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# Research trend on ethnomathematics from 2012 to 2022: A bibliometric analysis

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## ABSTRACT

Ethnomathematics integrates mathematical concepts with cultural practices, making mathematics education more relevant and engaging. Given the abstract nature of mathematics, this approach plays a crucial role in enhancing student interest and comprehension. This study aims to analyze global research trends in ethnomathematics from 2012 to 2022 by identifying key themes, influential authors, and research patterns. A bibliometric analysis was conducted on 994 documents retrieved from Google Scholar, utilizing Publish or Perish, Microsoft Excel, and VOSviewer for data processing and visualization. The findings reveal a steady increase in ethnomathematics publications, with journals being the predominant dissemination medium. Four primary research themes emerged: educational practices, integration into mathematics learning, development of teaching materials, and pedagogical approaches. The study concludes that ethnomathematics research continues to expand, reflecting a growing academic interest in culturally responsive mathematics education. The implications of this study emphasize the need for sustained research efforts to integrate cultural perspectives into mathematics education, fostering greater student engagement and promoting educational equity.

# *Trend penelitian etnomatematika dari tahun 2012 sampai tahun 2022: Analisis bibliometrik*

***Kata Kunci:***

*analisis bibliometric, etnomatematika, google cendekia, tren penelitian*

## *ABSTRAK*

*Etnomatematika mengintegrasikan konsep matematika dengan praktik budaya, sehingga membuat pendidikan matematika lebih relevan dan menarik. Mengingat sifat abstrak matematika, pendekatan ini berperan penting dalam meningkatkan minat dan pemahaman siswa. Penelitian ini bertujuan untuk menganalisis tren penelitian global dalam etnomatematika dari tahun 2012 hingga 2022 dengan mengidentifikasi tema utama, penulis berpengaruh, dan pola penelitian. Analisis bibliometrik dilakukan terhadap 994 dokumen yang diperoleh dari Google Scholar, dengan menggunakan Publish or Perish, Microsoft Excel, dan VOSviewer untuk pemrosesan data dan visualisasi. Hasil penelitian menunjukkan peningkatan publikasi etnomatematika yang stabil, dengan jurnal sebagai media utama penyebaran. Empat tema penelitian utama yang muncul adalah: praktik pendidikan, integrasi dalam pembelajaran matematika, pengembangan bahan ajar, dan pendekatan pedagogis. Penelitian ini menyimpulkan bahwa kajian etnomatematika terus berkembang, mencerminkan meningkatnya minat akademik terhadap pendidikan matematika*

*yang responsif secara budaya. Implikasi dari penelitian ini menekankan pentingnya upaya penelitian berkelanjutan untuk mengintegrasikan perspektif budaya dalam pendidikan matematika, guna meningkatkan keterlibatan siswa dan mendorong kesetaraan pendidikan.*



**Contribution to the literature**

This research contributes to:

- Providing a comprehensive bibliometric analysis of ethnomathematics research from 2012 to 2022.
- Filling a gap in the understanding of global research trends in this field.
- Highlighting key themes, prolific authors, and major publication sources.
- Aiding researchers in identifying future research directions and understanding the evolution of ethnomathematics in educational contexts.

## 1. INTRODUCTION

The term "ethnomathematics" originates from the Greek words "*ethno*," "*mathema*," and "*tics*," referring to the integration of mathematical concepts with cultural practices within various communities, including Indigenous groups, professional communities, and age-specific demographics [1]–[3]. Ethnomathematics examines how cultural contexts shape mathematical understanding, focusing on developing techniques for calculation and interpretation that allow individuals to engage with social and environmental phenomena [3], [4]. As a form of cultural study, ethnomathematics provides a unique perspective to explore how mathematics is adapted within specific cultures, positioning it as an ethnographic study [2]. The ethnomathematics enriches cultural research by offering a fresh perspective on cultural studies [5]–[7].

Mathematics is often perceived as an abstract subject, making it difficult for students to relate it to real-world contexts [7], [8]. This detachment from practical applications highlights the need for innovative teaching methods that make mathematics more meaningful and enjoyable. Ethnomathematics presents a culturally-based approach that enhances students' learning experiences by connecting mathematical concepts to their cultural backgrounds [9]. By fostering engagement and a deeper appreciation for mathematics, ethnomathematics also supports broader educational goals of inclusivity, equity, and social justice, as D'Ambrosio [10] and Presmeg [11] emphasize. Through this approach, students gain knowledge, attitudes, and behaviors relevant to their communities, promoting respect, solidarity, and collaboration [12].

Ethnomathematics integrates cultural elements into mathematics, increasing students' interest, understanding, and application of mathematical concepts in diverse contexts [13]–[15]. Bibliometric analysis provides insights into research trends, key topics, concept interrelations, and the evolution of fields, highlighting the development of a topic [16]. In ethnomathematics, bibliometric analysis has been used to assess research trends, such as mathematics learning in Indonesia from 2017 to 2022 [17], traditional games in learning [18], and various cultural practices from 2015 to 2020 [19]. These analyses typically rely on accredited journals and specific databases, such as Scopus or SINTA, focusing on narrow topics or regions [20].

While bibliometric studies have contributed valuable insights into ethnomathematics, many are limited to specific cultures, timeframes, or databases (e.g., Indonesian contexts from 2017-2022 or studies in Scopus from the last three years) [17]–

[20]. Several researchers have explored the development of ethnomathematics, including the creation of ethnomathematics e-modules [21], ethnomathematics research in Indonesia during 2015-2020 [19], systematic observations from 2013-2020 related to the integration of Sundanese ethnomathematics [22], and the state of the art of ethnomathematics [4]. However, a comprehensive bibliometric analysis using Google Scholar has yet to be conducted. This gap underscores the need for an extensive bibliometric analysis that addresses global trends in ethnomathematics research over the past decade. Therefore, this study aims to fill this gap by conducting a bibliometric analysis of ethnomathematics research from 2012 to 2022, providing a global perspective on publication output, top authors, publication patterns, and research trends.

This study aims to analyze ethnomathematics research trends from 2012 to 2022 to help educational researchers better understand the global landscape of ethnomathematics. This includes profiling publication output, identifying top and most cited authors, analyzing publication patterns, and visualizing research trends from 2012 to 2022.

## 2. METHOD

This study followed the guidance of a bibliometric analysis [16], [23], ensuring a systematic examination of relevant literature. Figure 1 portrays the complete stages.

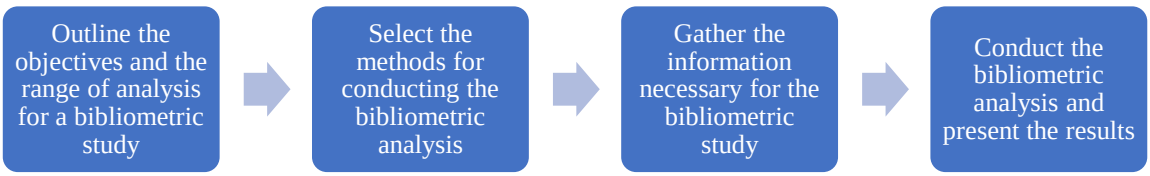


**Figure 1.** Four Stages of Bibliometric Procedures [16], [23]

The data used in this research were sourced from Google Scholar. Publish or Perish (PoP) was utilized to systematically search and filter articles within Google Scholar [24]. The data collection occurred on October 20, 2022, after obtaining ethics approval. Initially, a search using the keyword "ethnomathematics" yielded 1,032 publications. Upon filtering the results, it was discovered that 38 documents were duplicated. The final research sample consisted of 994 publications on ethnomathematics, including those with the term titles, abstracts, and keywords, published between 2012 and 2022. The data were saved in both (.ris) and (.csv) file formats. These were then processed using bibliometric and network analysis software, specifically Microsoft Excel and VOSviewer. VOSViewer's text-mining feature was employed to generate and display correlations in citation patterns of academic papers or publications [25]. The software was used to identify research trends in ethnomathematics by providing detailed bibliometric maps of the data [26]–[28]. This research aimed to analyze global ethnomathematics research activities, identify trends, and assess performance, including the types of publications, sources, top authors, and citation trends from 2012 to 2022. The author searched online using the keyword "ethnomathematics" in the title.

## 3. RESULTS AND DISCUSSION

### *3.1 Publication Output and Documents Sources*

Between 2012 and 2022, 994 documents related to ethnomathematics were found in the Google Scholar database. These publications consisted of five document types: 823 journal articles (82.80%), 104 conference proceedings (10.46%), 64 books (6.44%), two dissertations (0.20%), and one thesis (0.10%). This study also included books,

dissertations, theses, journals, and conference papers to capture a comprehensive view of the ethnomathematics research trend. Figures 2 and 3 illustrate the trends in ethnomathematics research publications between 2012 and 2022. The number of ethnomathematics publications has steadily increased over the years. Before 2018, fewer than 100 publications were produced annually. However, from 2019 to 2022, the annual publication counts consistently exceeded 100. While there was a slight dip in publication numbers from 2013 to 2014 and again from 2021 to 2022, the trend showed significant growth from 2015 to 2021. Research on ethnomathematics decreased in 2022 compared to the previous two years, likely because the data for this research were collected in October 2022. It is anticipated that ethnomathematics research articles will rise in the remaining two months of 2022.

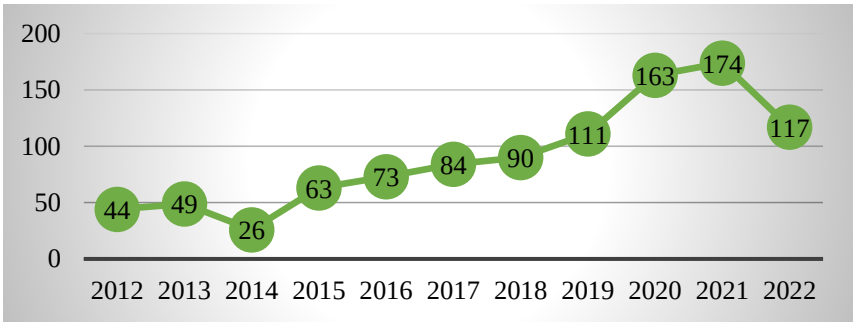


**Figure 2.** The Number of Documents on Ethnomathematics from 2012 to 2022

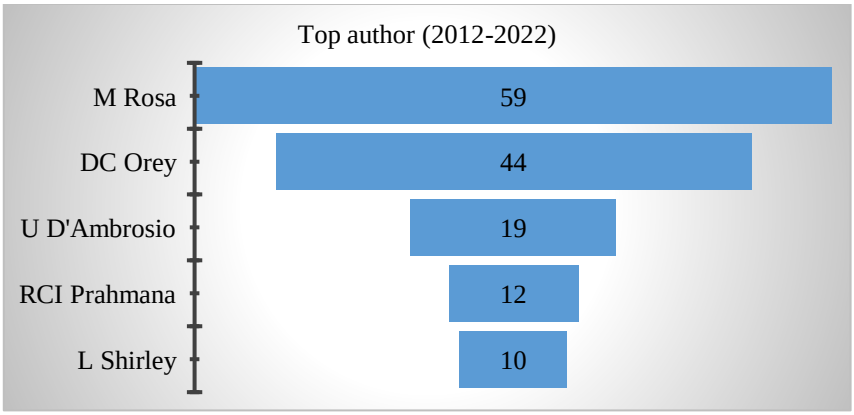


Figure 3. The Number of Ethnomathematics Articles Based on Source Categories

### *3.2 Top Authors and the Most Cited Authors in Researching Ethnomathematics*

This section discusses the most cited researchers and top authors in ethnomathematics over the past decade, from 2012 to 2022. Figure 4 illustrates the five most prolific ethnomathematics researchers based on their productivity. M. Rosa, D.C. Orey, U. D'Ambrosio, R.C.I. Prahmana and L. Shirley emerged as the most productive authors in this field. Generally, the authors' performance correlates with the most cited articles of the respective years, as presented in Table 1. Meanwhile, Table 2 highlights the most frequently cited papers from 2012 to 2022. Notably, the articles by D. Muhtadi, R.C.I. Prahmana (2017), F.S. Sirate (2012), A.S. Abdullah (2017), A. Arisetyawan, D. Suryadi, T. Herman, C. Rahmat (2014), and W. Widada, D. Herawaty, A. Lubis (2018) were the top five most cited papers during this period. These studies have significantly influenced the development of ethnomathematics research, providing valuable insights into its applications in various educational contexts. Their impact continues to shape contemporary discussions and inspire further investigations in the field.

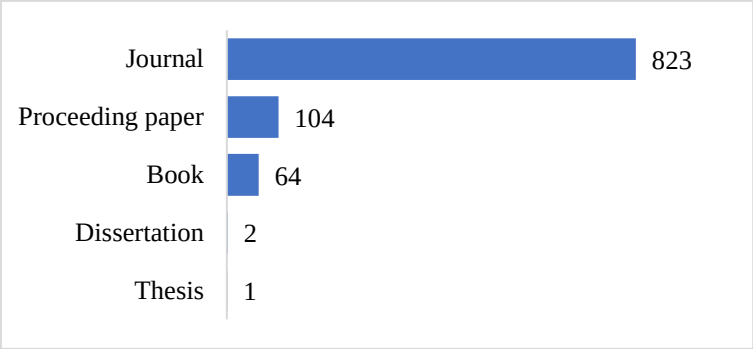


**Figure 4.** Top Five Authors in Ethnomathematics Research from 2012 to 2022

**Table 1.** The Most Cited Article or Document from 2012 to 2022

| Author(s) | Sources | ∑ Citations |
|---|---|---|
| M Ascher | Ethnomathematics: A multicultural view of mathematical ideas, pp. 1-214, Book | 955 |
| D Muhtadi, RCI Prahmana | Sundanese Ethnomathematics: Mathematical Activities in Estimating, Measuring, and Making Patterns. *Journal on Mathematics Education*, *8*(2), 185-198. | 142 |
| FS Sirate | Implementasi Etnomatematika dalam Pembelajaran Matematika pada Jenjang Pendidikan Sekolah Dasar. *Lentera Pendidikan: Jurnal Ilmu Tarbiyah dan Keguruan*, *15*(1), 41-54. | 130 |
| AS Abdullah | Ethnomathematics in Perspective of Sundanese Culture. *Journal on Mathematics Education*, *8*(1), 1-16. | 127 |
| A Arisetyawan, D Suryadi, T Herman, C Rahmat | Study of Ethnomathematics: A lesson from the Baduy Culture. International Journal of Education and Research, 2(10), 681-688. | 124 |

### *3.3 Publication Patterns of Ethnomathematics Research in 2012 to 2022: Sources Titles*

The journals and proceedings that made the most significant contributions to ethnomathematics research are listed in Table 2. *Journal of Physics: Conference Series* was a leading conference series that published works on ethnomathematics. Meanwhile, Revista Latinoamericana de Etnomatemática, Unnes Journal of Mathematics Education, Journal on Mathematics Education, and Revista Internacional de Pesquisa em Educação Matemática were the most prominent journals in this field.

**Table 2.** Number of Ethnomathematics Documents from 2012 to 2022 across Source Titles

| No | Sources Titles | Number of documents |
|---|---|---|
| 1 | Journal of Physics: Conference Series | 101 |
| 2 | Revista Latinoamericana de Etnomatemática | 19 |
| 3 | Unnes Journal of Mathematics Education | 18 |
| 4 | Journal on Mathematics Education (JME) | 9 |
| 5 | *Revista Internacional de Pesquisa em Educação Matemática* | 8 |

### *3.4 The Visualization of Ethnomathematics Research Trend in 2012 to 2022 Based on VoSViewer Software*

Using VoSViewer software, the author mapped the research trends in ethnomathematics by analyzing 994 papers from the Google Scholar database. This analysis helps to identify the novelty of research within this field. Figure 5 provides a comprehensive overview of ethnomathematics research. Globally, ethnomathematics

research is divided into four main clusters, indicated by red, green, yellow, and blue colors. The first cluster (red) focuses on the practice of ethnomathematics in mathematics education. The second cluster (yellow) explores ethnomathematics in mathematics learning. The third cluster (green) concerns ethnomathematics in learning materials, and the final cluster (blue) examines ethnomathematics in teaching approaches and materials. A closer look at the fourth cluster reveals that research on realistic mathematics, particularly the ethnomathematics approach, could offer a promising direction for future studies in this field.

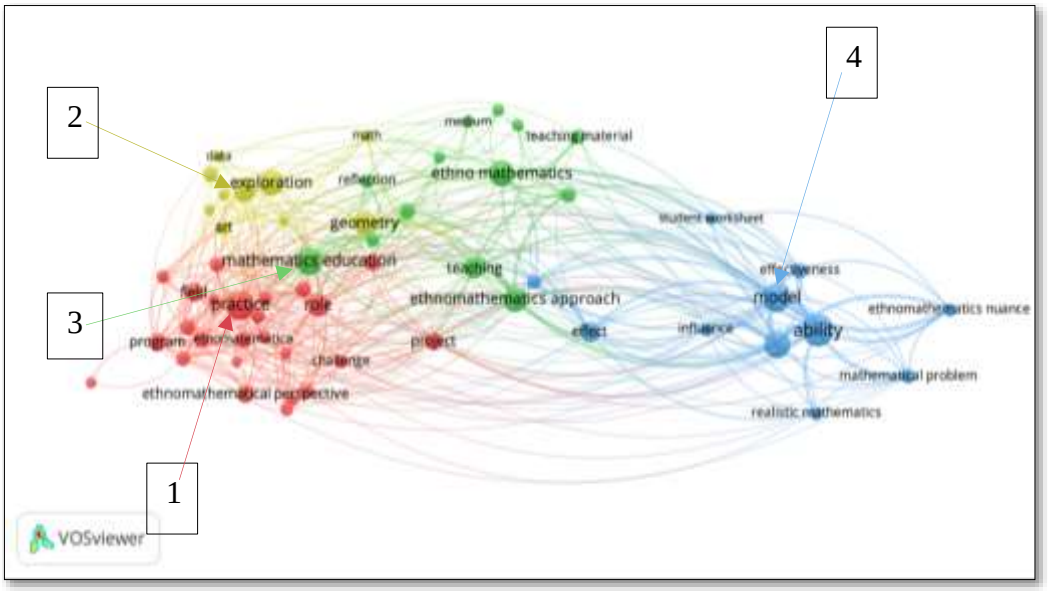


**Figure 5.** The Visualization of Ethnomathematics Research from 2012 to 2022

When we break it down into more detail, we identify connections among the variables that capture the research trends and novelty in ethnomathematics. Figure 6 illustrates research on ethnomathematics within the educational setting, linking it to teaching, mathematics education, geometry, exploration, modeling, and ability. Meanwhile, Figure 7 shows how the ethnomathematics approach is interconnected with other specific domains.

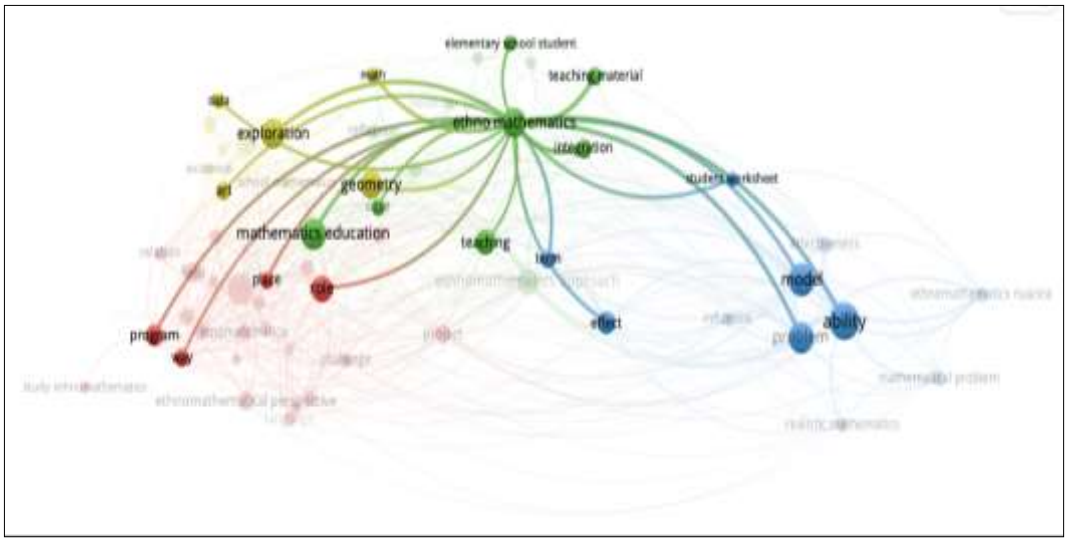


**Figure 6.** Ethnomathematics in the Educational Setting

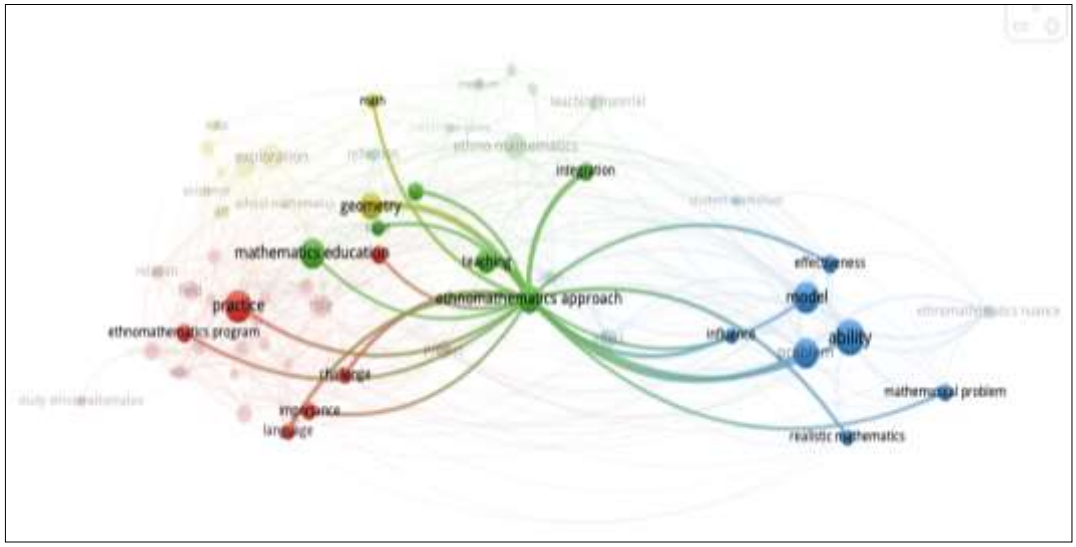


**Figure 7.** How Ethnomathematics Interconnected with Other Specific Domains

Figure 8 illustrates the global focus of ethnomathematics research within mathematics education, exploration, geometry, teaching, modeling, ability, and roles. The map also highlights how ethnomathematics research intersects with other academic disciplines. On the other hand, Figure 9 provides an overview of the leading ethnomathematics researcher and their co-authors. The top three authors were M. Rosa, D.C. Orey, and U. D'Ambrosio, with M. Rosa emerging as the dominant author. Among Rosa's co-authors were D.C. Orey, U. D'Ambrosio, R.C.I. Prahmana, L. Shirley, W.V. Alangui, M.E. Gavarette, and C. Stathopoulou. Additionally, Figure 9 indicates that M. Rosa was the most influential researcher in ethnomathematics between 2012 and 2022, as denoted by the largest circle. This suggests that Rosa's contributions have significantly shaped the trajectory of ethnomathematics research during this period. The strong co-authorship network also reflects the collaborative nature of ethnomathematics studies across different regions and institutions. Such collaborations may have contributed to the expanding scope and interdisciplinary connections of ethnomathematics research.

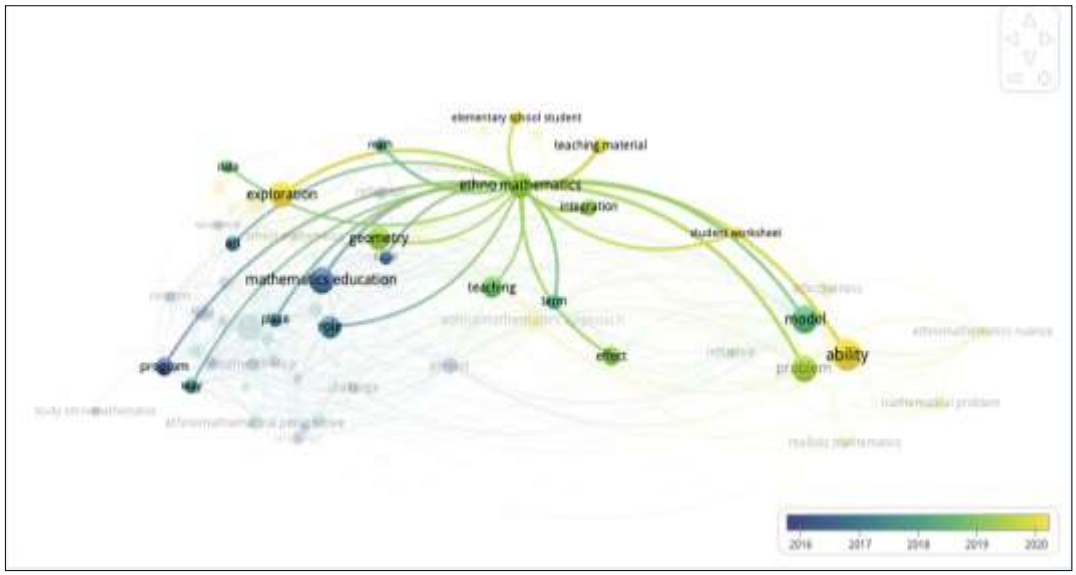


**Figure 8.** Research Focus on Ethnomathematics from 2012 to 2022

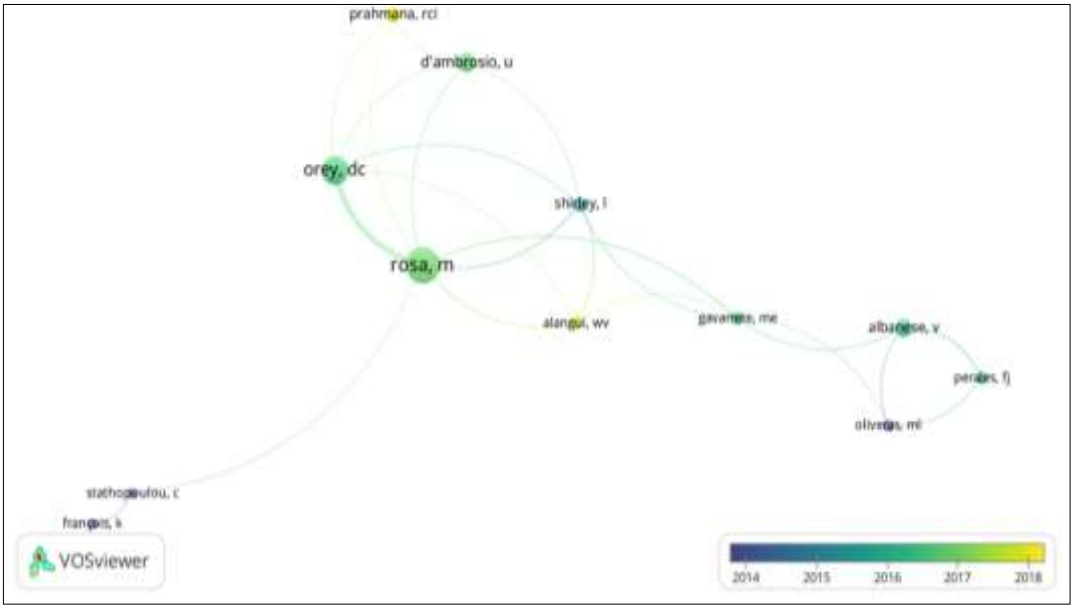


**Figure 9.** Author and Co-authorships in Ethnomathematics Research from 2012 to 2022

The term ethnomathematics was first introduced by Brazilian educator and mathematician D'Ambrosio during a presentation at the American Association for the Advancement of Science 1977 [29]. Between 2012 and 2022, the number of ethnomathematics-related documents increased significantly. Before 2018, fewer than 100 documents were published annually, but from 2019 to 2022, the number of such documents exceeded 100 each year. During this period, journal articles dominated the number of ethnomathematics documents, with 823 publications, followed by conference proceedings (104), books (64), dissertations (2), and theses (1).

Data analysis of the leading authors in the field revealed that M. Rosa, D.C. Orey, U. D'Ambrosio, R.C.I. Prahmana and L. Shirley were the most prolific contributors. M. Ascher, with 955 citations, was the most cited author from 2012 to 2022. Additionally, the top five most cited documents in ethnomathematics research from 2012 to 2022 were authored by M. Ascher (2017), D. Muhtadi, and R.C.I. Prahmana (2017), F. S. Sirate (2012), A.S. Abdullah (2017), and A. Arisetyawan, D. Suryadi, T. Herman, and C. Rahmat (2014). Journal of Physics: Conference Series emerged as the leading source of ethnomathematics research papers. These findings align with the research conducted by Pradana *et al.* [20]. , which also identified U. D'Ambrosio, R.C.I. Prahmana, M. Ascher, and D. Muhtadi are the top authors based on publication count. Moreover, Prahmana's works were among the most cited in ethnomathematics research [20].

Ethnomathematics research forms four key clusters: educational practice, its role in mathematics education, learning materials, and teaching approaches. Between 2012 and 2022, M. Rosa emerged as the field's most influential author and co-author. This study's findings are supported by the work of Lidinillah *et al.* [22], which highlights a trend towards culturally relevant learning methods and stresses the need for a more systematic integration of ethnomathematics into educational curricula.

This study underscores global trends in ethnomathematics from 2012 to 2022, particularly its integration into teaching. Future research should enhance teaching materials by incorporating cultural contexts to improve students' mathematical reasoning, problem-solving skills, and literacy [30], [31]. These findings imply that expanding research in ethnomathematics to include realistic mathematics education and culturally responsive teaching can enhance its practical applications in classrooms. Furthermore, methodological

improvements, such as incorporating multiple databases and broader keyword searches, would contribute to a more comprehensive understanding of the field's trajectory and emerging trends. The study's reliance on Google Scholar may have excluded publications from other databases, and its bibliometric approach limits qualitative insights into ethnomathematics' classroom applications. Future research should include diverse databases and qualitative methods to explore its educational impact.

## 4. CONCLUSION

This study used bibliometric analysis to examine global trends in ethnomathematics research from 2012 to 2022, identifying key publication patterns, top authors, and prominent research themes. The analysis revealed a steady increase in ethnomathematics publications, with four main clusters: ethnomathematics practice in education, exploration in mathematics learning, integration with learning materials, and approaches in teaching. These findings suggest that future ethnomathematics research could benefit from further exploration into realistic mathematics and culturally responsive teaching methods. Given this study's limitation of using only the Google Scholar database, future research should expand by including additional databases like Web of Science, Scopus, and Dimensions to capture a more comprehensive view. Employing a broader range of ethnomathematics-related keywords could provide deeper insights into the field's development and emerging trends.

## AUTHOR CONTRIBUTION STATEMENT

RR conceptualized and designed the study, conducted data collection and analysis using bibliometric tools, and drafted the manuscript. TNS guided ethnomathematics literature and interpretation and assisted in manuscript writing, revision, and final approval.

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