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Ethnomathematics on Traditional Culture: A Bibliometric Mapping Analysis and Systematic Review on Database Scopus

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ABSTRACT

This study aims to map research trends related to ethnomathematics in traditional culture by collecting and analyzing articles taken from the Scopus database. This research is a Bibliometric research on the Scopus database, to study the structure and dynamics of the field of ethnomathematics. There are five stages carried out in this study, namely the determination of keywords, data search, article selection, data validation, and data analysis. Researcher searched publications from the Scopus database using two keyword substrings: "Traditional Culture" ("Traditional" or "Culture") and "Ethnomathematics". These keyword searches were conducted in the Scopus Database in one day, March 25, 2022, to avoid a daily update bias as the database continues to collect and update data. 65 articles were retained for bibliometric mapping analysis and systematic review. From 65 articles retained, it was concluded that there was an increasing trend of publications in the last 3 years (2020-2022). this is shown by the keyword "Ethnomathematics" is the most widely used in 43 publications and the keyword "Traditional Games" is the most popular keyword in the latest research on ethnomathematics.

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1. INTRODUCTION

The problem of education has always been an interesting topic of conversation among the wider community[1], one of which is in the field of mathematics. Mathematics can be found in daily activities, sometimes it goes unaware off. However, most people perceive that mathematics is difficult[2]. Mathematics learning has a very important role for students in the era of globalization and modernization, namely as a tool to equip students with critical, logical, analytical and creative thinking skills[3]. However, we are currently suffering from various difficulties and challenges such as low motivation to learn math, difficulties in grasping and understanding complex mathematical concepts, codes, and values, attention and concentration deficits in class, and more, which negatively affect academic achievement[4]. In addition, learning is still teacher-centered (using the lecture method in learning mathematics) so that students are only used as learning objects[5-6]. If these values can be minimized, they should be able to create educational goals that are relevant to the applied curriculum[7]. Therefore, the 2013 curriculum demands the creativity of teachers to prepare teaching materials that are innovative, varied, interesting, contextual, and according to the level of student needs[8]. Therefore, education has an important role in influencing one's abilities[9].

Mathematics has been integrated in various fields of life, including the culture of the community[10]. ~~With~~ In different cultures, different mathematical concepts are used by certain communities.

Sociocultural studies showed that each community has historically constructed a certain kind of mathematics specific to its culture and history, an occurrence that D'Ambrosio (1997) labeled as "ethnomathematics"[11]. Culture contains various important elements in the form of social values, aspects of belief, and science, including knowledge of mathematics[12]. In order to bridge mathematics with the existing culture of the community, the domain is called Ethnomathematics. Etnhomathematics is a research discipline that explores the relationship between mathematics and culture[13]. The term ethnomathematics has been described as methods and techniques (tics) used to learn, understand, explain, and manage the reality (mathema) faced by distinct natural, social, political or cultural (ethno) environments[14]. Ethnomathematics, is considered by D'Ambrósio as the art or technique of understanding mathematics in its various sociocultural manifestations[15]. Ethnomatematics is mathematical knowledge which grows and develops in a country's culture[14,15].

Ethnomatematic utilizes mathematics concept widely that bound up with mathematics activity sort, covering activity agglomerates, get computing, measure, designing building or tool, play, determining location and any other as it[18]. D' Ambrosio (2001), regarded ethnomathematics as a teaching and learning approach, that builds on the learners prior knowledge, experience, the role played by the environment in terms of content and technique as well as their historical and current experiences of their immediate surroundings[19]. The ethnomathematical practice, generated by a particular cultural group, is not only the result of interactions with the natural and social environment, but also subjected to interactions with the power relations both among and within cultural groups[20]. The ethnomathematics perspective was applied in different countries with different groups of students, from different ages, where these students made connections between ethno-contexts and school mathematics[21]. So, Ethnomathematics is a way to learn and combine ideas, methods, and techniques used and developed by socio-cultural actors within a community to learn mathematical concepts[22].

The study of ethnomathematics is increasingly in demand by national and international academics. Unfortunately, there is no definite data until now about the number of international publications related to ethnomathematics from both domestic and foreign authors. In fact, this publication data is very important to know so that academics get a map regarding the development of studies in the field of ethnomathematics from year to year. Therefore, it is important to study the latest developments in ethnomathematical studies. In addition, it is also useful for publication of international publications as a reference in ethnomathematical studies

Several academics have researched the development of ethnomathematics in their respective countries. For example Supiyati & Halqi (2020) regarding the form of utilizing the cultural activities of the Sasak people as a source of learning mathematics in basic education[13]. Ergene, et al (2020) examines ethnomathematical activities designed by pre-service mathematics teachers [14]. Chahine (2020) about the role of ethnomathematics as pedagogy of humanisation that recognises the contributions of African cultures in the production and diffusion of mathematical knowledge[23], and much more.

In the last decade, bibliometric databases have come into the life of scientists, being commonly used for: (i) searching scientific documents, (ii) providing information on the impact of the scientific output of individuals and/or research institutions, and (iii) supporting the selection of scientific journals in which to publish[24]. Bibliometric indices are deployed in various academic research fields to statistically examine the quality, influence and impact of the publikasie existing in that field, facilitating researchers to examine and analyse the scientific publications[25]. No research conducted a survey of international publications within a certain time based on the Scopus database. Scopus is an abstract and indexing database with full-text links that is produced by the Elsevier Co[26]. The Scopus database was developed by Elsevier, combining the characteristics of both PubMed and Web of Science[27]. The Scopus academic database was chosen because The growth rate is higher [28], providing access to a collection of information commonly used for research and writing[29], and offers a basic search, a quick search, an author search, an advanced search, and a source search[30].

Several studies regarding this bibliometric analysis have been carried out, including research by kristial, et al (2022) regarding bibliometric analysis of the term "Ethnomathematics" which was taken from the Google Scholar media[31]. Another study by Salsabilah, et al (2022) regarding a review of the development of ethnomathematical research in traditional games[32]. The source used is still from Google Scholar. From the two previous studies, there has been no bibliometric analysis that examines ethnomathematics whose data comes from the Scopus database. Therefore, this study seeks to map research trends related to ethnomathematics in traditional culture by collecting and analyzing articles from the Scopus database.

2. METHOD

This study uses quantitative methods to identify research trends in the theme of Ethnomathematics in Traditional Culture. This research is a Bibliometric research on the Scopus database, to study the structure and dynamics of the field of ethnomathematics. There are five stages carried out in this study, namely the determination of keywords, data search, article selection, data validation, and data analysis. We searched publications from the Scopus database using two keyword substrings: "Traditional Culture" ("Traditional" or "Culture") and "Ethnomathematics". These keyword searches were conducted in the Scopus Database in one day, March 25, 2022, to avoid a daily update bias as the database continues to collect and update data.

From these keywords, 191 publications were obtained. By excluding non-article types, we get 102 articles. After that, a manual review was carried out to check the content of each article (including paper titles and abstracts) to eliminate repeated literature reviews and irrelevant publications to ensure that the selected articles involved the application of Ethnomathematics in Traditional Culture, 65 articles were retained for bibliometric mapping analysis and systematic review. Research questions were answered using bibliometric mapping analysis. VOSviewer software is adopted to analyze the most used author citations, co-citations and keywords of authors in articles.

3. RESULTS AND DISCUSSION

3.1. Development of Ethnomathematical Publications in Traditional Culture by Year

Of the 65 articles that were retained for analysis, the data obtained were from 1988 – 2022. Following are the results:

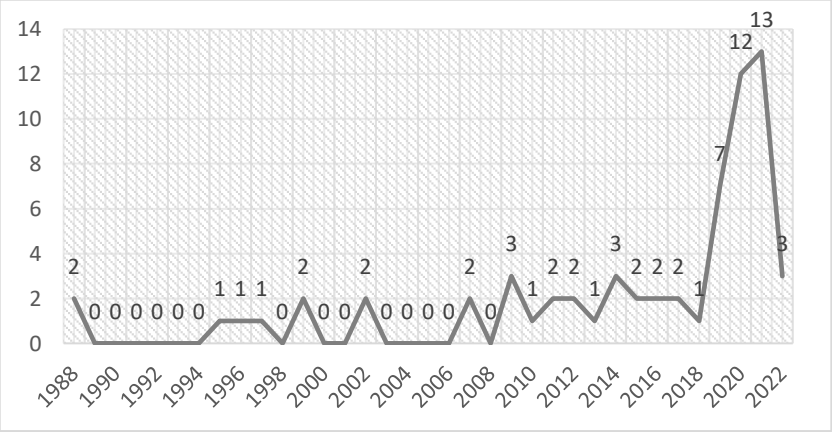


Figure 1. Publications published on Ethnomathematics in Traditional Culture from 1988-2022

From Figure 1 above, it is known that the development of publications on Ethnomathematics in Traditional Culture from 1988-2022, shows that there has been an increasing trend of publications in the last 3 years (2020-2022*), this indicates that the study of Ethnomathematics in Traditional Culture is increasingly in demand for research by experts.

3.2. Major Journals, Most Cited Articles, Most Productive and Cited Authors, and Most Productive Countries

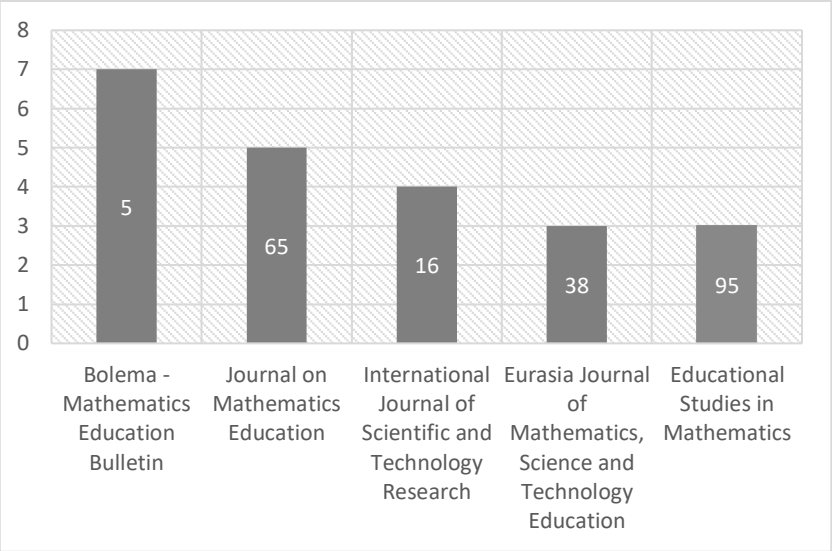


Figure 2. Top journals by number of publications from 1988 to 2022

Figure 2 shows the top 5 journals with the highest number of articles on the theme of Ethnomathematics in Traditional Culture from 1988 to 2022. They are Bolema – Mathematics Education Bulletin (7 Articles), Journal on Mathematics Education (5 Articles), International Journal of Scientific and Technology Research (4 Article), Eurasia Journal of Mathematics, Science (3 Article), and Technoloy Education, and the last is Educational Studies in Mathematics (3 Article). Figure 2 also shows that the most cited journals are Educational Studies in Mathematics (95 Citation) and the Journal on Mathematics Education (65 Articles). In addition, a co-citation analysis and cited sources were selected. The minimum number of citations from sources is adjusted to 5, and the number of sources to be automatically selected is displayed as 35.

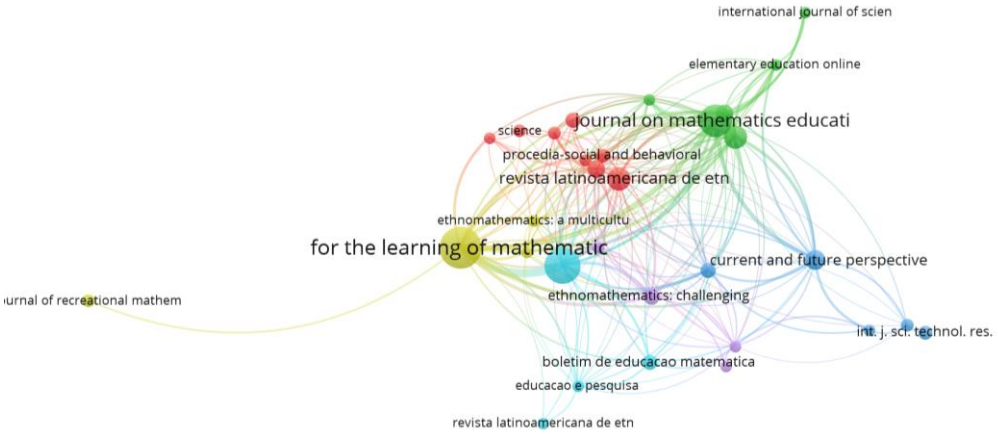


Figure 3. Most cited journals (co-citation analysis)

Figure 3 shows that the top three most cited journals are For the Learning Mathematics (57 co-citations), Educational Studies on Mathematics (43 co-citations) and the Journal on Mathematics Education (35 co-citations). In addition, you will also see the most cited articles. The following shows a total of 35 automatically selected results.

Table 1. Most cited articles

Rank	Title	Journal	Author, Year	Total # of Citations
1.	Making sense of ethnomathematics: Ethnomathematics is making sense	Educational Studies in Mathematics	Barton B., 1996	45
2.	Criticisms and contradictions of ethnomathematics	Educational Studies in Mathematics	Pais A., 2011	37
3.	Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and making patterns	Journal on Mathematics	Muhtadi D., Sukirwan, Warsito,	34

Rank	Title	Journal	Author, Year	Total # of Citations
		Education	Prahmana R.C.I., 2017	

Table 1 shows the 3 most cited articles, published by Educational Studies in Mathematics and the Journal on Mathematics Education. This more or less shows that the journal has taken research on the theme of Ethnomathematics in Traditional Culture and made it an important research focus.

The first article by Barton B., seeks to create a framework to talk about culture and mathematics. The resulting framework, the analysis derived from it, and the definitions of ethnomathematics that follow can help to categorize ethnomathematical studies and activities[33]. The second article by Pais A., contributes to the ongoing discussion of the epistemology and philosophy of ethnomathematics, and to debate their educational implications. Deeper theoretical discussion is needed in most of the research currently carried out in ethnomathematics so that well-meaning actions do not end up with outcomes that contradict their goals[34]. And the last article by Muhtadi D., et al. investigates the mathematical activities of the Sundanese in their daily life, and how the Sundanese practice mathematical concepts in their daily cultural life[35].

Table 2. Top author ranking by number of publications

Author	Countries/Areas	Publications	Total # of Citations (Citation per Paper)
Prahmana, R.C.I.	Indonesia/Asia	5	90 (18)
Oliveras M.L.	Spain/Europe	3	6 (2)
Pais A.	Denmark/Europe	2	47 (23,5)
Muhtadi D.	Indonesia/Asia	2	34 (17)
Sukirwan	Indonesia/Asia	2	34 (17)
Warsito	Indonesia/Asia	2	34 (17)
Ascher M.	USA	2	17 (8,5)
D'ambrosio U.	Brazil/ South America	2	11(5,5)
Albanese V.	Spain/Europe	2	7 (3,5)
Gavarrete M.E.	Costa Rica/Central America	2	5 (2,5)
Marsigit	Indonesia/Asia	2	4 (2)
Dos Santos Bernardi L.	Brazil/South America	2	1 (0,5)
Utami N.W.	Indonesia/Asia	2	1 (0,5)
Sayuti S.A.	Indonesia/Asia	2	1 (0,5)
Jailani J.	Indonesia/Asia	2	1 (0,5)
Fernández-Oliveras A.	Spain/Europe	2	1 (0,5)
Espigares-Gámez M.J.	Spain/Europe	2	1 (0,5)

Table 2 shows authors who have published two or more topic of Ethnomathematics in Traditional Culture. The top three with the highest number of citations are Prahmana, R.C.I. (90 Citations, 5 Articles), Pais A. (47 Citations, 2 Articles) and Muhtadi D., Sukirwan, and Warsito (34 Citations, 2 Articles).

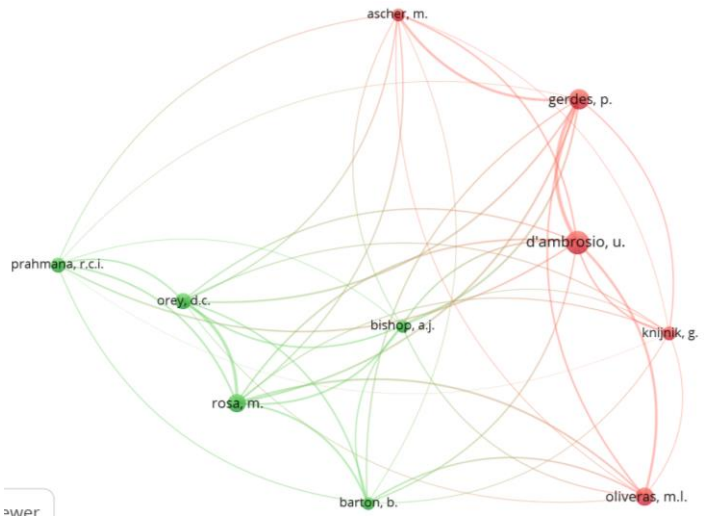


Figure 4. Most cited authors (co-citation analysis)

Figure 4 shows the co-citation analysis setting the minimum number of citations to 20. It was found that articles by D'ambrosio U. (74 Citations), Gerdes, P. (57 Citations) and Rosa M. (48 Citations) were cited the most in Ethnomathematics research on Traditional Culture.

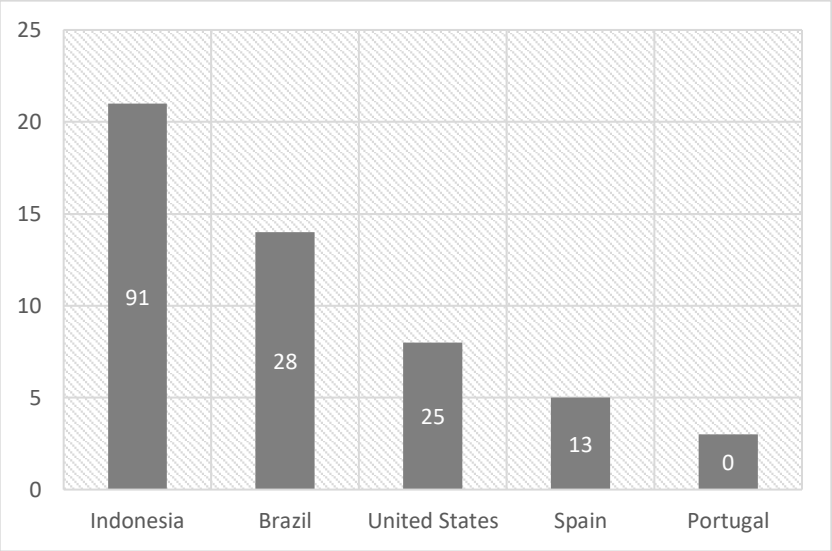
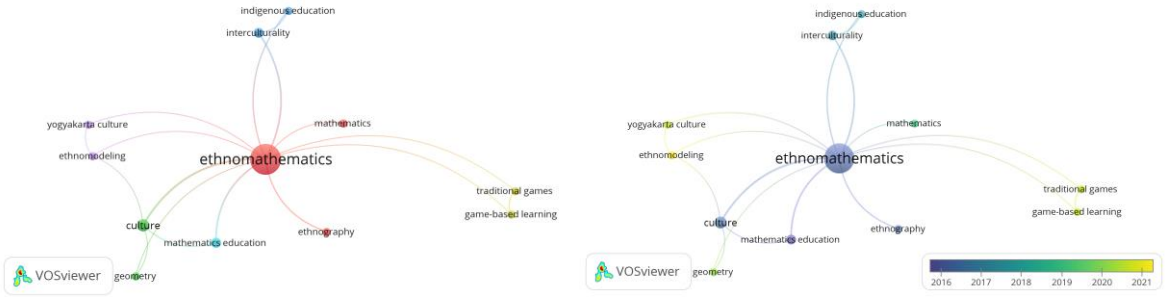


Figure 5. Number of publications by Country from 1988 to 2022

Figure 5 shows the top 5 countries with the highest number of articles on the theme of Ethnomathematics in Traditional Culture from 1988 to 2022. They are Indonesia (21 Articles, 91 Citations), Brazil (14 Articles, 28 Citations), United States (8 Articles, 25 Citations).), Spain (5 Articles, 13 Citations) and Portugal (3 Articles, 0 Citations).

3.3. Most Used Keywords

A total of 193 authors' keywords were included in 65 articles on Ethnomathematics in Traditional Culture from 1988 to 2022. Figure 6a and Figure 6b show the results of the cluster analysis generated by VOSviewer.



(a) (b)

Figure 6. (a) The most widely used keywords in Ethnomathematics research in Traditional Culture, and (b) Distribution of Ethnomathematics research in Traditional Culture using keywords by year

Figure 6(a) shows the most used keywords are “Ethnomathematics” (n = 43), “Culture” (n = 5), “Mathematics Education” and “Interculturality” (n = 3) and other keywords (n = 2). In addition, Figure 6(b) shows that the author's keywords that are popular in recent studies are “Traditional Games”, “Game-Based Learning”, “Ethnomodelling” and “Yogyakarta Culture”.

From 65 articles retained, it was concluded that there was an increasing trend of publications in the last 3 years (2020-2022). The highest number of articles on the theme of Ethnomathematics in Traditional

Culture is 7 articles from Bolema – Mathematics Education Bulletin. the most cited journal is Educational Studies in Mathematics with 95 Citations. Based on co-citation analysis, the journal For the Learning Mathematics became the first with 57 co-citations. The most cited article was the article entitled "Making sense of ethnomathematics: Ethnomathematics is making sense" by Barton B., in 2007. Meanwhile, the author with the most publications was Prahmana, R.C.I who came from Indonesia with 5 publications (average citations) per Paper is 18 citations). Based on co-citation analysis, the article by D'ambrosio U. has been quoted the most in Ethnomathematics research on Traditional Culture as many as 74 citations. In addition, Indonesia occupies the first position as the country with the most number of articles as many as 21 articles (91 citations). And lastly, the keyword "Ethnomathematics" is the most widely used in 43 publications and the keyword "Traditional Games" is the most popular keyword in the latest research on ethnomathematics. This is in line with research by Salsabilah, et al that research on ethnomathematical concepts through traditional games in mathematics learning, is a research topic that has increased over the last few years based on an increase in citations every year [32]. Overall, to see the development of ethnomathematics, we can see it through a developing trend, by paying special attention to it.

4. CONCLUSION

From 65 articles retained, it was concluded that there was an increasing trend of publications in the last 3 years (2020-2022). The highest number of articles on the theme of Ethnomathematics in Traditional Culture is 7 articles from Bolema – Mathematics Education Bulletin. The most cited journal is Educational Studies in Mathematics with 95 Citations. Based on co-citation analysis, the journal For the Learning Mathematics became the first with 57 co-citations. The most cited article was the article entitled "Making sense of ethnomathematics: Ethnomathematics is making sense" by Barton B., in 2007. Meanwhile, the author with the most publications was Prahmana, R.C.I who came from Indonesia with 5 publications (average citations). per Paper is 18 citations). Based on co-citation analysis, the article by D'ambrosio U. has been quoted the most in Ethnomathematics research on Traditional Culture as many as 74 citations. In addition, Indonesia occupies the first position as the country with the most number of articles as many as 21 articles (91 citations). And lastly, the keyword "Ethnomathematics" is the most widely used in 43 publications and the keyword "Traditional Games" is the most popular keyword in the latest research on ethnomathematics.

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