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Mapping the Trends and Development of Ethnoscience Research in Science Education: A Bibliometric Analysis (2015–2025)

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Abstract

The integration of local wisdom into science education is increasingly recognized for fostering contextual learning; however, a comprehensive mapping of its global development remains limited. This study aims to map the publication trends, knowledge structures, and future trajectories of ethnoscience research over the past decade. A bibliometric analysis was conducted on 849 articles published between 2015 and 2025, sourced from the Dimensions.ai database, and visualized using VOSviewer. The findings reveal a significant publication surge peaking in 2025 (29.1%), with Indonesia driving the research output primarily through teacher education institutions. Co-occurrence analysis identifies four distinct thematic clusters: macro-level curriculum policy, instructional material development, experimental Classroom implementation, and student performance evaluation. The structural evolution of these clusters suggests that ethnoscience is increasingly being adopted as a viable instructional approach. Nevertheless, significant research gaps remain, particularly at the intersection of climate change adaptation and emerging technologies. The implications of this study provide a concrete roadmap for future researchers, highlighting the critical need to integrate ethnoscience with artificial intelligence and global environmental challenges to ensure the sustained relevance of culturally responsive science education.

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Keywords: Ethnoscience; Science education; Bibliometric analysis; VOSviewer; Local wisdom.

INTRODUCTION

Science learning increasingly emphasizes the importance of contextual approaches that connect scientific concepts with students' real-life experiences (Onowugbeda et al., 2022; Heald et al., 2023). In this regard, integrating local wisdom into science education has become a strategic effort to make learning more meaningful and relevant while also strengthening students' cultural identity amid globalization (Harefa, 2024; Rasidi et al., 2025). One prominent approach that facilitates this integration is ethnoscience, which bridges scientific knowledge with local cultural values and practices (Pane et al., 2022). Previous studies have shown that ethnoscience-based learning not only enhances students' conceptual understanding but also improves their ability to apply scientific knowledge in everyday contexts (Khasna et al., 2022). Furthermore, this approach supports the development of essential competencies such as critical thinking and problem-solving by encouraging students to actively engage with culturally relevant scientific phenomena (Hikmah et al., 2025; Jannah et al., 2022; Maulida, 2023; Putri et al., 2024).

Ethnoscience in science education is generally understood as the process of transforming local community knowledge into formal scientific concepts that can be systematically learned (Jannah et al., 2022). Existing studies have predominantly focused on integrating ethnoscience into instructional practices, particularly through the development of teaching materials, learning models, and Classroom implementations that utilize local cultural contexts (Lestari et al., 2022; Ali et al., 2025; Özünlü, 2025). These studies tend to emphasize the effectiveness of ethnoscience-based approaches in enhancing students' motivation and engagement by making learning more relevant to their daily lives (Kasi et al., 2022). In addition, a growing body of research reports that such approaches can improve critical thinking skills,

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scientific literacy, and cognitive learning outcomes by making abstract concepts more concrete (Sarkingobir & Bello, 2024; Atmojo et al., 2025; Kurniawan et al., 2025). Despite these promising findings, most studies remain fragmented and context-specific, focusing on isolated implementations rather than offering a comprehensive overview of research trends and developments in ethnoscience within science education.

Despite the growing body of research on ethnoscience in science education, existing studies predominantly focus on Classroom implementation, particularly on the development of learning models and teaching materials grounded in local wisdom (Sudirman et al., 2025; Fahrudin et al., 2023). While these studies consistently highlight the effectiveness of ethnoscience in improving learning outcomes, they offer only limited insight into the field's broader development (Khery et al., 2025). However, previous studies have not systematically examined global trends in ethnoscience research, resulting in a lack of understanding of how the field has evolved over time (Ahzan et al., 2025). More specifically, there is still a scarcity of studies that explore the underlying knowledge structure, including thematic clusters and relationships among research topics, which are essential for identifying the intellectual landscape of the field (Fahrudin et al., 2023). In addition, the absence of comprehensive mapping results in fragmented information on research directions and limits the identification of potential areas for future investigation (Sari et al., 2023; Rofik et al., 2022). Therefore, a more systematic and integrative approach is needed to analyze research trends, knowledge structures, and future directions in ethnoscience within science education.

Based on these gaps, a comprehensive and systematic approach is required to analyze the development of ethnoscience research in science education (Ratih et al., 2024). Compared with conventional literature reviews, bibliometric analysis offers significant advantages, enabling large-scale mapping of publication trends, identification of dominant themes, and analysis of conceptual relationships within a research field (Suprapto et al., 2021; Gumilar et al., 2022). In addition, this method facilitates the exploration of collaboration networks and the contributions of countries and institutions, thereby providing a more holistic understanding of scientific development (Cui & Dong, 2025). Through these capabilities, bibliometric analysis allows for a deeper examination of the structure and dynamics of ethnoscience research over time (Dastani et al., 2022; Supriyadi et al., 2023). Therefore, this study aims to analyze publication trends, identify knowledge structures, and explore potential research gaps in global ethnoscience research in science education during the period 2015–2025. The novelty of this study lies in its use of a large dataset and a recent time span, combined with systematic mapping and visualization techniques to provide a comprehensive overview of the field. This study is expected to contribute both theoretically, by advancing ethnoscience as a research domain, and practically, by offering insights and guidance for future studies and science education practices.

MATERIALS AND METHODS

Research Design

This study employed a quantitative bibliometric approach to systematically analyze the development of ethnoscience research in science education (Puspita et al., 2023; Tiro et al., 2024). Bibliometric analysis allows for the examination of publication trends, author productivity, collaboration networks, and thematic structures within a research field (Gumilar et al., 2022; Sunarti et al., 2024). Specifically, this study used co-occurrence analysis to identify keyword relationships and research clusters, and descriptive statistics to examine publication trends over time.

Data Source and Search Strategy

The data were retrieved from the Dimensions.ai database, which provides comprehensive coverage of international scientific publications. The search was conducted using a combination of keywords to ensure broader data coverage, including: ("ethnoscience" OR "ethno-science" OR "local wisdom") AND ("science education" OR "science learning" OR "physics education"). The search was limited to journal articles published between 2015 and 2025. The initial search yielded 4,486 documents, which were then filtered based on relevance and inclusion criteria.

Data Selection Procedure (PRISMA)

The research procedure followed the PRISMA protocol, which consists of identification, screening, eligibility, and inclusion stages. The process began with an initial search and continued with manual data cleaning to ensure content relevance.

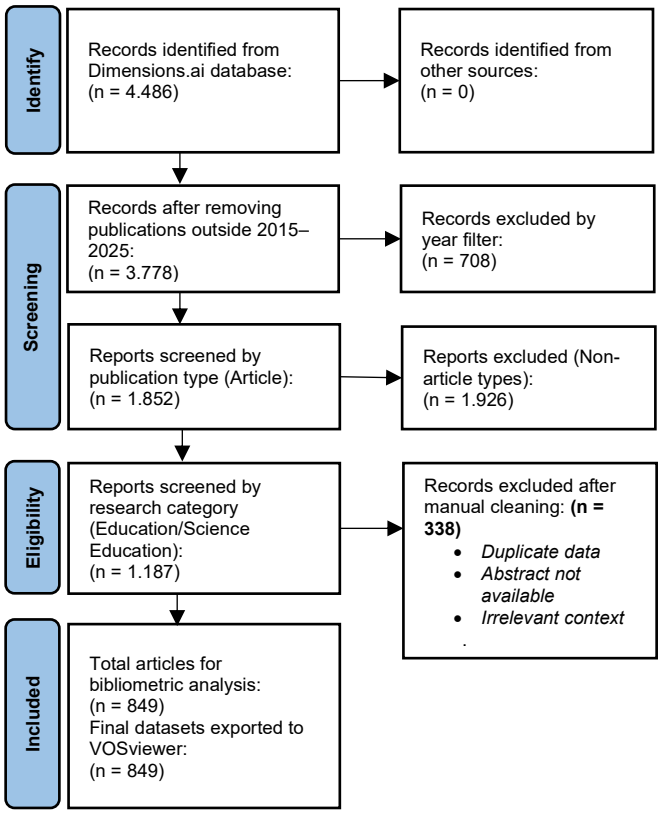

Figure 1. PRISMA Flow Diagram of the Ethnoscience Research Article Selection Process (2015–2025).

Data Analysis Techniques

The data analysis was conducted using two main approaches: descriptive analysis and visualization analysis. Descriptive analysis was performed using Microsoft Excel to examine annual publication trends, author productivity, and country distribution. Visualization analysis was conducted using VOSviewer software to map the knowledge structure of ethnoscience research. The analysis focused on keyword co-occurrence, with a minimum occurrence threshold of 5 keywords. Network visualization was used to identify research clusters, while overlay visualization was applied to analyze research trends over time. This approach enabled the identification of thematic relationships, dominant research areas, and potential research gaps. These analytical techniques were selected to address the research objectives, particularly to identify publication trends, map knowledge structures, and explore research gaps in ethnoscience studies.

RESULTS AND DISCUSSION

Result

Annual Publication Trend

The annual publication trend demonstrates a significant shift in research intensity over the past decade. While the early period (2015–2018) shows minimal activity, the number of publications gradually increased after 2019 and accelerated sharply from 2023 onwards. Notably, more than 75% of total publications are concentrated in the last three years (2023–2025), indicating a rapid expansion of interest in ethnoscience research. The 2025 peak further confirms that this field has entered a phase of substantial growth and growing global relevance.

Table 1. Annual Publication Trend of Ethnoscience in Science Education (2015-2025)

Publication Year	Number of Documents	Percentage (%)
2025	247	29,1
2024	228	26,9
2023	201	23,7
2022	77	9,1
2021	52	6,1
2020	21	2,5
2019	14	1,6
2018	2	0,2
2017	5	0,6
2016	1	0,1
2015	1	0,1
Total	**849**	**100%**

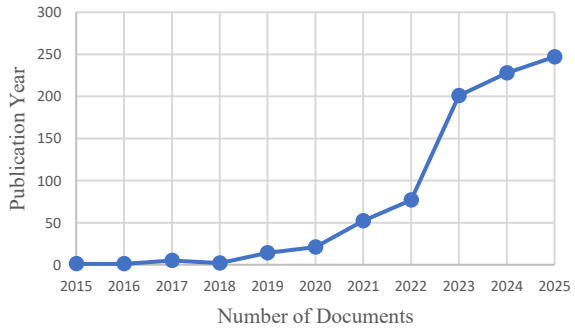

Figure 2. Trends in International Publications on Ethnoscience Research from 2015 to 2025.

Core Journals and Productive Publishers

The analysis of core journals reveals a distinction between publication productivity and scientific impact. While Jurnal Penelitian Pendidikan IPA contributes the highest number of publications, Jurnal Pendidikan IPA Indonesia records the highest citation count, indicating a stronger academic influence. This suggests that a higher number of publications does not necessarily correspond to greater impact, highlighting the importance of research quality and relevance within the field.

Table 2. Top 10 Core Journals Publishing Ethnoscience in Science Education Research (2015-2025)

Journal Name	Number of Publications	Citations
Jurnal Penelitian Pendidikan IPA	258	886
Jurnal Pendidikan IPA Indonesia	36	1.046
International Journal of Evaluation and Research in Education (IJERE)	20	126
Jurnal Pendidikan MIPA	19	8
Unnes Science Education Journal	18	18
Jurnal Pijar Mipa	15	25
Jurnal Pendidikan Fisika dan Teknologi	13	15
Journal of Education and Learning (EduLearn)	13	79
International Journal of Ethnoscience and Technology (IJET)	13	115
KnE Social Sciences	11	16

Most Productive Authors

The analysis of author productivity indicates that ethnoscience research is driven by a relatively concentrated group of scholars. Although Sudarmin is identified as the most productive author, Woro Sumarni demonstrates the highest citation impact, suggesting broader recognition within the academic community. This pattern reflects the presence of both high-output contributors and high-impact researchers, who together shape the field's development.

Table 3. Top 10 Most Productive Authors in Ethnoscience Research (2015-2025)

Author Name	Affiliation	Publications	Citations
Sudarmin	Universitas Negeri Semarang	28	232
Woro Sumarni	Universitas Negeri Semarang	21	474
Hikmawati	Universitas Mataram	18	124
Sri Yamtinah	Universitas Sebelas Maret	16	44
Insih Wilujeng	Universitas Negeri Yogyakarta	14	85
Asrizal	Universitas Negeri Padang	14	82
Joni Rokhmat	Universitas Mataram	14	12
Nadi Suprapto	Universitas Negeri Surabaya	13	140

Author Name	Affiliation	Publications	Citations
Aliefman Hakim	Universitas Mataram	13	13
Ari Syahidul Shidiq	Universitas Sebelas Maret	12	44

Affiliation and Country Distribution

The distribution of affiliations highlights the dominance of Indonesian higher education institutions, particularly teacher education universities, as major contributors to ethnoscience research. This concentration suggests that integrating local wisdom into science education has become a strategic national focus. At the global scale, Indonesia emerges as the leading contributor, while international collaborations indicate growing recognition of ethnoscience in the global research landscape.

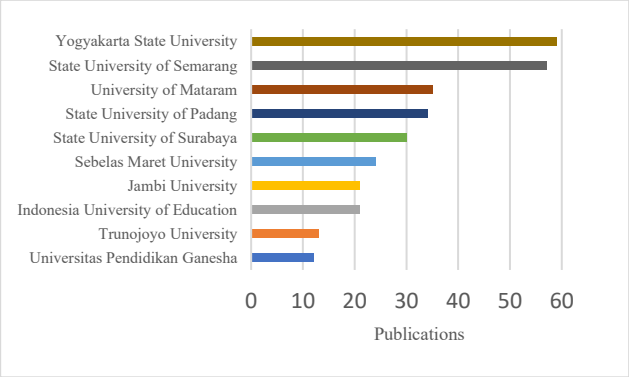

Figure 3. Top 10 most productive research organizations in ethnoscience research.

Geographically, the distribution of publications shows that Indonesia is the leading contributor, with 726 articles, making it the global epicenter of ethnoscience research. However, the data in Table 4 also reveal emerging patterns of international collaboration. Cross-country partnerships are observed between Indonesian researchers and those from countries such as Taiwan (15 articles), Malaysia (13 articles), and the United States (5 articles). Contributions from various countries, including the Philippines, Nepal, Nigeria, and Germany, indicate that ethnoscience perspectives are increasingly being adopted to enrich the global science education literature.

Table 4. Top 10 Countries Contributing to Ethnoscience Research (2015-2025)

Country	Number of Publications
Indonesia	726
Taiwan	15
Malaysia	13
Philippines	6
United States	5
Nepal	5
Australia	4
Nigeria	4
China	3
Germany	2

Keyword Co-occurrence Analysis

The keyword co-occurrence analysis reveals four major research clusters that represent the intellectual structure of ethnoscience studies. The first cluster (red) focuses on macro-level educational aspects such as curriculum and technology, indicating the theoretical foundation of the field. The second cluster (green) emphasizes the development and validation of instructional materials, reflecting the dominant research focus on product-oriented studies. The third cluster (blue) relates to experimental implementation, highlighting the application of ethnoscience in Classroom settings. Finally, the fourth cluster (yellow) is associated with learning outcomes and cultural values, representing the ultimate goal of improving student performance. Overall, this structure indicates a progression from conceptual development to practical implementation and impact evaluation within ethnoscience research. The visualization is presented in Figure 4.

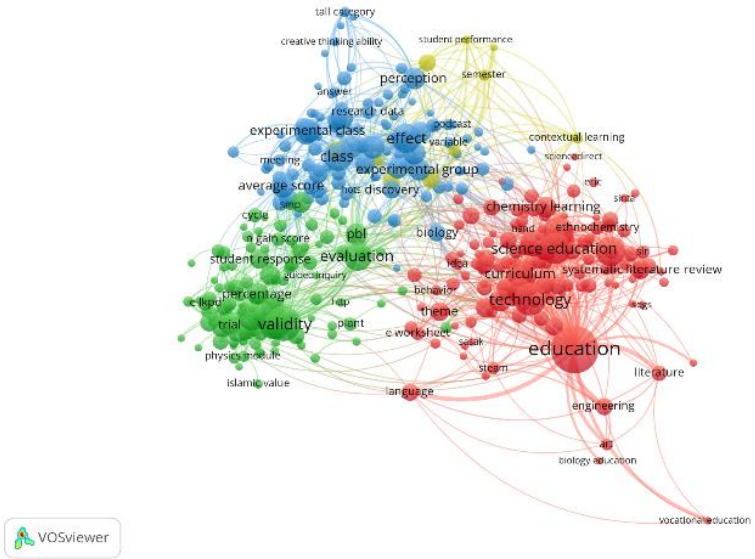

Figure 4. Keyword Co-occurrence Network Visualization in Ethnoscience Research (2015–2025).

Research Gap Analysis

The distribution of keywords also indicates an imbalance in research focus. While a large proportion of studies focus on instructional material development and validation, relatively little attention is paid to emerging themes such as climate change and advanced digital technologies. This suggests the presence of underexplored areas that offer opportunities for future research development.

Discussion

The Rapid Growth and Future Trajectory of Ethnoscience Research

The observed increase in ethnoscience publications over the past decade indicates a growing research interest in integrating local knowledge into science education. The relatively low number of publications between 2015 and 2018 suggests that ethnoscience was initially positioned more as a cultural perspective rather than an integral component of formal science learning. However, the steady increase after 2019, followed by a sharp rise during 2023–2025, reflects a shift toward greater academic recognition of ethnoscience within educational research.

Nevertheless, this growth should be interpreted cautiously. Although more than 75% of publications in the last three years are concentrated, this may also indicate that the field is still in a developing phase rather than fully established globally. This pattern is consistent with the increasing demand for contextual and meaningful learning approaches (Sarı et al., 2025) and the growing recognition of ethnoscience as a bridge between local knowledge and formal scientific concepts (Ahzan et al., 2025; Fahrozy et al., 2022). However, the extent to which this growth reflects a balanced global development remains limited and uneven across regions.

Distribution of Core Journals and Scientific Impact

The distribution of core journals reveals an important distinction between publication productivity and scientific impact. While *Jurnal Penelitian Pendidikan IPA* dominates in terms of publication volume, *Jurnal Pendidikan IPA Indonesia* demonstrates a higher citation impact, indicating a stronger influence within the academic community. This finding suggests that publication quantity does not necessarily correlate with research impact, underscoring the importance of quality, visibility, and relevance in shaping scholarly influence.

This pattern aligns with previous findings highlighting the role of journal reputation and indexing in determining citation performance (Sihombing et al., 2025). Furthermore, the emergence of specialized journals such as the *International Journal of Ethnoscience and Technology (IJET)* indicates a gradual consolidation of ethnoscience as a distinct research area (Ali et al., 2025). However, the dominance of nationally oriented journals also suggests that the international dissemination of ethnoscience research may still be limited. Expanding publication in higher-impact international journals could enhance the global visibility and academic positioning of this field (Fitri et al., 2025).

Dominance of Indonesian Institutions and Author Productivity

The strong dominance of Indonesian institutions in ethnoscience research reflects a unique contextual advantage, particularly the richness of local wisdom as a source of scientific exploration (Kasi et al., 2022). The concentration of productive institutions within teacher education universities suggests that ethnoscience has been strategically integrated into curriculum development and pedagogical innovation. This finding is supported by the presence of highly productive and influential researchers, such as Sudarmin and Woro Sumarni, who contribute significantly to both publication output and citation impact (Rini et al., 2025).

However, this concentration also indicates a potential limitation in the global diversification of ethnoscience research. While the expansion of contributions beyond Java Island, including institutions such as the University of Mataram, demonstrates regional growth, the overall pattern remains heavily centered in Indonesia. This suggests that ethnoscience research may still be context-dependent and not yet widely adopted in other regions. Strengthening international collaboration could therefore play a crucial role in broadening the scope and applicability of ethnoscience within global science education (Suprapto et al., 2021; Yuliana et al., 2025).

Global Map of Ethnoscience: From Local Context to International Collaboration

The geographical distribution of publications highlights Indonesia as the primary contributor to ethnoscience research, reinforcing its role as a key driver of the field's development. This dominance reflects the successful utilization of cultural diversity as a foundation for contextual science learning (Muhammad et al., 2022). At the same time, contributions from countries such as Taiwan, Malaysia, and the United States indicate emerging international interest in integrating cultural perspectives into science education.

Despite this, the relatively small number of publications from non-Indonesian contexts suggests that ethnoscience has not yet achieved a fully global distribution of research. International collaborations, particularly with developed countries such as the United States, Australia, and Germany, indicate the potential for broader recognition; however, these collaborations remain limited in scale. This imbalance suggests that ethnoscience is still transitioning from a locally grounded approach toward a more globally integrated research domain. Expanding cross-country comparative studies could help position ethnoscience as a more universally applicable framework for connecting local knowledge with scientific understanding (Jannah et al., 2023).

Knowledge Structure and Thematic Evolution of Ethnoscience

The identification of four major research clusters reflects a structured progression in the development of ethnoscience research. Rather than representing isolated themes, these clusters indicate a continuum from conceptual foundations (curriculum and technology) to practical implementation (instructional materials and Classroom practices) and ultimately to learning outcomes. This progression suggests that ethnoscience research has evolved in a relatively systematic manner.

However, the strong dominance of studies related to instructional material development (Cluster 2) also indicates a potential imbalance. The emphasis on validation and product-oriented research may limit the expansion of theoretical and interdisciplinary perspectives within the field. While experimental studies (Cluster 3) demonstrate the effectiveness of ethnoscience-based approaches in Classroom settings (Idul & Fajardo, 2023), the relatively limited integration of broader educational theories suggests an opportunity for further conceptual development. Therefore, future research could benefit from integrating

ethnoscience with emerging theoretical frameworks and interdisciplinary approaches to strengthen its academic foundation (Khoiri & Sunarno, 2018; Ayomi et al., 2025; Gunawan et al., 2023; Kantina et al., 2022).

Research Gaps and Future Directions

The analysis of keyword distribution reveals several important research gaps that provide directions for future studies. Although the dominance of instructional material development indicates methodological maturity, it also suggests a degree of saturation in product-based research (Novanda et al., 2024). In contrast, topics such as climate change and artificial intelligence appear relatively underrepresented, despite their relevance in contemporary science education.

The limited integration of ethnoscience with climate change issues highlights a missed opportunity to utilize local knowledge in addressing environmental challenges (Samah et al., 2025; Hosen & Nakamura, 2020). Similarly, the absence of advanced digital technologies, particularly AI-based learning systems, suggests that ethnoscience research has not fully adapted to the demands of digital transformation. Future research could therefore focus on developing interdisciplinary approaches that combine ethnoscience with environmental education and emerging technologies, such as AI-driven simulations or digital learning platforms (Sajida et al., 2025). By addressing these gaps, ethnoscience has the potential to evolve beyond its traditional role in cultural preservation and contribute more significantly to addressing global educational and environmental challenges (Hikmah et al., 2025).

CONCLUSION

This study presents a bibliometric analysis of ethnoscience research in science education from 2015 to 2025 based on 849 articles. The findings indicate a notable increase in publication trends, particularly after 2022, reflecting growing academic interest in integrating local knowledge into science learning. Indonesia emerges as the dominant contributor, while the knowledge structure reveals four main clusters covering curriculum, instructional development, implementation, and learning outcomes. However, the research focus remains uneven, with a strong emphasis on instructional material development.

These findings highlight the potential of ethnoscience as a contextual approach in science education. However, this study is limited by its reliance on a single database and a restricted search strategy. Future research should expand data sources and explore underrepresented areas, particularly by integrating ethnoscience with climate change and emerging technologies such as artificial intelligence, to strengthen its global relevance.

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AUTHOR'S CONTRIBUTION

Contribution Indicator	Author					
	1	2	3	4	5	6
Conceptualization	✓	✓				
Literature Review	✓		✓		✓	
Research Design / Methodology		✓		✓		
Instrument Development	✓	✓				
Data Collection	✓					
Data Curation		✓				
Formal Analysis	✓	✓	✓	✓	✓	✓
Data Interpretation	✓			✓		
Writing – Original Draft	✓		✓			
Writing – Review & Editing	✓	✓	✓	✓	✓	✓
Visualization / Tables					✓	✓
Supervision	✓	✓	✓	✓	✓	✓

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