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Published antara 2019 dan 2023	*<2019*
Indexed journal	*Jurnal tidak terindeks, jurnal review, bab dalam buku, konferensi prosiding, disertasi master, kata pengantar, dan pendapat*
Bahasa Inggris	*Bukan Bahasa Inggris*
Ethnomodeling dalam matematika atau pendidikan matematika	*Ethnomodeling dalam fisika, tekhnologi, pendidikan ipa, dll*

After compiling all results from all identified sources, we used selection criteria such as document type, language, and subject matter to exclude articles that were not relevant to the study. When selecting the inclusion and exclusion sections, the inclusion and exclusion criteria should be clearly defined to ensure that the studies selected are relevant to the primary research objective. Table 2 shows the inclusion and exclusion criteria for the reviewed studies and the results of this study. 24 articles were determined to be relevant and full-text articles from these publications were searched.

Eligibility

As shown in Figure 1, the qualification phase is caused by incomplete articles. First, journal articles that did not meet our criteria for ethnomodeling in mathematics education were rejected. Next, verify that all 48 articles meet the study inclusion criteria. The purpose, title, abstract, methodology, results, and discussion of each article are thoroughly reviewed. So far, 24 articles have been rejected for not fully explaining the ethnomodeling of mathematics education or clearly explaining and validating the data findings in the research results section. As a result, 24 papers were selected for publication at the end of the review process (see Figure 2).

▪ RESULT AND DISSCUSSION

Several ethnomodeling studies (n=24) were analyzed, and published between 2019 and 2023. This section addresses the following research questions:

Table 3. Distribution of ethnomathematic research in mathematics learning

Author/Year	RQ1	RQ2	RQ3	RQ4	RQ5
Sukestiyarno et al., 2023	S	Activity	IND	Ethnomodeling	Geometry
Turmuzi et al., 2023	D	Idea	IND	Ethnomodeling	No
Rafiepour & Moradalizadeh, 2022	CF	Artifact	IND	Ethnomodeling	Algebra & Geometry
Chapman, 2022	S	Activity	IND	Ethnomodeling	Geometry
Wiryanto et al., 2022	S	Activity	IND	Ethnomodeling	Geometry
Desai et al., 2022	T	Activity	IND	Ethnomodeling	No
Rodríguez-Nieto & Alsina, 2022	CF	Artifact	IND	Ethnomodeling	Geometry
Sunzuma, G., Maharaj, 2022	T.S	Activity	ZWE	Ethnomodeling	Arithmetic
Fauzi et al., 2022	CF	Artifact	IND	Ethnomodeling	Geometry
Prahmana & Istiandaru, 2021	CF	Idea	IND	Ethnomodeling	Algebra

Orey, D.C., Rosa, 2021	CF	Idea	IND	Ethnomodeling	No
Pathuddin et al., 2021	CF	Activity	IND	Ethnomodeling	Geometry
Rosa & Orey, 2021	S	Activity	IND	Ethnomodeling	Geometry
Umbara et al., 2021	CF	Activity	IND	Ethnomodeling	Algebra & Set
Sunzuma, G., Maharaj, 2021	T	Activity	IND	Ethnomathematics	Geometry
Miguel & Zavaleta, 2021	CF	Idea	IND	Ethnomathematics	No
Busrah & Pathuddin, 2021	S	Activity	IND	Ethnomodeling	polynomial functions & integral volume
Prahmana & D'Ambrosio, 2020	CF	Activity	IND	Ethnomodeling	Geometry
Owens, 2020	S	Activity	AUS	Ethnomodeling	Geometry
Ergene, Ö., Ergene, B.Ç., Yazıcı, 2020	S	Activity	TUR	Ethnomodeling	Geometry
Gök, 2020	CF	Activity	TUR	Ethnomodeling	Algebra
Verner, I., Massarwe, K., Bshouty, 2019	T	Activity	IND	Ethnomathematics	Geometry
Utami et al., 2019	D. CF	Idea	IND	Ethnomathematics	No
Rodin, 2019	D	Idea	USA	Ethnomathematics	No

Note. RQ: Research question; S: Student; T: Teacher; D: Document; CF: Culture Figure; IND: Indonesia; ZWE: Zimbabwe; AUS: Australia; TUR: Turky; USA: Amerika Serikat

Research Question 1:

Categorizing based on research data sources, there are two types of ethnomathematics research. (1) ethnomathematics research conducted to clarify mathematical concepts in certain cultural communities and/or identify possible modeling of mathematics to teach mathematics in schools, (2) The use of mathematics as an approach to studying mathematics in research schools for testing or analyzing Ethnomathematics. The distribution of ethnomathematics studies based on data sources has the same proportion (n = 12) in each case. In the first type, data sources come from Figures or documents (Busrah & Pathuddin, 2021; Fauzi et al., 2022; Gök, 2020; Miguel & Zavaleta, 2021; Orey, D.C., Rosa, 2021; Prahmana & D'Ambrosio, 2020; Prahmana & Istiandaru, 2021; Rafiepour & Moradalizadeh, 2022; Rodin, 2019; Rodríguez-Nieto & Alsina, 2022; Turmuzi et al., 2023; Umbara et al., 2021; Utami et al., 2019). In the second type, the data source comes from teachers or students as content for learning mathematics in schools (Busrah & Pathuddin, 2021; Chapman, 2022; Desai et al., 2022; Ergene, Ö., Ergene, B.Ç., Yazıcı, 2020; Owens, 2020; Rosa & Orey, 2021; Sukestiyarno et al., 2023; Sunzuma, G., Maharaj, 2022; Verner, I., Massarwe, K., Bshouty, 2019; Wiryanto et al., 2022)

Theme 1:

This type focuses on clarifying mathematical concepts inherent in a particular culture or on developing models for teaching mathematics in schools. The data comes from cultural figures or documents. These findings are relevant because they connect mathematics to rich local contexts, as explained in the study by Rodríguez-Nieto & Alsina

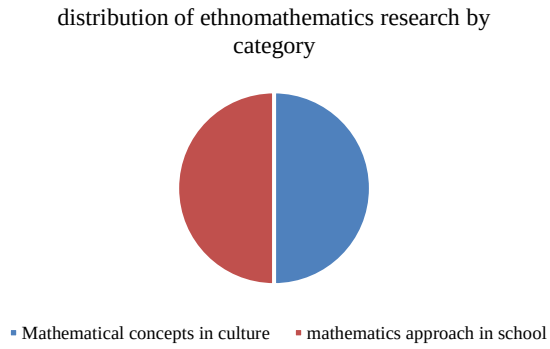

Figure 3. Distribution of ethnomathematics research by category

(2022), which highlights the importance of cultural integration in mathematics learning to increase the relevance of learning.

This approach suggests that by utilizing cultural documents and figures, ethnomathematics research allows for the disclosure of mathematical patterns hidden in culture. For example, research by Prahmana & D'Ambrosio, (2020) shows that the use of cultural context in mathematics education can improve conceptual understanding and encourage students to be more actively involved. This finding is in line with the research of Miguel & Zavaleta (2021), which uses cultural traditions to support the learning of geometric concepts.

This research is in line with the research of Rosa & Orey (2021), which emphasizes the importance of "ethnomodeling" in integrating culture with mathematics education. However, in the context of implementation in formal schools, Rodin (2019) research highlights the challenges in integrating cultural approaches with the national curriculum.

Theme 2:

This type emphasizes the use of mathematics as an analytical tool in learning, with data sourced from teachers or students. Research such as Verner, I., Massarwe, K., Bshouty, (2019) shows that the use of ethnomathematics in learning improves problem-solving skills and conceptual mastery.

This approach is designed to evaluate the effectiveness of mathematics teaching with a culture-based approach. For example, research by Chapman, (2022) tested a culture-based teaching strategy that focused on students and proved an increase in learning outcomes. This approach not only proved the success of culture-based learning but also provided insight into how ethnomathematics-based teaching can improve students' understanding of formal mathematics.

This finding is in line with research by Sunzuma, G., Maharaj, (2022), which showed that teacher involvement in using a cultural approach can increase students' confidence in mathematics. However, research by Desai et al., (2022) found certain barriers, such as teacher perceptions of the complexity of integrating culture into an established curriculum, which can be a challenge in implementation.

Research Question 2:

In classifying "cultural forms" used in ethnomathematics research it is divided into three categories: ideas, activities, and products. Ideas are culture in the form of ideas, a set of values, a set of norms, and an abstract set of rules. Of course, because it is abstract, these thoughts cannot be touched or touched, but because the existence of this culture can be expressed in the form of letters, the results of culture in thought forms are generally expressed in books, called works of authorship. Activity is a form of culture in the form of behavior, patterns of behavior by people in a community setting. This form is also often referred to as a social system consisting of human activities that interact, communicate, and mingle according to certain patterns that exist in the rules of society. Crafts and works are the result of the activities and work of the entire community and are a form of physical culture in the form of objects that can be touched, seen, and even recorded.

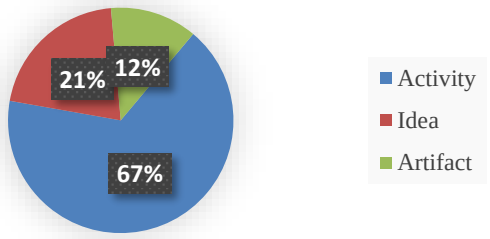

Figure. 4: Distribution of published articles by culture

Based on Figure 4, most of the ethnomathematics studies were carried out on activities (n=15), then 6 studies on ideas, and the rest (n=3) on artifacts. Study of game-style activities (Chahine, 2020; Gök, 2020; Johnson et al., 2022; Nugraha et al., 2020; Supriadi, 2022), the process of making regional specialties (Busrah & Pathuddin, 2021; Nursyahidah & Albab, 2021; Pathuddin et al., 2021), the process of making handicrafts (Laurens et al., 2020; Prahmana & D'Ambrosio, 2020), counting auspicious days (Umbara et al., 2021), visiting (Sunzuma, G., Maharaj, 2021), cultural rituals (Acharya et al., 2021; Qomariyah Nawafilah, 2020) and daily activities (Nursyahidah et al., 2018). Artifacts in the form of traditional houses and ritual tools (Fauzi et al., 2022; Hariastuti et al., 2020; Mirza et al., 2022; Sari et al., 2022; Supiyati et al., 2019). Forms of cultural thought that are the subject of research include folklore (Prahmana & Istiandaru, 2021), Javanese Primbon (Utami et al., 2019), and the pranathamansa system of the Yogyakarta people as well as birth and death rituals. (Prahmana & D'Ambrosio, 2020; Prahmana & Istiandaru, 2021).

Research Question 3:

Figure 5 shows the selected study categories according to the country in which they were conducted. Although our systematic review includes only publications published in English, research is conducted in diverse cultural contexts around the world. Indonesian researchers (n=19) have been shown to dominate integrated studies (Busrah & Pathuddin, 2021; Chapman, 2022; Desai et al., 2022; Fauzi et al., 2022; Miguel & Zavaleta, 2021; Orey, D.C., Rosa, 2021; Pathuddin et al., 2021; Prahmana & D'Ambrosio, 2020; Prahmana & Istiandaru, 2021; Rafiepour & Moradalizadeh, 2022; Rodríguez-Nieto &

Alsina, 2022; Sukestiyarno et al., 2023; Sunzuma et al., 2021; Turmuzi et al., 2023; Umbara et al., 2021; Utami et al., 2019; Verner, I., Massarwe, K., Bshouty, 2019; Wiryanto et al., 2022). Further research: Zimbabwe (Sunzuma, G., Maharaj, 2022), Australia (Owens, 2020), Turkey (Ergene, Ö., Ergene, B.Ç., Yazıcı, 2020; Gök, 2020), United States (Rodin, 2019).

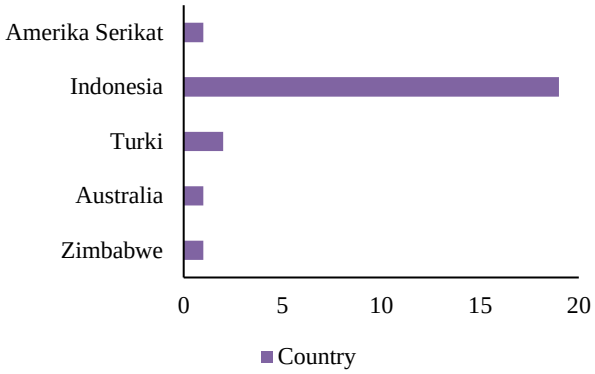

Figure 5. Distribution of research studies by country

Research Question 4:

By categorizing the types of studies used in two categories, namely ethnomathematics (pure) and ethnomodeling (Figureure 6).

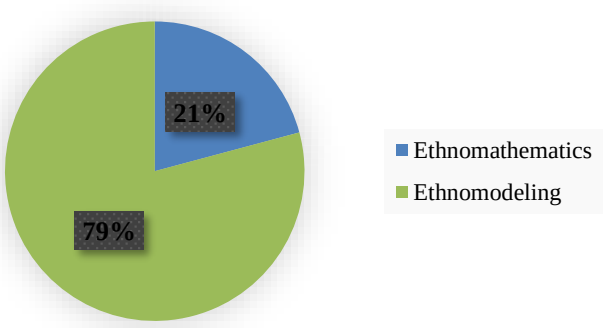

Figure 6. Distribution of research studies by jenis kajian

Research that leads to ethnomodeling (n = 19) is in great demand by researchers (Busrah & Pathuddin, 2021; Chapman, 2022; Desai et al., 2022; Ergene, Ö., Ergene, B.Ç., Yazıcı, 2020; Fauzi et al., 2022; Gök, 2020; Orey, D.C., Rosa, 2021; Owens, 2020; Pathuddin et al., 2021; Prahmana & D'Ambrosio, 2020; Prahmana & Istiandaru, 2021; Rafiepour & Moradalizadeh, 2022; Rodríguez-Nieto & Alsina, 2022; Sukestiyarno et al., 2023; Sunzuma, G., Maharaj, 2022; Turmuzi et al., 2023; Umbara et al., 2021; Wiryanto et al., 2022). There are only 5 studies (Miguel & Zavaleta, 2021; Rodin, 2019; Sunzuma, G., Maharaj, 2022; Utami et al., 2019; Verner, I., Massarwe, K., Bshouty, 2019) that purely examine ethnomathematics.

Research Question 5:

Figure 7 identifies the use of learned cultural content to learn mathematics. Several researchers (n = 20) confirmed that their findings could be implemented as mathematics learning content (Busrah & Pathuddin, 2021; Chapman, 2022; Desai et al., 2022; Ergene, Ö., Ergene, B.Ç., Yazıcı, 2020; Fauzi et al., 2022; Gök, 2020; Orey, D.C., Rosa, 2021; Owens, 2020; Pathuddin et al., 2021; Prahmana & D'Ambrosio, 2020; Rafiepour & Moradalizadeh, 2022; Rodríguez-Nieto & Alsina, 2022; Sukestiyarno et al., 2023; Sunzuma, G., Maharaj, 2022; Umbara et al., 2021; Verner, I., Massarwe, K., Bshouty, 2019; Wiryanto et al., 2022). five other researchers (Miguel & Zavaleta, 2021; Prahmana & Istiandaru, 2021; Rodin, 2019; Turmuzi et al., 2023; Utami et al., 2019) believe that the expressed mathematical model can be used for training and does not provide justification. The most studied mathematics subject was geometry (n=13), followed by algebra (n=4), sets (n=1) and arithmetic (n=3), polynomial functions & volume integrals (1).

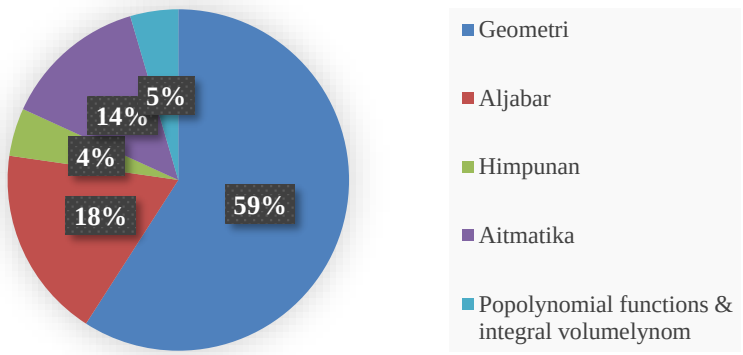

Figure 7. Distribution of research studies by topik matematika

Research trends show that geometry (n=13) is the most studied mathematics subject in the context of ethnomathematics. Most studies (n=20) stated that their findings could be implemented in mathematics learning, while five studies only mentioned models that could be used for training without further justification. Rosa & Orey found that geometry is also a dominant subject in ethnomathematics research, mainly because geometry is often associated with cultural artifacts, such as traditional patterns and architectural buildings. They also noted that the integration of ethnomathematics into formal learning still faces challenges, including the lack of teacher training in utilizing culture as a context for mathematics.

This study's tendency is consistent with Orey, D.C., Rosa, (2021) findings, which both demonstrate geometry's predominance as the primary area of study. Although further implementation work is needed, both studies concur that there is a great chance to incorporate study findings into instruction.

The local cultural context particularly Indonesia and its integration into formal education are the main topics of this study. The ethnomathematics technique is more frequently utilized to investigate local cultural values and traditions in nations like Brazil (Orey, D.C., Rosa, 2021) and Mexico (Miguel & Zavaleta, 2021), with less focus on formal adoption in education. Research in African nations focuses on empowering

students by creating local contexts that encourage learning mathematics (Sunzuma, G., Maharaj, 2022). But there are still issues with the official application of ethnomathematics.

To encourage the discovery of new mathematical knowledge, (D'Ambrosio, 1985) founded Ethnomathematics, which traces mathematical knowledge to its discoveries from the cultural roots of different societies. This pilot project succeeded in arousing public interest in ethnomathematics research through various techniques and data sources. In the context of research that focuses on research data sources, essentially all ethnomathematics research begins by exploring culturally relevant information from sources outside the school. Research conducted in schools using teaching or student research projects is a further development of the results of ethnomathematics research itself so that 50% of the results of ethnomathematics research are used in mathematics in schools. Shows that they are being tracked for their educational success. This shows that ethnomathematics has succeeded in facilitating students' mathematics learning.

It has been observed that the cultural form of 'activity' dominates ethnomathematics research. Considering that "ideas" and "artifacts" are born from human activity, this seems reasonable. Bishop (1991) describes mathematics as a cultural product that develops as a result of various activities, not limited to computation, measurement, classification, reasoning, generalization, and/or evaluation, but as part of the cultural product itself. I assume there is. Cultural knowledge and customs permeate everyday life. At all times, individuals compare and use materials and tools that are the intellectual property of their own culture (D'Ambrósio, 2005). From there, a kind of mathematical knowledge or concept is produced by human cultural activities. Each culture has developed mathematical practices suited to the needs and interests of its activities. Cultural artifacts are now understood as goods and other objects created by and serving to define the culture of a particular group or community of people. Gueuudet and Trouche (2009) expand the definition of artifacts by introducing the term 'resource' or material to cover all artifacts that enable their implementation in the learning process. Crafts can be clothes, houses, tools, baskets, ornaments, paintings, designs, etc. All of these crafts provide information about the culture of their creators and ideas related to these objects. As for ideas, the ethnomathematics ideas of certain groups of people have generally been excluded from formal academic discussions of mathematics. Rosa and Gavarrete (2017) believe that not only knowledge and approaches to learning mathematics are considered in the curriculum, but also the mathematical perceptions of cultural groups in society. Recognize how they uniquely generate and communicate the knowledge needed to be integrated into formal mathematics in the classroom (Pradhan et al., 2017). Ethnomathematics is more likely to be used to create and integrate mathematics material into the mathematics curriculum that is culturally relevant and relevant to students' own experiences (Rosa et al., 2017).

The next countries that carry out ethnomathematics research are: Indonesia occupies the top position as a country with the most advanced ethnomathematics research. Ethnomathematics as a research genre in mathematics and mathematics education has fueled the interest of researchers to explore mathematical concepts in practice among many groups of people. Exploring mathematical concepts in a culture is a breakthrough and an innovation in research infrastructure. There are many studies on ethnomathematics in Indonesia. This is not surprising because Indonesia is a maritime country with land and

sea stretching from Sabang to Merauke. This means that Indonesia has more than 17,000 islands with cultural diversity (Hendriyanto et al., 2021). The existing cultural diversity is an asset of the Indonesian people that is not owned by other countries.

There are two main reasons for introducing ethnomathematics practices in schools. To prove that school mathematics is a definitive, permanent, absolute, and unique form of knowledge. and takes into account the intellectual achievements of different civilizations, cultures, societies, occupations, and gender (Johnson et al., 2022). Ethnomathematics is the interface between cultural anthropology, mathematics, and mathematical modeling, helping to understand and relate the diverse thinking and practice of mathematics in society to traditional and academic mathematics. Although ethnomodelling can be seen as an intersection of cultural anthropology, ethnomathematics, and "mathematical modeling that can be used as a tool for educational activities in ethnomathematics programs," students are shown to learn how to "work". It deals with real situations and life problems. It is real" (Rosa & Orey, 2013).

▪ CONCLUSION

The key finding from the systematic assessment of the literature review is that using an ethnomathematics approach to studying mathematics has a positive tendency to create meaningful learning for students. The five topics of research concentration are (1) data sources: documents and cultural figures are data sources that can be used to study ethnomathematics while teachers and students are test subjects from the results of ethnomathematics studies for mathematics learning; (2) cultural forms: forms of 'activity' dominate ethnomathematics studies which are carried out culturally compared to 'ideas and artifacts'; (3) research country: ethnic and cultural diversity makes Indonesia occupy the top position in expressing mathematical concepts in certain cultures; (4) studies used: research trends are increasing in ethnomodeling studies; and (5) the use of research results for learning mathematics: research results can be used to carry out the process of learning mathematics in schools, where the topic of geometry is the most common compared to other mathematics topics.

Ethnomathematics as a learning approach can be justified by its ontological, epistemological, and axiological truths. Ontologically, ethnomathematics objects can be studied in their essential form and are closely related to human perception (for example: thinking, feeling, and using the senses); epistemologically, ethnomathematics can be seen based on the nature of knowledge, justification, and rationality of beliefs; and axiologically ethnomathematics as knowledge fulfills aspects of usability related to how to use it and the moral principles that grow in the wider community. The study of ethnomathematics axiology can present the importance of exploring ethnomathematics based on the rationality of mathematics as a whole and the rationality of different cultures. Furthermore, this study provides new information about the trend of applying the ethnomathematics approach to learning mathematics. The knowledge gap in understanding patterns and trends in research and development of mathematics learning is filled by this systematic review. In addition, this brief overview of learning mathematics through an ethnomathematics approach may be useful for both academics and practitioners and can open up new research avenues.

This study supports Orey, D.C., Rosa, (2021) research, which highlights the value of "ethnomodeling" in fusing culture and math education. However, study by Rodin,

(2019) emphasizes the difficulties in incorporating cultural methods with the national curriculum when it comes to implementation in formal institutions. This result is consistent with studies by Sunzuma, G., Maharaj (2022), which demonstrated that pupils' confidence in mathematics can be raised when teachers use a cultural approach. But according to research by Desai et al. (2022), there are several obstacles that can make implementation difficult, like teachers' opinions about how difficult it is to incorporate culture into a preexisting curriculum.

Recommendation, It has been demonstrated that ethnomodeling is a methodological strategy that links academic mathematics with ethnomathematics, which in turn may be utilized as mathematical instruction in formal education settings. It is not, however, justified to employ the ethnomathematics method in all educational mathematics resources. Ethnomatics strongly limits the definition of "culture" to "cultural forms," which include the beliefs, customs, and artifacts practiced by particular communities. Since not all cultures have mathematical values, it is impossible to categorize the diversity of current civilizations as ethnomathematics. Numerous "cultural forms" remain undiscovered in the field of ethnomathematics research. This gives academics in the field of ethno-mathematics the chance to carry out their research and use ethnomodeling to integrate ethno-mathematics into academic mathematics.

Limitations, This research is limited by the search terms used. Only works found on Scopus and ERIC are reviewed. Research on the use of AR education may be available in other databases such as Web of Science, Google Scholar, and Dimensions. Second, we limit the number of journal articles of interest to those published between 2019 and 2023. Our review process is highly impactful and limited in the results of our review. Therefore, our conclusions differ from those of other reviews (identification, screening, relevance) if any of the research themes, conceptual approach, selection criteria (inclusion or exclusion), and review process were changed. There is a possibility. A more detailed and systematic review process could include elements such as citation analysis, reference counting, and expert evaluation of papers. Article impact analysis based on authoritative index databases may also be considered. For a more in-depth analysis of the literature, a bibliography and meta-analysis can be carried out.

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