Indonesian Journal of Ethnomathematics
Volume 1, No. 1, April 2022, pp. 29-42
ISSN 2775-8001

Ethnomathematics' Research in Indonesia during 2015-2020

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Abstract

The idea of ethnomathematics initiated by Urbiratan D'Ambrosio in 1977, has now used in Indonesia in the form of various studies on ethnomathematics in various cultures in Indonesia. However, since ethnomathematics implemented in Indonesia since 2013 until now, there has been no comprehensive study of how ethnomathematics study trends in Indonesia, even though it is important for the advancement of quality and contribution of Indonesian ethnomathematics studies in the future. The study aims to comprehensively review ethnomathematics over a period of 5 years from 2015 to 2020. The method used is Systematics Literature Review which will be used to identify 30 articles from 11 highest Indonesian accredited journals, namely Sinta 1 and Sinta 2, by the Ministry of Research, Technology and Higher Education of the Republic of Indonesia. Research data is collected by collecting articles from each journal and classified by title, year, journal name, context, research subject, mathematical content, research methods and research materials. Data is analyzed with descriptive analysis, then the results of the analysis are presented in the form of presentations and descriptions. Hopefully, this study can contribute to providing a comprehensive study of ethnomathematics studies to be used as references and references in improving the quality and contribution of ethnomathematics studies in the future.

Keywords: Ethnomathematics, Culture, Systematic Literature Review, Indonesia

Abstrak

Ide ethnomathematics yang digagas oleh Urbiratan D'Ambrosio pada tahun 1977, kini telah menjamur di Indonesia dalam bentuk berbagai studi mengenai ethnomathematics di berbagai kebudayaan di Indonesia. Namun, sejak ethnomathematics masuk di Indonesia di tahun 2013 hingga saat ini belum ada kajian komprehensif bagaimana trend studi ethnomathematics di Indonesia, padahal hal tersebut penting untuk kemajuan kualitas dan kontribusi studi ethnomathematics Indonesia kedepannya. Penelitian ini bertujuan untuk mengkaji secara komprehensif ethnomathematics dalam kurun waktu 5 tahun mulai dari tahun 2015 hingga tahun 2020. Metode yang digunakan yaitu Systematics Literatur Review yang akan digunakan untuk mengidentifikasi 30 artikel dari 11 jurnal terakresitasi Sinta 1 dan Sinta 2 oleh kementerian Riset, Teknologi dan Pendidikan Tinggi Republik Indonesia. Data penelitian dikumpulkan dengan mengumpulkan artikel dari setiap jurnal dan diklasifikasikan berdasarkan judul, tahun, nama jurnal, konteks, subjek penelitian, konten matematika, metode penelitian dan materi penelitian. Data dianalisis secara deskriptif, selanjutnya hasil analisis sajikan dalam bentuk presentasi dan deskripsi. Harapannya, penelitian ini dapat berkontribusi memberikan kajian komprehensif studi ethnomathematics untuk dapat dijadikan referensi dan acuan dalam meningkatkan kualitas dan kontribusi studi ethnomathematics kedepannya.

Kata Kunci: Etnomatematika, Budaya, *Systematic Literature Review,* Indonesia

How to Cite: Hidayati, F. N., & Prahmana, R. C. I. (2022). Ethnomathematics' Research in Indonesia during 2015-2020. *Indonesian Journal of Ethnomathematics, 1*(1), 29-42. http://doi.org/10.48135/ije.v1i1.29-42

Introduction

Every culture in the world uses and develops mathematical ideas, ways, and techniques in dealing with the realities of life (D'Ambrosio, 1985, 2016; Rosa & Orey, 2016; Risdiyanti & Prahmana, 2019). The mathematical ideas, ways and techniques developed by a culture are called ethnomathematics by D'Ambrosio, a Brazilian mathematician (Rosa & Orey, 2016). D'Ambrosio initiated ethnomathematics motivated by the teaching of mechanistic mathematics, directly on abstract formulas and structures and away from the reality of student life (D'Ambroiso, 2016; Rosa & Orey, 2016, Risdiyanti & Prahmana,

2019). Since the first ethnomathematics was initiated in 1977, ethnomathematics continues to grow and is known by the world through D'Ambrosio's writings and through his speeches at various conferences.

In Indonesia, ethnomathematics began to enter the science, especially in the science of mathematics education, namely in 2013 (Karnilah, 2013). Starting from the study of ethnomathematics of Baduy people who do not receive formal education but have used and developed their own mathematics to deal with various problems in their daily lives (Karnilah, 2013; Arisetyawan, et al, 2014). Since then, the study of ethnomathematics in various cultures in Indonesia began to be widely developed and published in various journals in Indonesia. This is one of them influenced by the many and varied cultures in Indonesia ranging from Sabang to Merauke, thus attracting the interest of researchers and teachers to explore ethnomathematics in various cultures in Indonesia.

In 2016, studies on Ethnomathematics mushroomed in Indonesia, various studies were published in various journals ranging from Sinta 1 to Sinta 6. However, so far there has been no comprehensive study of how ethnomathematics studies trend in Indonesia. Though this is important for the advancement of ethnomathematics research and ethnomathematics-based mathematics learning in Indonesia. Can be used as a reference and reference for educators and researchers to improve the quality of ethnomathematics studies in Indonesia. Therefore, this study aims to conduct a survey on the publication of ethnomathematics articles starting within 5 years, starting from 2015 to 2020. Hopefully, the results of this study can contribute thought to Indonesian science, especially to mathematics and Indonesian mathematics education. It can also be a reference for teachers and researchers in developing ethnomathematics studies.

Methods

The method used in this research is Systematics Literature Review which is a method and research process to critically identify and assess relevant research, as well as to collect and analyze such data (Liberarti et al, 2009; Synder, 2019). This method aims to identify all empirical evidence that fits a certain predefined criterion to answer a hypothesis (Synder, 2019). In this study, the review literature was conducted with the highest ranking by the Ministry of Research, Technology and Higher Education of the Republic of Indonesia, as an achievement of peer reviewed journals with very good management and publication quality. Eleven of these journals were selected that fall into the category of Sinta 1 and Sinta 2. The first category was Journal on Mathematics Education (JME) and the second category was Mathematics Education Journal (AKSIOMA), Mathematics Education Journal (Al-Jabar), Jurnal Elemen, Journal of Mathematics and Natural Science Education (Formatif), Infinity Journal, Jurnal Didaktik Matematika (JDM), Journal of Research and Advances in Mathematics Education (JRAMathEdu),

Journal of Mathematics Education Research (JRPM), Creative-Innovative Mathematical Journal (Kreano) and Beta: Jurnal Tadris Matematika (Beta). Of the eleven journals reviewed 30 articles published in the period 2015 to 2020.

Data collection was done with researchers collecting articles to be reviewed using the keywords "ethnomatematics" and "ethnomathematics" in each journal. Furthermore, researchers classify the article based on predetermined criteria based on title, year, journal name, context, research subject, mathematical content, research methods and research material. Furthermore, data is analyzed with meta-analysis, a statistical method that combines the results of different studies to weigh and compare patterns or relationships in the context of several studies on the same topic (Davis et al. 2014; Synder, 2019). After analyzing the data is then presented in the form of a presentation for each criterion and described to show the potential contribution of the article in each criterion.

Results and Discussion

Trend in Ethnomathematics Articles in Journals in Indonesia

Based on 11 journals in the 2015-2020 period, trend in the ethnomathematical research in Indonesia increased in terms of the number of articles. However, no research on ethnomathematics was published in 2015, while three ethnomathematics articles were published in 2016. The first article described existing mathematical concepts in the community in Lampung (Rakhmawati, 2016). Further, the second article published in Infinity described that elements of mathematics were found in Rajapolah weaving craft (Prabawati, 2016). Lastly, the third article in the JDM journal covered the development of TIMSS-type reasoning questions with Lampung cultural context to improve students' mathematical reasoning (Wahyudi, 2016).

Total ethnomathematics article publications decreased significantly in 2020. However, from 2016 to 2019, total published articles have increased and reached the highest number in 2019 of 10 articles spreading in JME, AKSIOMA, Elemen and JRAMathEdu journals. The graph of total ethnomathematics research in Indonesia each year is shown in Figure 1.

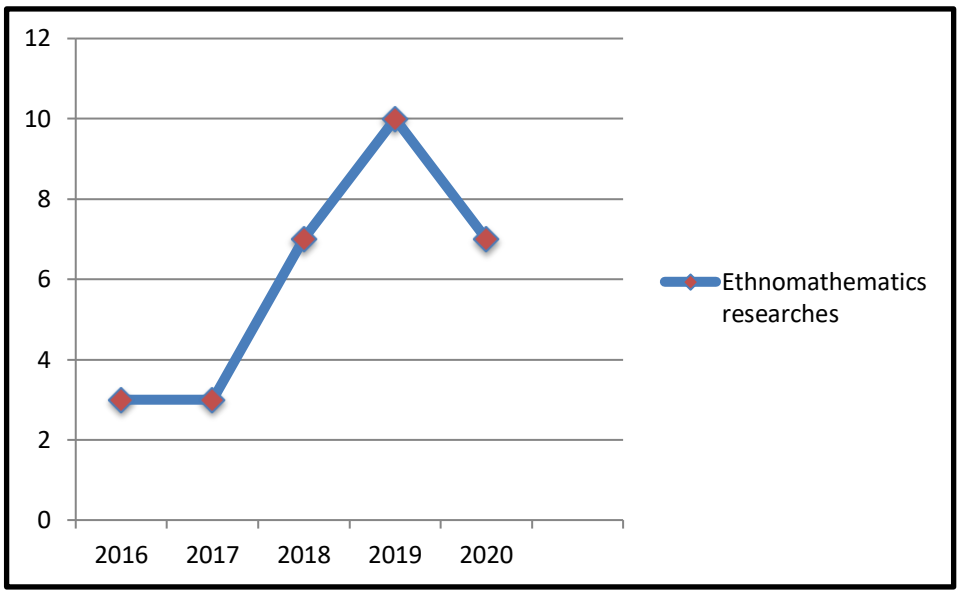

Figure 1. Graph of total ethnomathematics research in Indonesia each year

Total ethnomathematics articles published in Jurnal Elemen was 7 articles in 2020. This was the highest number of articles from other journals. The first ethnomathematics article published in Jurnal Elemen in 2018 covered geometric transformation teaching materials using discovery learning with an ethnomathematical approach (Fitriyah, Santoso, & Suryadinata, 2018).

Based on the analysis results, the number of ethnomathematics articles was dominant in Jurnal Elemen, AKSIOMA and JME. The number of ethnomathematics articles in Jurnal Elemen was almost a quarter of all ethnomathematics articles, while AKSIOMA and JME had the same number of ethnomathematics articles of 17% of all ethnomathematics articles. The percentage of ethnomathematics articles in each journal is shown in Figure 2.

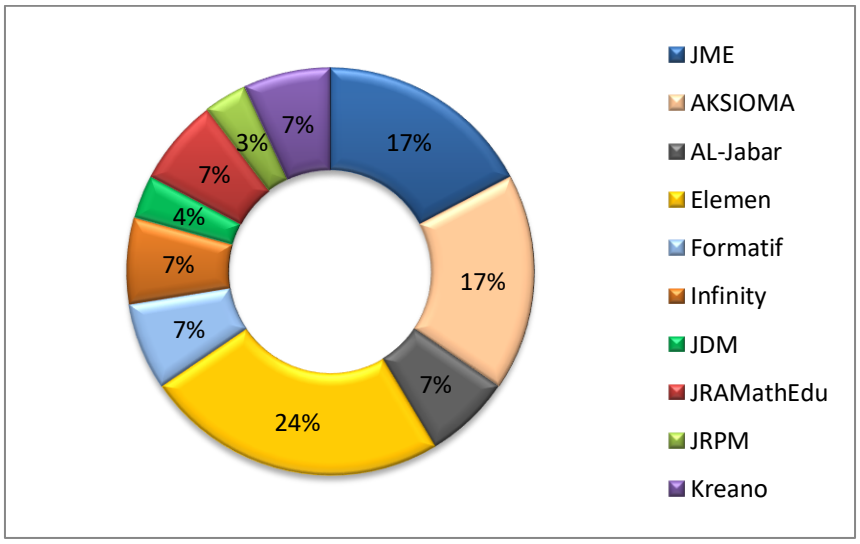

Figure 2. Percentage of ethnomathematics articles in each journal

Ethnomathematics Research Materials in Indonesia

Mathematics contains a lot of materials to be studied. However, mathematics is often perceived as difficult by students. Therefore, inclusion of cultural elements in learning mathematics known as ethnomathematics can create meaningful and contextual learning for students (Disnawati & Nahak, 2019). With the ethnomathematical concept, numerous mathematical materials can be applied in school learning so that students understand better, are interested in learning mathematics, and also know the existing culture in an area.

Based on the analysis of various ethnomathematics articles in Indonesia from 30 articles in 11 journals, the materials obtained and covered were quite diverse, including measurement, geometry, basic numbers, residual theorems, modulo, modulus congruence, geometric transformations, two-dimensional and three-dimensional geometry, circle, volume of geometric space, area, tangent, point axiom, line, space, congruence, number pattern, one variable linear equation, number, and fraction operations. To group the materials to be easier to analyze, an outline of the grouping is made, covering Geometry, Measurement, Numbers and Operations, Algebra and Numeric Value. The grouping of material in the ethnomathematics journals is shown in Figure 3

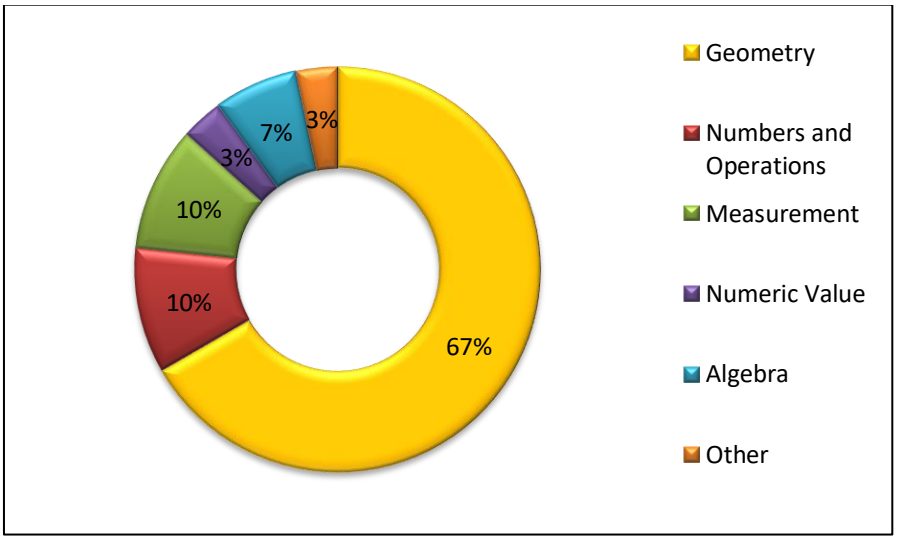

Figure 3. Mathematical materials in ethnomathematics journals in Indonesia

More than half of all ethnomathematics research cover geometry materials. Geometry materials are associated with the context of traditional houses or heritage buildings of a culture with geometric mathematical concepts. Ethnomathematics articles containing geometry materials were published in JME, Al-Jabar, JDM, JRPM and KREANO journals. Furthermore, the ethnomathematics articles dominated by "Numbers and Operations" materials were published in Elemen, Formatif and Infinity journals, while the ethnomathematics articles dominated by Measurement materials were published in

JME and AKSIOMA journals. In ethnomathematics research, both materials were associated with the context of activities carried out by a community or tribe.

Ethnomathematics Research Methods in Indonesia

Ethnomathematics articles in the 11 journals examined were the research results using various methods. The research methods included Explorative-Ethnographic, Qualitative-Ethnographic, Explorative-Descriptive, Research and Development (RnD), Descriptive-Qualitative, Descriptive-Ethnographic, Development Research, Experiment Research, Qualitative-Explorative, Qualitative and Ethnographic methods.

The data showed that one-fifth of ethnomathematics research used qualitative-ethnographic methods, namely 3 articles in JME journal and the remaining were in AKSIOMA, Elemen and JRPM journals. The second most widely used method was descriptive-qualitative method. The number of articles containing descriptive-qualitative method in AKSIOMA, Elemen and Formatif journals was one article, respectively. Meanwhile, the number of articles containing descriptive-qualitative method in JRAMathEdu journal was two articles. The third most widely used methods were explorative-ethnographic method and development research by 14%, respectively. The research using exploratory-ethnographic method were published in JME journal by two articles and the remaining were published in Al-Jabar and Formatif journals. Meanwhile, development research was published in Jurnal Elemen by two articles and the remaining were published in Infinity and KREANO journals.

In addition to these research methods, other research methods used were Research and Development (RnD) by 10% published in AKSIOMA, JDM and KREANO journals of one article, respectively and qualitative method by 75% published in JME, AKSIOMA and Elemen journals of one article, respectively. Then, other ethnomathematics research methods such as descriptive-ethnographic, explorative-descriptive, experimental research, qualitative-exploratory and ethnographic studies were only found in one ethnomathematics research article as the lowest number.

Based on the analysis, the dominant research method in articles from all journals containing ethnomathematics articles was using qualitative-ethnographic method followed by descriptive-ethnographic method, exploratory-ethnography, development research, research and development and qualitative method. A different and rarely used research method was experimental research because other methods have been used in different combinations. The percentage of ethnomathematics research methods in Indonesia can be seen in Figure 4.

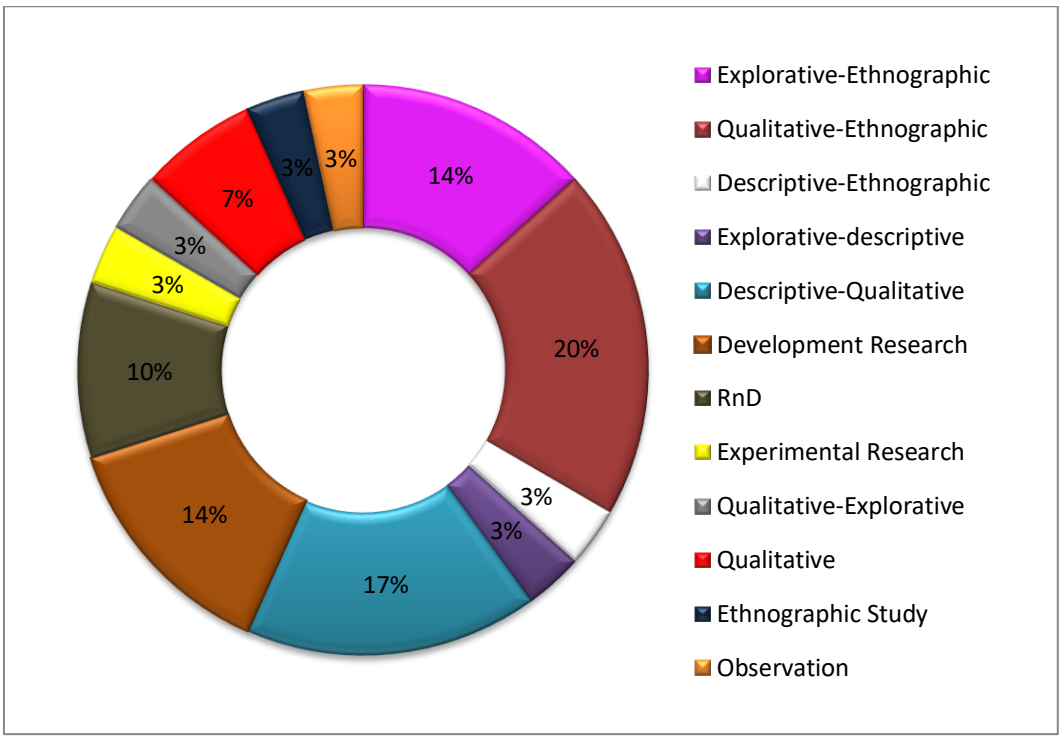

Figure 4. Percentage of ethnomathematics research methods in Indonesia

Figure 4 shows that the most widely used method was ethnographic method. Ethnographic approach provides a further analysis and description of a culture being studied based on in-depth field research (Rakhmawati, 2016). Based on in-depth analysis and description, it can obtained mathematical activities in a culture to be used as the application of learning materials at schools (Muslimahayati & Wardani, 2019). This method is in accordance with ethnomathematics research exploring a culture to find mathematical elements or concepts.

Ethnomathematics Research Subjects in Indonesia

Based on 30 articles from 11 journals, the ethnomathematics research subjects consisted of two types, namely educational unit level to develop or apply teaching materials on ethnomathematics and subjects in a culture to explore the existence of a mathematical concept or activity in the culture. At the education unit level, the subjects were elementary, middle, high schools, and university students. For ethnomathematics research on a culture, the subjects were people of a tribe or area of cultural origin, community leaders, a person related to culture or subject in the form of culture to be studied. Based on existing data, the subject of ethnomathematics research articles in Indonesia is shown in Figure 5.

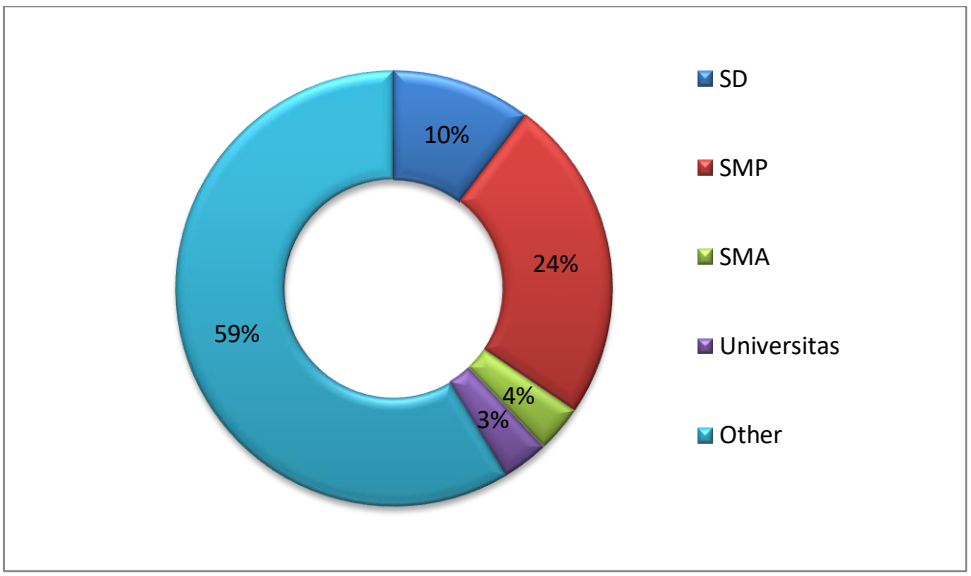

Figure 5. Subjects of ethnomathematics research articles in Indonesia

Figure 5 shows that more than half of the research subjects are others or community and those related to culture. Meanwhile, subjects at the educational unit level are mostly middle school students by 24%. Seven journals on ethnomathematics with the subject of middle school students were published in AKSIOMA, Elemen, JDM, JRAMathEdu and KREANO. Ethnomathematics research at the school level was in the form of developing teaching materials and student worksheets.

The application of ethnomathematics was low, namely at high school and university levels. The research with the two subjects were published in Jurnal Elemen by 1 article, respectively. Ethnomathematics research at high school covered application of discovery learning-based geometric transformation teaching materials through ethnomathematics approach (Fitriyah et al., 2018), the result indicated that the teaching material was suitable for use in discovery learning-based geometric transformation subject at school. Meanwhile, ethnomathematics research at the university level covered the mathematical representation of ethnomathematics-based PBL model in terms of personality type (Amalia & Isnani, 2019). Based on the above discussion on research subjects, the researcher recommends research at high school and university levels to become an opportunity for ethnomathematics development in Indonesia through the expansion of ethnomathematics courses at the university level. Thus, the reform of mathematics learning through ethnomathematics will be broader and more comprehensive.

Ethnomathematics Research Articles in Indonesia during 2015-2020

The number of ethnomathematics research in Indonesia in the 2015-2020 period based on 11 journals accredited Sinta 1 and 2 by the Ministry of Research, Technology and Higher Education was 30

articles. Table 1 shows classification based on materials starting from Elementary School, Middle School, High School, and others for those not included in formal education. The data presented in Table 1 indicates that ethnomathematics research in Indonesia still exists and increases every year spreading in 11 journals accredited by the Ministry of Research, Technology and Higher Education with a variety of materials, methods, and subjects. The results of ethnomathematics research in the 2015-2020 period in Indonesia indicated that more than half of the articles contained geometry materials associated with several research contexts. The ethnomathematics research subjects were mostly community leaders, while the subjects at the education level were mostly Middle School students.

Through the classification of ethnomathematics research by subject, it is expected that it can be used as a guide in studying ethnomathematics and provides references on ethnomathematics research conducted in the 2015-2020 period in Indonesia. This can be seen in the following data in Table 1.

Table 1. Summary of ethnomathematics research articles in Indonesia

No	Subject	Material	Reference
1	Elementary School	Geometry	(Dhofir et al., 2019; Kusaeri & Pardi, 2019 (Himmatul ulya, 2020))
		Numbers and Operations	(Rohaeti, Fitriani, & Akbar, 2020)
2	Middle School	Geometry	(Ayuningtyas & Setiana, 2019; Khaerunnisa & Pamungkas, 2018; Lestari & Aisyah, 2018; Nur, Waluya, Rochmad, & Wardono, 2020; Wahyudi, 2016)
		Numbers and Operations	(Disnawati & Nahak, 2019)
		Algebra	(Nursyahidah, Saputro, & Rubowo, 2018)
3	High School	Geometry	(Fitriyah et al., 2018)
4	University	Other	(Amalia & Isnani, 2019)
5	Others	Geometry	(Deda & Amsikan, 2019; Dosinaeng et al., 2020; Hidayatullloh, Nur; Hariastuti, 2018; Noto, Firmasari, & Fatchurrohman, 2018; Prabawati, 2016; Prahmana & D'Ambrosio, 2020; Rakhmawati, 2016; Sroyer, Nainggolan, & Hutabarat, 2018; Sulaiman &

	Nasir, 2020; Supiyati, Hanum, & Jailani, 2019; Yudianto, Susanto, & Priciliya, 2020)
Measurement	(Abdullah, 2017; Hardiani & Putrawangsa, 2019; Muhtadi, Sukirwan, Warsito, & Prahmana, 2017)
Numeric Values	(Utami, Sayuti, & Jailani, 2019)
Algebra	(Muslimahayati & Wardani, 2019)
Numbers and Operations	(Aditya, 2018)

Conclusion

We summarized 30 articles in table 1 and categorized the ethnomathematics research articles published into 3 categories, namely ethnomathematics research materials, research methods, and ethnomathematics research subject. Ethnomathematics is defined as mathematics in culture, the term ethnomathematics was initially used by D'Ambrosio in 1977. On the other hand, most ethnomathematics articles were published in Jurnal Elemen, followed by JME and AKSIOMA journals with qualitative-ethnographic research methods being the most widely used.

The most studied ethnomathematical materials were geometry, followed by numbers and operations and measurement. Ethnomathematics research was mostly conducted at Middle School level. The researcher recommends ethnomathematics researchers to undertake studies at another level, such as high school or university levels with other mathematical materials and abilities to be developed.

Overall, based on the research results, the researcher recommends the trend for further ethnomathematics research to frequently publish articles to accredited journals with the highest ranking to increase the visibility of modeling in mathematics education. In addition, a more varied application of ethnomathematics studies is needed for teachers in the future so that the teaching and learning process of mathematics will be better.

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