23 (3), 2022, 1195-1204

Jurnal Pendidikan MIPA

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpmipa/

A Systematic Review of the Ethnomamatics Characteristics in Indonesian Culture

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Abstract: Based on the differences and similarities of mathematical cultural roots in Indonesia, it is necessary to describe its characteristics and indicators. This article systematically reviews indicators in the roots of mathematical culture in Indonesia based on previous research guided by Prisma's statements. Metadata was analyzed using open coding and re-encoded through axial and selective coding to form ethnomathematics characteristics in Indonesian culture. The results showed that ethnomathematics in Indonesian culture has four characteristics, including 1) Using integer operations, patterns and number bases, residual theorem, modulo, and unity, Kubik, determination of surface area in starting development activities and determining seasonal systems; 2) Using the concept of geometric transformation in making Batik motifs and traditional houses; 3) Conducting games by exploring arithmetic and probabilities, ideas, and mathematical practices; and 4) Using human body size as a measuring tool in starting a development activity and planting land.

Keywords: systematic review, Ethnomamatics, characteristics, Indonesian culture.

Abstrak: *Berdasarkan perbedaan dan kesamaan akar budaya matematika di Indonesia maka perlu dideskripsikan karakteristik dan indikatornya. Artikel ini secara sistimatis mengulas indikator dalam akar budaya matematika di Indonesia berdasarkan penelitian sebelumnya yang dipandu oleh pernyataan PRISMA. Metadata dianalisis menggunakan pengkodean terbuka dan dikodekan ulang melalui pengkodean aksial dan selektif untuk membentuk karakteristik etnomatematika pada budaya Indonesia. Hasil penelitian menunjukkan bahwa etnomatematika pada budaya Indonesia memiliki empat ciri, antara lain: 1) Menggunakan operasi bilangan bulat, pola dan basis bilangan, teorema sisa, modulo, dan kongruensi, kibik, penentuan luas permukaan dalam memulai kegiatan pembangunan dan menentukan sistem musim; 2) Menggunakan konsep transformasi geometri dalam pembuatan motif Batik dan rumah adat; 3) Melakukan permainan dengan cara mengeksplorasi aritmatika dan probabilitas, ide, dan praktik matematika; dan 4) Menggunakan ukuran tubuh manusia sebagai alat ukur dalam memulai suatu kegiatan pembangunan maupun lahan tanam.*

Kata kunci: *sistimatis review, Etnomatematika, karakteristik, budaya Indonesia.*

▪ INTRODUCTION

Ethnomathematics is a term used to express the relationship between culture and mathematics. D'Ambrosio defines Ethnomathematics as *The prefix ethno is accepted today as a broad term that refers to the sociocultural context and includes language, jargon, codes of behaviour, myths, and symbols. The derivation of mathema is complicated but tends to mean explaining, knowing, understanding, and doing activities such as ciphering, measuring, classifying, inferring, and modelling. The suffix tics is derived from techné and has the same root as technique* (Rosa & Clark, 2011). When society carries out mathematical activities in everyday life, the community is doing ethnomathematics. But the public does not realize that they use mathematical materials

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DOI: http://dx.doi.org/10.23960/jpmipa/v23i3.pp1195-1204
Received: 17 August 2022
Accepted: 21 September 2022
Published: 23 September 2022

directly in their daily lives. According to Alan Bishop (1988), culturally ingrained mathematics, especially the exercises that emerge from tallying, finding, measuring, planning, playing, and clarifying, is the cultural root of all mathematics (Ernest, 1991), which in this study is categorized as a characteristic of ethnomathematics.

Furthermore, Indonesian people who have a variety of cultures must also have a variety of mathematical implementations in the culture. But many still have not been studied by mathematicians and do not have the whole meaning described by ethnomathematics. In addition, the results of ethnomathematics studies have focused on the culture of a particular society. So it must be united in a chain of mathematical cultural roots concepts, especially in Indonesian culture.

The study of Ethnomathematics in Indonesian culture is based on mathematical studies, among others, and is categorized into five categories. First in the field of geometry studied by (Hardiarti, 2017; Rachmawati, 2012; Sopamena & Yapono, 2016; Hartoyo, 2013; Prahmana & D'Ambrosio, 2020; Haryanto, Toto, Subanji, & Abadyo, 2016; Abdullah, 2017; Supiyati, Hanum, & Jailani, 2019; Muhtadi, Sukirwan, Warsito, & Prahmana, 2017; Pathuddin, Kamariah, & Ichsan Nawawi, 2021; and Mania & Alam, 2021). Second, in algebra by (Muhtadi et al., 2017; Pathuddin & Nawawi, 2021; Maemali, Prayitno, & Widayanti, 2020; Abdullah, 2017; Supiyati et al., 2019; Prahmana, Yunianto, Rosa, & Orey, 2021; and Utami, Sayuti, & Jailani, 2019). Third in the field of algebra and geometry (Sopamena & Juhaevah, 2019; Pathuddin & Nawawi, 2021; Utami, Hermanto, Muhtadi, & Sukirwan, 2021); The four areas of arithmetic are (Sitokdana, Tanone, & Tanaem, 2019; Pathuddin et al., 2021; Sitokdana et al., 2019; Mania & Alam, 2021; Nurjanah, Mardia, & Turmudi, 2021; Umbara, Wahyudin, & Prabawanto, 2021; N. W. Utami et al., 2019; and Muhtadi et al., 2017).

The fourth of anthropometrics is studied by (Supiyati et al., 2019; Nurjanah et al., 2021; Sitokdana et al., 2019), and the fifth related to learning in the classroom by (Nur, Waluya, Rochmad, & Wardono, 2020; Hardiarti, 2017; Trinowati, 2017; Irawan, Kencanawaty, & Febriyanti, 2018; Lubis, Widada, Herawaty, Nugroho, & Anggoro, 2021; Nursyahidah, Saputro, & Rubowo, 2018). Based on the literature review results, many activities at the root of the mathematics culture in Indonesia are very diverse.

Ethnomathematics in Indonesia, with its diversity, needs to be united in a mathematical concept frame so that it can be a concern in the learning process and consideration of mathematics curriculum policy in the future. However, based on the published research results, there has been no comprehensive review based on the cultural roots of all mathematics in Indonesian culture that can be used as one of the local mathematics materials in the curriculum. So that with this systematic review, interventions in regional math or local mathematic wisdom materials can be included in the school math curriculum.

▪ METHOD

The study used systematic literature reviews (SLRs) to select appropriate documents. The search is conducted from two databases (namely, Education Resources Information Center (ERIC) and Scopus). This systematic review of research uses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method introduced and described by Moher, Liberati, Tetzlaff, and Altman (Moher et al., 2009); (Moher et al., 2016) are referenced in this study. Furthermore, PRISMA

consists of four steps: identification, screening, feasibility, and inclusion. The PRISMA process is detailedly adapted from Moher et al. (2009), as seen in figure 1.

PRISMA

Identification

Distinguishing proof of significant records includes looking in a chosen database utilizing terms that best coordinate the investigation's reason. For example, the phrase by this research's objective is ethnomathematics in Indonesian culture. Shaffril, Krauss, and Samsuddin (2018) say that particular watchwords will produce more precise reports. In the interim, other terms that comparative concepts may allude to are considered to be the impediments of this survey. The Scopus database was chosen to conduct this survey, taking into consideration the focal points of this database compared to others. According to Burnham, Scopus is an abstract and indexing database with full-text links produced by Elsevier Co., which reportedly has excellent navigation skills (Burnham, 2006). It implies that other databases are set as limits to this survey.

Articles identified with the string "ethnomathematics" are taken based on headings, abstracts, and keywords. In total, the papers identified from the database of the next 26, the search is limited to the established framework, namely Ethnomathematics in Indonesian culture. Based on the total of article 26, there are 11 documents listed with the primary term. The search was conducted on December 31, 2021.

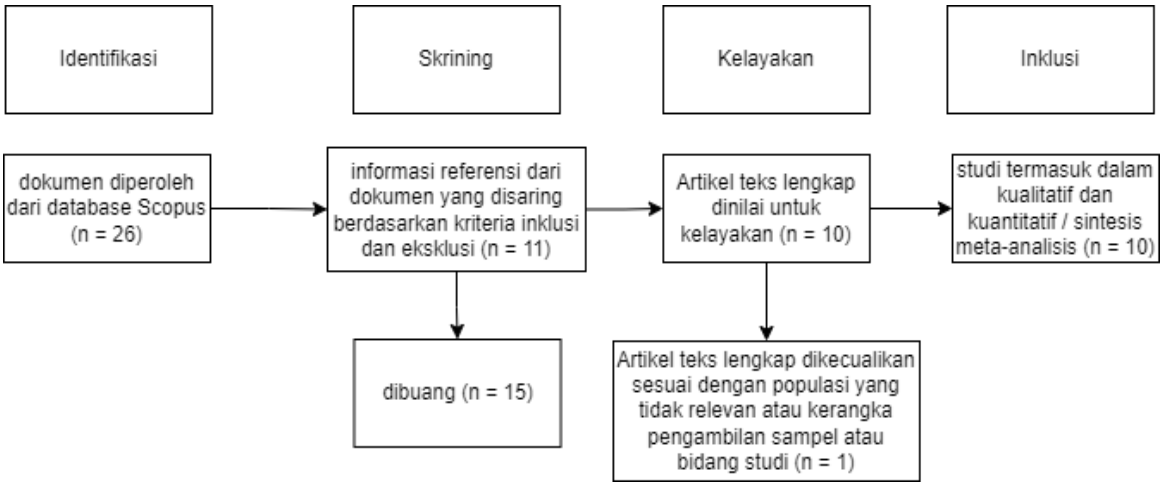

Figure 1. Prisma process

Screening

The screening method is based on built-up incorporation and avoidance criteria. Consideration criteria for this sort of writing are open get to, last distribution stages, diary article as it were, and dialect is English. Prohibition criteria are unimportant subject ranges for narrowing down papers on ethnomathematics in Indonesian culture. The inclusion and exclusion criteria for this study are shown in table 1. Based on the identification of 10 articles taken earlier, 16 unrelated pieces have been removed.

Table 1. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
type of document	Article	Book chapters, conference papers, reviews, books, and editorials.
Language	English	Non-English
Publication Stage	Finish	Articles in the Press
Type of access	Open Access	Access is not open
Subject Area	Mathematics and mathematics education	Neuroscience, Biochemistry, Genetics, Molecular Biology, Agricultural Sciences and Biology, Medicine, Immunology and Microbiology, Computer Science, Environmental Science, Engineering, Health Professions.

Eligibility

A total of 10 documents were collected. The review begins with skimming the article taken, followed by a tabulation of the title, abstract, objective, methodology, and conclusion comment. Here, no document is manually excluded because the population framework is already relevant or the field of study, namely mathematics and mathematics education. The remaining ten articles were utilized within the conclusion as sources of meta-analysis and a blend of things (as outlined in figure 1). Meta-analysis and Blend of Considers: 10 articles perused physically. The reason for coding is to organize information and summarize ethnomathematics examination units on Indonesian culture. By and large, meta-analysis and blend of considers based on the joint direction of SLRs (i.e., Ghazali, Mohamed, & Mustafa, 2021; Okoli & Schabram, 2012).

The code may be evaluated and recorded, agreeing to reference data through open coding, shapes, and comprehensive metadata. In the second moment, meta-data were re-encoded utilizing dichotomous systemic investigation (Tsvetkov, 2014). Third, data-driven code is built posteriorly, separated from words or expressions within the content that allude to ethnomathematics. The initial code serving as a unit of analysis is an aspect, case, attribute, statement, variable, scale, and construction or criterion in a document. Next, categories are revised, improved, and refined to form broad categories and multiple themes. This category is highlighted in Table 2. The coding handle in this consideration is based on rules by (Vaismoradi, Jones, Turunen, & Snelgrove, 2016).

Table 2. The description of the analysis unit, categories, and themes in this research

Term	Description
Unit of analysis	Words or phrases in ethnomathematics texts in Indonesian cultures (statements, measurements, modeling, calculations, timing, scattering, integer operations, sets, relationships, congruence, modulo, geometric transformations, geometric characteristics, anthropometric abilities, numerical values, approximation, patterns, and construct geometry)
Category	Conceptual code built from ethnomathematics speaks to commonly elite investigation units straightforwardly or by implication communicated within the content.
Tema	Indicators of concepts are at the root of the mathematical culture of all mathematics in Indonesian culture. Themes are synthesized from integrated categories.

Second, the data is refined from open code, and further meta-data is organized through axial coding and selective encoding. Finally, the unique code that appears is associated with a formal schematic representation of Ethnomathematics in Indonesian culture, as stated in Table 3. In this article, data from axial and selective codes serve as descriptors to formulate ethnomathematics in Indonesian culture. As Brereton, Kitchenham, Budgen, Turner, and Khalil (2007) suggested, all three study members examined thorough procedures from article identification to coding and meta-analysis.

▪ RESULT AND DISSCUSSION

Based on the coding results, four themes arise from indicators of mathematical concepts/fields in ethnomathematics: arithmetic, geometry, algebra, and anthropometry. The number of articles based on code (n) and the percentage of articles that refer to the code identified is calculated as N = 10. It is the total number of all articles reviewed. The following table shows the themes and categories from the preoccupied coding.

Table 3. Themes and categories that emerge from open coding

Theme (indicator)	Categories	Number of articles	Source
Arithmetic	The calculation, timing, encroaching, operation of integers, patterns, estimates, and numerical values.	7 (70%)	(Pathuddin et al., 2021), (Sitokdana et al., 2019), (Mania & Alam, 2021), (Nurjanah et al., 2021), (Umbara et al., 2021), (N. W. Utami et al., 2019), dan (Muhtadi et al., 2017),
Geometry	measurement, partnership and revival, geometric transformation, geometric characteristics, and geometric constructs	7 (70%)	(Haryanto et al., 2016), (Abdullah, 2017), (Supiyati et al., 2019), (Prahmana & D'Ambrosio, 2020), (Muhtadi et al., 2017), (Pathuddin et al., 2021), dan (Mania & Alam, 2021)
Algebra	attributes/symbols, statements, modeling, sets, relationships, congruences, modulo, and patterns	4 (40%)	(Abdullah, 2017), (Supiyati et al., 2019), (Prahmana et al., 2021), dan (N. W. Utami et al., 2019)
Anthropometry	Size that refers to the size of the human body, seperti seperunjung, sedepa, sejengkal, sekepal, sehasta, dan senyari	3 (30%)	(Supiyati et al., 2019) , (Abdullah, 2017), and (Nurjanah et al., 2021)

Based on these findings, it can be analyzed that four themes emerge from 10 categories. The first theme is arithmetic, which includes calculation, timing, encroaching, operation of integers, patterns, and numerical values. The second is

geometry, which provides measurement, wake and revival, geometric transformation, geometric characteristics, approximation, and build geometry.

The third theme is algebra. This theme covers aspects of modeling, sets, relationships, unity, modulo, and patterns. The final article is about anthropometry. Anthropometry is a measure that refers to the size of the human body. Anthropometric themes include measurements (seperunjung, sedepa, sejengkal, sekepal, sehasta, dan senyari). By breaking down previous metadata and open thematic coding analysis, the four qualitative themes are fragmented and re-encoded to form a descriptor to understand Ethnomathematics in Indonesian culture through axial codes and selective codes. First, the enhanced principles are presented in Table 4. Then, the axial code is connected and represented in schematic diagrams.

The code that appears is labeled as characteristic of ethnomathematics, among others; Counting, locating, Measuring, designing, playing, and Explaining, which serves as a mathematical descriptor of the cultural roots of Indonesia. Counting is the practice and tool of counting physically and mentally; there have been thousands of years in various forms. Location is concerned with finding a path, placing an object, determining the direction, and determining the relationship of one thing to another. Measuring activities generally use a different size, such as using a part of the body to measure length. Measuring activities generally use various sizes, such as body parts, to measure distance. Designing activities are concerned with making patterns for making objects or cultural artifacts used at home, in commerce, decoration, war, gaming, and religious purposes. I am playing deals with various traditional games in society involving these types of mathematical reasoning, probability, and strategic thinking. Finally, explaining refers to various cognitive aspects of questioning and conceptualizing the environment.

Table 4. Axial and selective code

The theme of Open Coding	Axial Encoding (Descriptor)	Key Terms
Arithmetic	Counting	Calculations; operation of integrability; decide the most acceptable time to begin house-building exercises;
	Locating	Determine the season system.
	Measurement	Timing; determine the date of burial; operation of integers; pattern compliance and forecasting
	Designing	Pattern
	Explaining	Statement; Exploration of basic mathematical operations concepts; exploration of the ideas of arithmetic operations modulo 6 and 3 in stages two to four; exploration of the concepts of arithmetic sequences and probabilities in stage five of the game; and numerical values.
Geometry	Counting	Cibik (unit for measuring volume); brick (unit to calculate surface area)
	Locating	Geometric characteristics and construct geometry.
	Measurement	Measurements; Cibik (unit for measuring volume); brick (unit to calculate surface area).
	Designing	Using the concept of geometric transformation in the manufacture of Batik motifs,

	Explaining	Statement; partnership and revival; geometric transformation; triangular prism and half ball.
Algebra	Counting	Documents contain numerical values such as number base, remainder theorem, modulo, and congruence modulus.
	Locating	The statement, relationships, and pattern; Documents contain numerical values such as number base, remainder theorem, modulo, and congruence modulus.
	Measurement	We are using measurements.
	Designing	Mathematical modeling; use of the clock symbol; documents that contain numerical values such as number base, remainder theorem, modulo, and congruence modulus in formal mathematics; Creating patterns that appear in activities.
	Explaining	Statement; exploration of the concept of arithmetic operations modulo 6 and 3 in stages two to four; set.
Antropometri	Locating	seperunjung; sedepa; sejengkal; sekepal; sehasta; dan senyari
	Measurement	seperunjung; sedepa; sejengkal; sekepal; sehasta; dan senyari
	Explaining	Taking measurements using anthropometric capabilities

Finally, through all codes, the core theme appears labeled as a characteristic of Ethnomathematics in Indonesian culture. Because research in mathematics education seems to categorize ethnomathematics indicators in Indonesian culture, the code that appeared was then associated with forming schematic diagrams of Ethnomathematics in Indonesian culture.

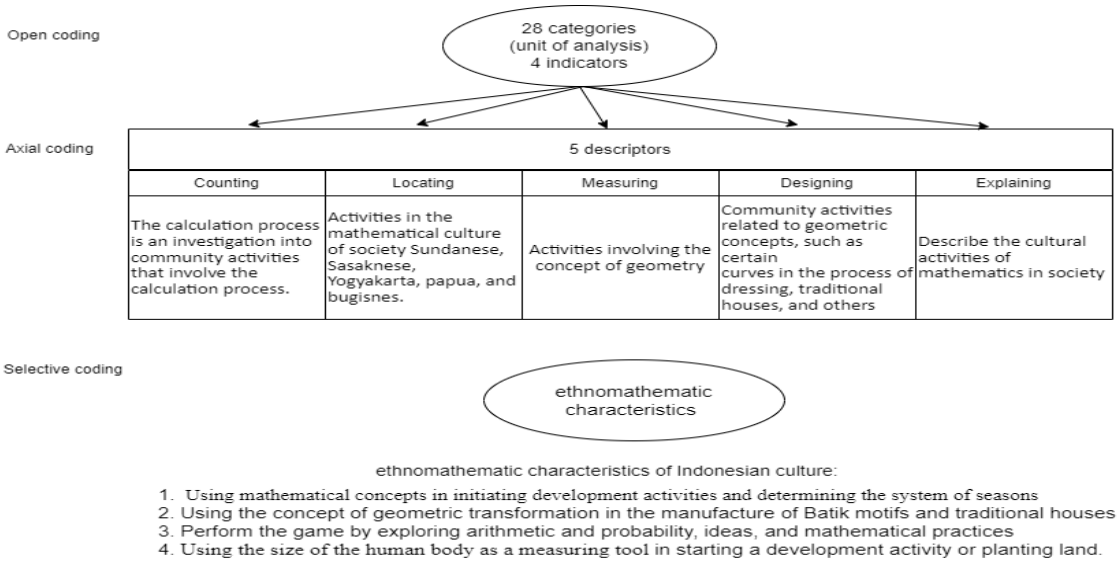

Figure 2. Schematic diagrams of ethnomathematics in indonesian culture

Therefore, the characteristics of Ethnomathematics in Indonesian culture are as: 1) Using integer operations, number patterns, number bases, remainder theorems, modulo, and congruence, Kubik (volume size), brick (determination of surface area) in initiating development activities and determining the system of seasons; 2) Using the concept of geometric transformation in the manufacture of Batik motifs and traditional houses; 3) Perform the game by exploring arithmetic and probability, ideas, and mathematical practices; and 4) Using the size of the human body as a measuring tool in starting a development activity or planting land. The study's findings further explain Bishop's statements about the cultural roots of a particular society, namely counting, locating, measuring, designing, playing, and explaining (Ernest, 1991). The six cultural roots in the study were categorized into ethnomathematics characteristics.

▪ CONCLUSION

Based on the findings of research through the SLRs + Prisma procedure with 28 categories, four indicators, and six descriptors, it was concluded that ethnomathematics in Indonesian cultures has four characteristics, among others: 1) Using integer operations, number patterns, number bases, residual theorems, modulo, and congruence, Kubik (volume size), brick (determination of surface area) in initiating development activities and determining the season system; 2) Using the concept of geometric transformation in the manufacture of Batik motifs and traditional houses; 3) Perform the game by exploring arithmetic and probability, ideas, and mathematical practices; and 4) Using the size of the human body as a measuring tool in starting a development activity and planting land. However, this research still needs to be developed by paying attention to other ethnomathematics phenomena, such as ethnomathematics in education and others.

▪ ACKNOWLEDGMENTS

We thank the authors whose articles have been used as informational material for this research need.

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