
Research Trends in Ethnoscience in Science Education: A Bibliometric Analysis Based on the Scopus Database

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ABSTRACT

This study aims to analyze the development of ethnoscience research in science learning using publications indexed in Scopus. The study used a descriptive bibliometric approach to documents on ethnoscience and science learning published between 1998 and 2026. The analysis focused on publication growth trends, the most productive affiliations and countries, primary publication sources, the most influential authors, and a keyword co-occurrence map using VOSviewer. The analysis shows that ethnoscience research in science learning experiences has fluctuated but has been increasing, with the largest spike in 2025. Publication productivity is dominated by Indonesia at both the country and institutional levels, with Indonesian universities occupying the top position as the most productive affiliates. At the source level, publications are concentrated in journals oriented towards science education and contextual learning innovation. Citation analysis shows that scientific influence remains concentrated in a small number of authors, while the keyword map indicates that ethnoscience is a key node connected to the themes of science education, project-based learning, scientific literacy, critical thinking skills, indigenous science, and context-based learning. These findings confirm that ethnoscience has evolved from simply integrating local knowledge into learning to a multidimensional, contextual, and relevant pedagogical approach aimed at strengthening 21st-century competencies. This research has implications for the importance of expanding international collaboration, strengthening publication quality, and developing more innovative and impactful ethnoscience-based science learning models.

Keywords: Bibliometrics; Ethnoscience; Science learning; Scopus; VOSviewer

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INTRODUCTION

Science education in the 21st century can no longer be understood merely as a process of transferring abstract and universal scientific concepts. Instead, it should be oriented toward learning that is contextual, meaningful, and closely connected to students' real-life experiences. Within this framework, ethnoscience has gained increasing attention as it serves as a bridge between school science and local knowledge, cultural practices, community experiences, and the ways in which communities understand natural phenomena in their environments (Pieter & Risamasu, 2026 ; Setiyadi, 2025; Sihombing et al., 2025). The integration of ethnoscience into



science education enables scientific concepts to be explained through contexts that are familiar to students, making learning not only easier to understand but also more socially and culturally relevant (Dewi et al., 2019; Fadillah et al., 2025; Fasasi, 2017).

Ethnoscience fundamentally positions local knowledge as a legitimate epistemic resource that can engage in dialogue with modern science. This approach is particularly important in countries with high cultural diversity, where science education often faces the challenge of a disconnect between school-based content and students' everyday lives (Kurniawan et al., 2019; Rahmawati et al., 2025). When students learn scientific concepts through local agricultural practices, traditional food processing, plant-based medicine, community technologies, or indigenous ecological wisdom, science is presented not as an unfamiliar body of knowledge but as an integral part of the cultural experiences they already know. Therefore, ethnoscience contributes not only to conceptual understanding but also to the strengthening of cultural identity, the development of scientific literacy, and the cultivation of more reflective ways of thinking.

In recent years, research on ethnoscience in science education has demonstrated increasingly significant growth. This topic is no longer limited to exploring local knowledge as contextual learning content; rather, it has expanded toward the development of learning models, instructional materials, educational media, assessment strategies, scientific literacy initiatives, and integration with 21st-century approaches such as project-based learning, blended learning, and Ethno-STEM (Dewi et al., 2023). These developments indicate that ethnoscience has evolved from serving merely as a cultural context to becoming a more systematic and transformative pedagogical strategy. Furthermore, growing attention to culturally responsive education has positioned ethnoscience as an important approach for fostering science learning that is inclusive, humanistic, and relevant to the needs of society.

Nevertheless, the development of ethnoscience research in science education still requires a more comprehensive mapping. Although numerous studies have examined the implementation of ethnoscience in specific contexts, relatively few have systematically analyzed how this field has evolved, who the most influential intellectual contributors are, which journals serve as the primary publication outlets, which countries and institutions dominate the field, and what themes most frequently emerge and interact with one another. The absence of such mapping often results in the development of ethnoscience being understood only partially, despite the fact that information regarding the publication landscape is essential for understanding the trajectory of scientific growth, identifying research gaps, and formulating future research agendas (Hadi et al., 2020; Heliawati et al., 2022).

One approach that is particularly relevant for addressing this need is bibliometric analysis. Bibliometric methods enable researchers to map the development of a field quantitatively and visually through the analysis of publication trends, citation patterns, author productivity, institutional affiliations, countries, publication sources, and keyword networks. Through bibliometric analysis, the development of ethnoscience in science education can be understood not only from the content of the research itself but also from the knowledge production structures that shape the field. This approach is important because it can reveal whether ethnoscience has evolved into an established research theme, identify its key contributors, and highlight the directions in which the field is currently developing (Ainaya et al., 2025; Sutrimo et al., 2025).

However, given that several bibliometric and review studies on ethnoscience have already been published, the present study must be positioned more specifically to highlight its unique contribution. Unlike previous studies, which generally examined ethnoscience, indigenous knowledge, local wisdom, or culturally based STEM education from broader perspectives, this study focuses specifically on ethnoscience in science education and science learning. This specificity is reflected in its database selection, search strategy, analytical focus, and contribution to future research agendas. First, this study utilizes the Scopus database as its primary data source to ensure that the mapping is based on internationally recognized publications with comprehensive metadata suitable for bibliometric analysis. Second, the search

terms are specifically designed to combine the concepts of ethnoscience and science education/science learning, thereby excluding studies in cultural studies, anthropology, or indigenous knowledge that are not directly related to science education. Third, the study goes beyond presenting publication trends and actor productivity by analyzing thematic structures through keyword co-occurrence analysis to identify dominant research clusters and the relationships among themes. Fourth, the mapping results are intended to inform future research agendas, particularly by highlighting opportunities for developing ethnoscience in science education through more collaborative, contextualized, and science literacy-oriented approaches. Therefore, this study does not merely replicate previous bibliometric or review research; rather, it provides a more focused mapping of ethnoscience as a pedagogical approach within science education.

Based on this need, the present study aims to analyze research trends in ethnoscience within science education using the Scopus database. Specifically, the study maps (1) publication trends over time, (2) the most productive affiliations and countries, (3) the leading publication sources, (4) the most influential authors based on citation and publication counts, and (5) the thematic structure of the field through keyword co-occurrence analysis. This study is important because it provides a comprehensive overview of the position of ethnoscience within the science education landscape while also serving as a foundation for formulating future research directions that are more robust, collaborative, and globally competitive.

METHODS

This study employed a descriptive bibliometric design using secondary data obtained from Scopus export files. Data collection was conducted through the Scopus database on April 5, 2026. The search strategy was applied to the TITLE-ABS-KEY field using the following search string.

The search query used was: TITLE-ABS-KEY (“ethnoscience” OR “ethno-science” OR “local wisdom” OR “indigenous knowledge” OR “local knowledge”) AND TITLE-ABS-KEY (“science learning” OR “science education” OR “IPA learning” OR “natural science learning”). The selection of these keywords was based on the study’s focus on examining the development of ethnoscience research in science education. The terms “ethnoscience,” “local wisdom,” “indigenous knowledge,” and “local knowledge” were used to represent concepts related to local or indigenous knowledge systems, whereas the terms “science learning,” “science education,” “IPA learning,” and “natural science learning” were included to restrict the scope of the analysis to science education and science learning contexts.

The search was limited to the period from 1998 to 2026; journal articles and conference papers; publications in English and Indonesian; and relevant subject areas, including social sciences, arts and humanities, environmental science, and other fields related to science education. The final dataset comprised 52 relevant documents published between 1998 and 2026. During the initial identification stage, a total of 52 documents were retrieved. After screening based on the inclusion and exclusion criteria, 52 documents were excluded because they did not align with the focus of the study, did not address science education/science learning, were non-article documents, were duplicates, or lacked complete metadata. Therefore, the total number of documents included in the final analysis was 52.

The unit of analysis in this study consisted of available publication metadata, including article titles, publication years, author names, citation counts, affiliations, countries, publication sources, abstracts, and author keywords. The analysis employed two main approaches: performance analysis and science mapping. Performance analysis was used to identify scientific productivity and impact based on annual publication output, citation counts, authors, affiliations, countries, and publication sources. Meanwhile, science mapping was applied to illustrate the conceptual structure of the research field through the co-occurrence analysis of author keywords.

The analysis was conducted in several stages. In the initial stage, the metadata were cleaned through the normalization of entities with variations in spelling and naming, particularly institutional names, country names, and author keywords. This normalization process was carried

out to avoid double counting of entities that referred to the same meaning. The next stage involved analyzing annual publication productivity to identify patterns in the growth of the research theme. Subsequently, tabulations were performed for the top 10 affiliations, top 10 countries, top 10 publication sources, and leading authors based on the number of documents and total citations.

Keyword network analysis was conducted using VOSviewer version 1.6.20. The counting method applied was full counting, meaning that each occurrence of a keyword within a document was counted in full. The minimum occurrence threshold was set at two occurrences. From all available author keywords, a total of 199 keywords were identified, of which 26 met the minimum threshold and were included in the co-occurrence network visualization. The mapping results generated six keyword clusters with a total link strength of 87. These keyword clusters were subsequently interpreted to explain the main research focuses and emerging directions in ethnoscience research within science education.

In general, the analysis was divided into two main orientations: performance analysis, which was used to map scientific productivity and impact, and science mapping, which was employed to illustrate the conceptual structure of the field. The findings are presented in the form of tables, trend graphs, and keyword network maps, with an emphasis on descriptive and interpretive analysis aimed at mapping the research landscape rather than conducting inferential statistical testing (Donthu et al., 2021; van Eck & Waltman, 2010). The data selection process and analytical workflow are presented in Figure 1.

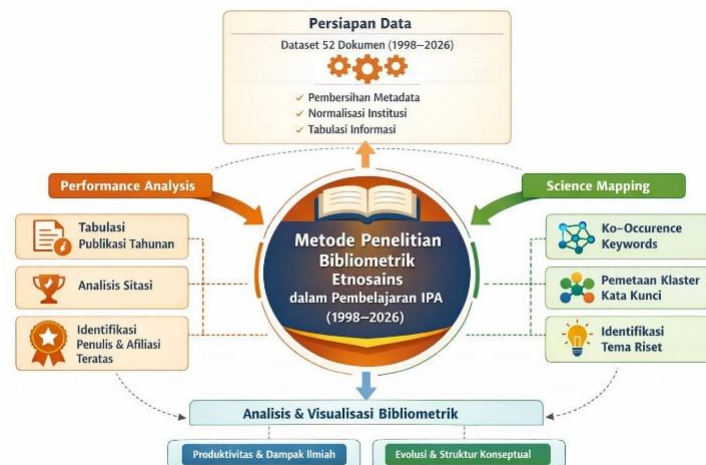


Figure 1 Research procedure

RESULT AND DISCUSSION

Annual Publication Trends

Based on the Scopus data, publication trends in ethnoscience research within science education exhibit a fluctuating yet generally increasing pattern, particularly in recent years. The earliest publication identified in the dataset consisted of a single document. Thereafter, the number of publications remained very limited until the early 2010s, indicating that ethnoscience in science education had not yet emerged as a consistently developed research topic. Growth became evident in 2017 with two publications, followed by three publications in both 2019 and 2020. In 2021, the number of publications increased to five before declining slightly to four in 2022. Subsequently, publications rose to seven in 2023, decreased again to four in 2024, and then experienced a substantial surge in 2025 with seventeen publications. The year 2026 recorded five publications; however, this figure should not be interpreted as a final decline because the publication year is still in progress. Figure 2 illustrates the publication trends of ethnoscience research in science education based on Scopus data.

The pattern shown in Figure 2 indicates that publication growth has not occurred in a linear manner. The fluctuations observed across several years suggest that ethnoscience research in science education is still in a phase of development and consolidation. Quantitatively, the most significant increase occurred in 2025, when the number of publications rose from four documents in 2024 to seventeen documents in 2025. This substantial growth reflects a marked increase in academic interest in ethnoscience within science education during the most recent period.

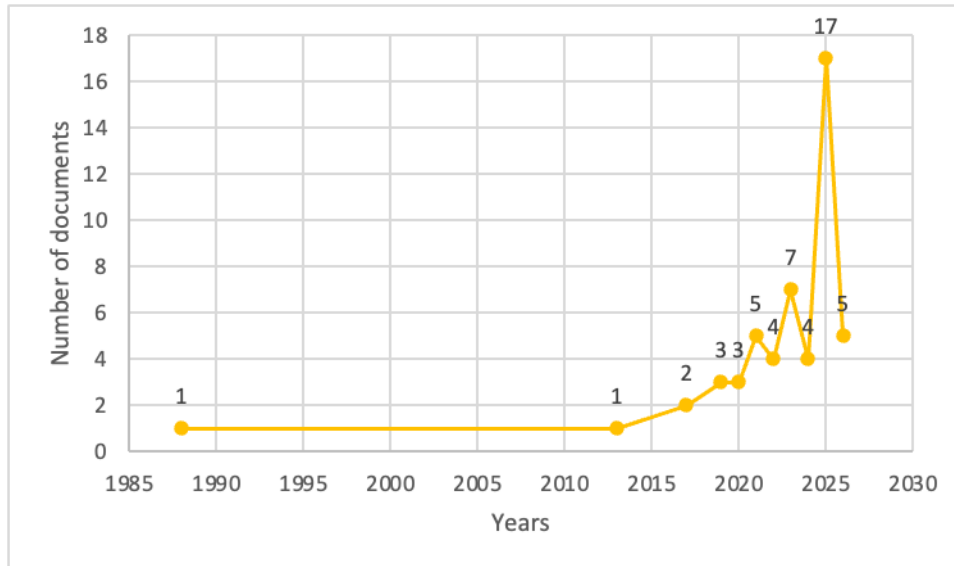


Figure 2 Annual publication trends in ethnoscience research in science education

When compared across periods, publications prior to 2017 were very limited and appeared only sporadically. In contrast, the period from 2019 to 2026 demonstrates more intensive publication activity, characterized by a higher number of documents and more consistent annual output. This pattern suggests that ethnoscience has begun to establish a clearer position as a research topic within science education, particularly after 2020. Nevertheless, the fluctuations observed in 2022 and 2024 indicate that publication growth has not yet become fully stable. Therefore, the overall publication trend can be interpreted as positive growth, albeit one that remains uneven across years.

These findings confirm that scholarly attention to ethnoscience in science education has strengthened considerably, particularly over the past five years. However, interpretations of this trend should remain grounded in the available bibliometric evidence. Based on the data, the primary strength of this trend lies in the increase in publication output during recent years, especially the publication peak recorded in 2025. At the same time, the declines observed in certain years indicate that the field is still developing dynamically and has not yet exhibited a stable growth pattern. Overall, the data suggest that ethnoscience in science education is an expanding research theme; however, continued publication activity in the coming years will be necessary to demonstrate sustained and consistent growth within the field.

In the context of implementation, studies conducted in Indonesia have also demonstrated that indigenous knowledge can be productively integrated into science and STEM education. For example, knowledge of traditional Indonesian medicine can be linked to modern scientific concepts and utilized to design learning experiences that are more authentic and relevant for students. Such findings highlight the strong practical foundation of ethnoscience for continued development within science education, which may help explain the increasing trend in related publications (Hikmah et al., 2025; Kasi et al., 2021).

Nevertheless, the declines observed in certain years, such as 2022 and 2024, indicate that the development of this field remains in a stage of consolidation. In other words, although ethnoscience research has expanded rapidly, the stability of its growth continues to be influenced

by thematic dynamics, shifts in educational policy priorities, and variations in pedagogical implementation across different contexts. This observation is consistent with recent reviews showing that the integration of local and indigenous knowledge into science education continues to advance, although its forms of implementation vary considerably across regions and educational levels (Hastuti et al., 2019; Hidayah et al., 2024). Overall, the pattern suggests that ethnoscience in science education is a field undergoing both strengthening and expansion, driven by increasing recognition of the importance of integrating local knowledge, contextualized learning, and dialogue between culture and science within educational practices.

Most Productive Affiliations

The analysis results indicate that institutional productivity in ethnoscience research within science education is concentrated in higher education institutions, particularly those in Indonesia. Based on the Scopus data, Universitas Negeri Semarang emerged as the most productive affiliation with 10 documents, followed by Universitas Negeri Surabaya and Universitas Negeri Padang with 8 documents each. Subsequently, the University of Mataram produced 6 documents, while Universitas Negeri Yogyakarta and Universitas Jambi each contributed 5 documents. Other affiliations included Universitas Sebelas Maret with 4 documents, while National Dong Hwa University and Universität Bremen each produced 3 documents. This distribution suggests that research productivity is not concentrated within a single institution but is instead distributed across several productive groups with relatively gradual differences in publication output. Figure 3 presents the most productive affiliations in ethnoscience publications within science education based on Scopus data.

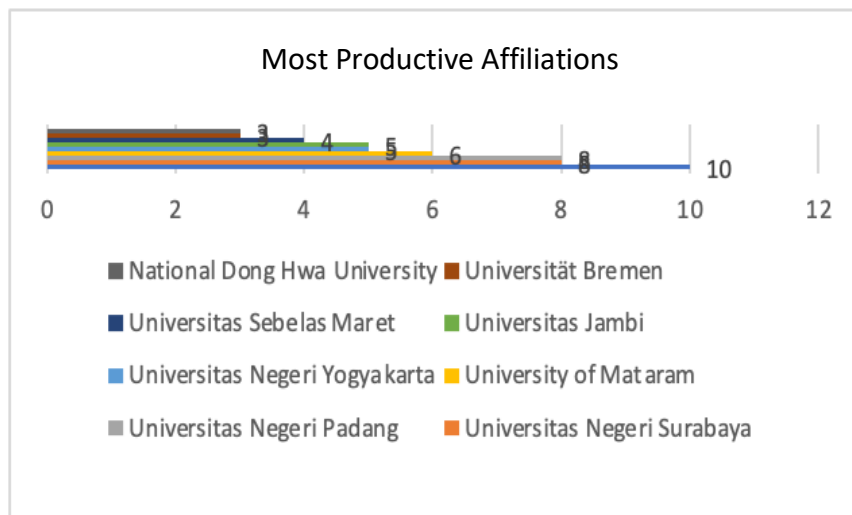


Figure 3 Most productive affiliations in ethnoscience research in science education

Figure 3 shows that Universitas Negeri Semarang holds the highest position with a difference of two documents compared to Universitas Negeri Surabaya and Universitas Negeri Padang, which occupy the next positions. This gap indicates that although Universitas Negeri Semarang is the leading contributor, its dominance is not significantly higher than that of the second-ranked affiliations. Thus, research productivity in ethnoscience within science education is relatively distributed across several public universities in Indonesia rather than being concentrated in a single institution.

When viewed based on productivity clusters, three main patterns can be identified. The high-productivity group consists of Universitas Negeri Semarang, Universitas Negeri Surabaya, and Universitas Negeri Padang, each producing 8–10 documents. The medium-productivity group includes the University of Mataram, Universitas Negeri Yogyakarta, and Universitas Jambi with 5–6 documents each. Meanwhile, the low-productivity group within the top ten consists of Universitas Sebelas Maret, National Dong Hwa University, and Universität Bremen, with 3–4

documents each. This pattern indicates that Indonesian institutions dominate most of the top ranks, while foreign affiliations appear in smaller proportions (Jihannita et al., 2024).

Quantitatively, the six Indonesian affiliations in the top list—Universitas Negeri Semarang, Universitas Negeri Surabaya, Universitas Negeri Padang, University of Mataram, Universitas Negeri Yogyakarta, Universitas Jambi, and Universitas Sebelas Maret—account for the majority of publications. The presence of National Dong Hwa University and Universität Bremen, each contributing three documents, indicates that ethnoscience in science education has begun to attract attention from institutions outside Indonesia, although their contribution remains limited compared to Indonesian institutions. These findings reinforce that ethnoscience research in science education is still highly centered in the Indonesian context (Hidayanti & Wulandari, 2023; Izzah et al., 2023).

The dominance of Indonesian public universities also indicates that ethnoscience research in science education has developed more strongly within science education environments and instructional development contexts. This is reflected in the large number of affiliations originating from higher education institutions with established traditions in science education research. Therefore, affiliation data not only identifies the most productive institutions but also demonstrates that the development of ethnoscience in science education is primarily driven by universities focused on education, pedagogy, and the development of locally contextualized teaching materials.

Overall, the map of the most productive affiliations confirms that the ethnoscience research landscape in science education is still dominated by Indonesian institutions, with Universitas Negeri Semarang as the leading contributor. However, the differences in publication output among affiliations are not highly extreme, as several other institutions also demonstrate relatively strong productivity. These findings indicate that ethnoscience research in science education has developed across multiple academic centers while also opening opportunities for broader collaboration, particularly with institutions outside Indonesia that are beginning to appear in the dataset (Jufrida et al., 2024; Khusniati et al., 2023).

Most Productive Countries

The analysis results show that publication productivity in ethnoscience research within science education is strongly concentrated in Indonesia. Indonesia ranks first with 47 documents. This disparity indicates that Indonesia is the main contributor within the analyzed dataset. However, this dominance should be interpreted cautiously, as bibliometric results are strongly influenced by search strategies, Scopus database coverage, publication language, and the keywords used in the search query. Figure 4 presents the distribution of the most productive countries in ethnoscience research within science education based on Scopus data.

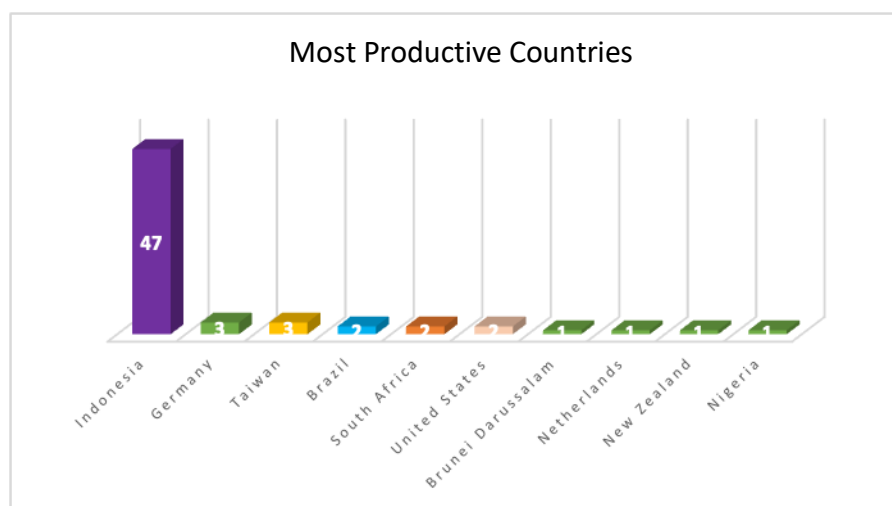


Figure 4 Most productive countries in ethnoscience research in science education

Figure 4 shows that publications on ethnoscience in science education are not evenly distributed across countries. Among all identified countries, Indonesia contributes the largest share, while other countries account for relatively small numbers of publications. Quantitatively, the gap between Indonesia and the next-ranked countries is substantial, with a difference of 44 documents compared to Germany and Taiwan, each of which has only 3 documents. These findings indicate that, within the Scopus dataset used, ethnoscience research in science education is predominantly developed within the Indonesian academic context.

Nevertheless, the high number of publications from Indonesia cannot be directly interpreted as absolute global dominance. This result may be influenced by query bias, particularly if the keywords used are more closely aligned with the term “ethnoscience,” which is widely used by science education researchers in Indonesia. Other overlapping terms, such as “indigenous knowledge,” “traditional ecological knowledge,” “local knowledge,” or “culturally responsive science education,” may be more frequently used in other countries but are not fully captured if they are not explicitly included in the search strategy. Therefore, these findings should be understood as a representation of publication productivity based on the selected keyword combinations, Scopus database coverage, and the document selection criteria applied in this study.

In addition to query-related factors, Scopus indexing coverage may also influence the distribution of countries. Publications from Indonesia discussing ethnoscience in science education are more likely to be indexed in Scopus-covered journals, whereas similar studies from other countries may appear in local journals, conference proceedings, books, or other databases that are not included in the dataset. Language factors should also be considered. English-language articles from Indonesia that use the term “ethnoscience” are more likely to be captured in the search results, whereas studies based on local knowledge in other countries may use different terminology depending on their respective academic traditions (Muhlis et al., 2023; Mulyono et al., 2024).

Considering these limitations, the findings presented in Figure 4 remain important as they indicate that Indonesia is the most prominent publication hub within the dataset. This can be linked to the strong attention of Indonesian researchers toward integrating local wisdom, culture, and environmental contexts into science education (Mulyono et al., 2024; Nisa' et al., 2024). In the Indonesian context, ethnoscience is often used to connect formal scientific concepts with students' lived experiences, cultural practices, and community-based local knowledge. Therefore, the high number of Indonesian publications can be interpreted as an indication that ethnoscience is highly relevant to the development of contextual and culturally based science learning (Lestari et al., 2024).

The emergence of other countries such as Germany, Taiwan, Brazil, South Africa, the United States, Brunei Darussalam, the Netherlands, New Zealand, and Nigeria indicates that studies related to local knowledge and science education also receive international attention. However, the small number of documents from these countries limits the scope of interpretation. Their contributions are not yet strong enough to indicate a stable productivity pattern, but they may suggest that this topic has the potential to develop more broadly if the search is expanded with more diverse terminology.

Overall, the country distribution shown in Figure 4 indicates that ethnoscience research in science education within the Scopus dataset is quantitatively dominated by Indonesia. However, this dominance should be interpreted with methodological caution. Indonesia's leading position in these results is better understood as dominance within the dataset and the applied search strategy, rather than a definitive conclusion that similar research is not developed in other countries. Therefore, future studies are recommended to employ a broader set of keywords, including “ethnoscience,” “indigenous knowledge,” “traditional ecological knowledge,” “local knowledge,” and related terms, as well as to consider additional databases beyond Scopus in order to produce a more comprehensive mapping of country productivity.

Top Publication Sources

The analysis shows that publications on ethnoscience research in science education are distributed across several sources; however, their contributions remain concentrated in a small number of core journals. Based on Figure 5, *Jurnal Pendidikan IPA Indonesia* ranks first with 7 documents. This pattern indicates that only a limited number of journals serve as the primary publication outlets for ethnoscience research in science education.

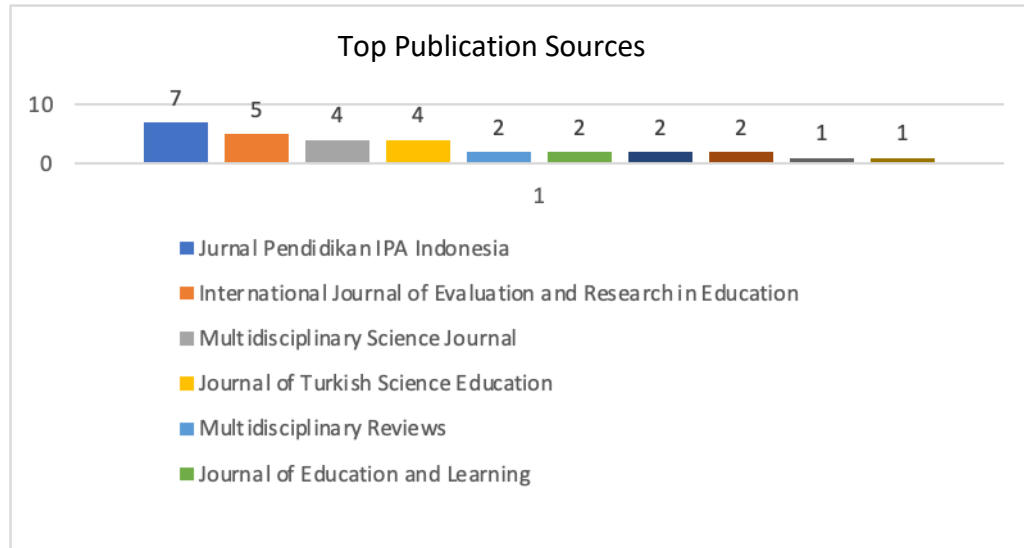


Figure 5 Top publication sources in ethnoscience research in science education

The findings in Figure 5 show that the distribution of publications is not evenly spread across journals. This indicates that publication productivity is not widely dispersed but is still concentrated in a small number of specific journals. The dominance of *Jurnal Pendidikan IPA Indonesia* as the source with the highest number of documents indicates that ethnoscience research in science education remains strongly connected to the Indonesian science education context. This finding is also consistent with the characteristics of the dataset, which show that ethnoscience publications are largely developed within culturally based science education settings. Meanwhile, the presence of the *International Journal of Evaluation and Research in Education* in second position suggests that some publications have begun to focus on aspects of evaluation, measurement, and learning effectiveness. However, given its relatively small number of publications (only five documents), this contribution does not yet reflect wide dissemination.

Overall, the data in Figure 5 indicate that the publication landscape of ethnoscience research in science education is still concentrated in four main sources, namely *Jurnal Pendidikan IPA Indonesia*, *International Journal of Evaluation and Research in Education*, *Multidisciplinary Science Journal*, and *Journal of Turkish Science Education*. These top four sources collectively account for 20 documents, while other journals contribute only 1–2 documents each. Thus, it can be concluded that ethnoscience research in science education already has several clearly identifiable publication outlets; however, its distribution across a wider range of journals remains limited.

Top Authors Based on Citations

The analysis shows that author productivity in ethnoscience research within science education, when viewed based on citation counts, tends to be concentrated among a small number of authors with strong academic impact. The figure indicates that Zidny R. ranks first with 279 citations. Figure 6 presents the most productive publications in ethnoscience research in science education based on Scopus data.

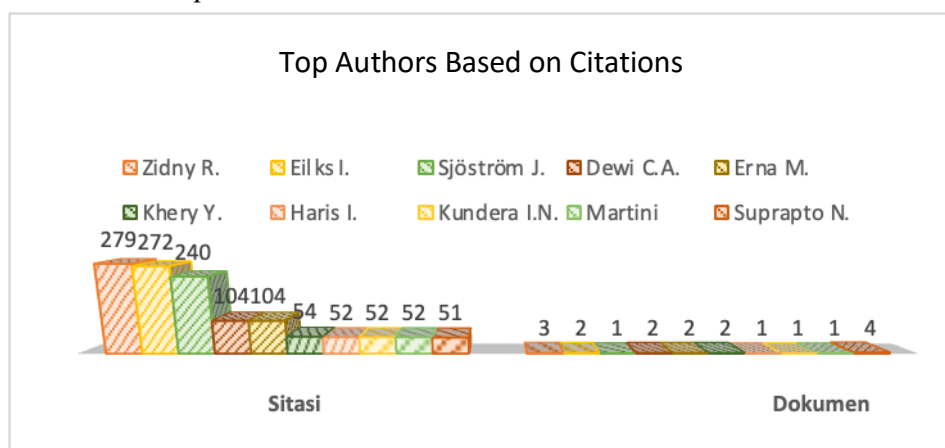


Figure 6 Top authors based on citations in ethnoscience research in science education

The findings in Figure 6 show that the landscape of scholarly influence in this field is relatively concentrated among a small number of authors with higher citation visibility compared to others. When viewed in terms of document count, the pattern does not fully align with citation performance. Suprpto N. is recorded as the most productive author in terms of publications, with 4 documents. Thus, this figure confirms that productivity based on the number of publications does not always correspond directly to citation impact.

Substantively, these findings indicate that in ethnoscience research within science education, there is a distinction between quantitative productivity and academic influence. For instance, Sjöström J. is recorded as having only one publication but accumulating 240 citations, suggesting that this work likely serves as an important reference or a conceptual article with high resonance within the academic community. This pattern shows that scientific influence in this field is more strongly determined by quality, thematic relevance, and the strength of conceptual contribution rather than merely the frequency of publication (Pebrianti et al., 2024; Risdianto et al., 2021; Rusilowati et al., 2021).

From a bibliometric perspective, the dominance of citations among certain authors also indicates the existence of a core group of references in the development of ethnoscience research. Highly cited authors are likely to serve as theoretical, methodological, or empirical references in explaining the integration of local knowledge into science education. This is important because ethnoscience is an interdisciplinary field: it requires not only an understanding of science concepts but also the ability to connect local culture, social context, and relevant pedagogical approaches. Therefore, authors who produce works with broad conceptual reach tend to receive higher citation counts. In addition, this distribution suggests that the development of ethnoscience research in science education is still influenced by key scholars who shape the direction of the scientific discourse. Authors with high citation counts can be seen as intellectual influence hubs, while authors with higher publication counts but more moderate citation impact contribute consistently to thematic enrichment. In other words, this field develops through a combination of highly influential works and sustained publication output (Rusmansyah et al., 2023; Sanova et al., 2023; Sasmita et al., 2024).

Overall, the figure shows that the authorship structure in ethnoscience research within science education is not evenly distributed, but rather concentrated among a small number of authors with dominant citation influence. This finding highlights that author productivity maps should be

interpreted in two dimensions—publication quantity and scientific impact—as both provide different yet complementary perspectives on the development of this research field.

Top Authors Based on Number of Documents

The analysis shows that author productivity in ethnoscience research within science education is relatively concentrated among a small number of authors with close publication counts, although their citation impacts vary more widely. Based on the number of documents, Diliarosta S., Sumarni W., and Suprpto N. rank highest, each with 4 documents. Meanwhile, other authors, including Harjono A., Lufri L., Rokhmat J., Sudarmin, Suryanti, Verawati N.N.S.P., and Widodo W., each contributed 3 documents. The findings in Figure 7 indicate that publication productivity in this field is not dominated by a single leading author but is relatively evenly distributed among several core contributors.

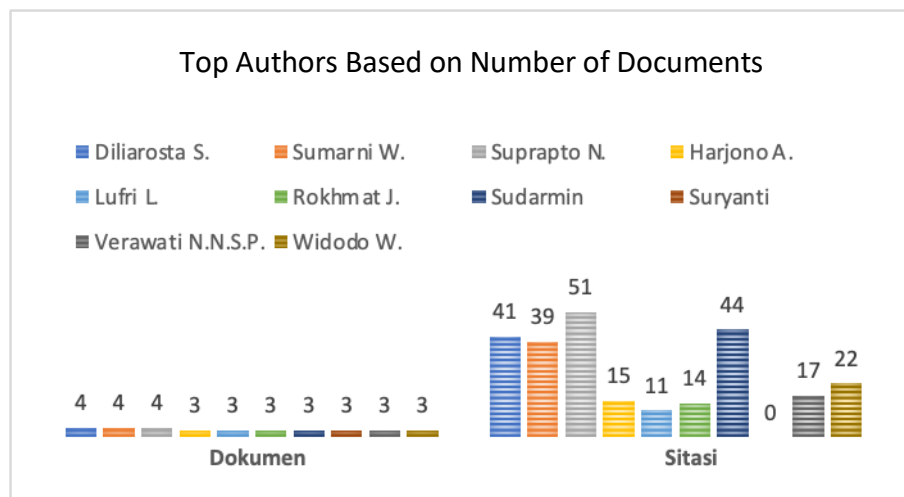


Figure 7. Top Authors Based on Number of Documents in Ethnoscience Research in Science Education

As shown in Figure 7, this pattern indicates that the number of publications does not always correspond directly to scientific influence as reflected in citation counts. Substantively, this finding confirms that within the ethnoscience research landscape, academic impact is determined more by the resonance and relevance of a work than by publication quantity alone. For example, Suprpto N. and Sudarmin demonstrate a strong citation impact despite having a number of documents similar to other authors. This can be interpreted as evidence that their works occupy a more central position in the development of ethnoscience discourse in science education, serving as conceptual, methodological, and practical references (Setiawan et al., 2023; Solheri et al., 2022). In other words, authors who produce highly cited works tend to play a guiding role in shaping thematic development, even when their publication output is not substantially higher than that of other contributors.

Overall, this data shows that the authorship structure in ethnoscience research within science education is supported by a relatively balanced group of core authors in terms of productivity, but with differences in scientific influence. This condition reflects that the development of this field is not only characterized by the growth in the number of publications but also by the emergence of several authors who function as important reference nodes in shaping the direction of the research. Therefore, analyzing productive authors based on both documents and citations is essential to identify the key intellectual actors who play a significant role in strengthening and expanding the development of ethnoscience research in science education.

Keyword Clusters

The keyword co-occurrence analysis shows that “ethnoscience” is the most central theme in the research landscape of ethnoscience in science education. This is evidenced by the large node size

of “ethnoscience” and its central position within the network, where it is connected to many other keywords. From a bibliometric perspective, this indicates that ethnoscience is not only frequently occurring but also functions as a bridging node that links multiple research themes. Thus, ethnoscience research in science education develops within an integrated structure, where “ethnoscience” serves as the main axis connecting pedagogical issues, culture, scientific literacy, and learning model innovation. Figure 8 presents the keyword co-occurrence network map of ethnoscience research in science education.

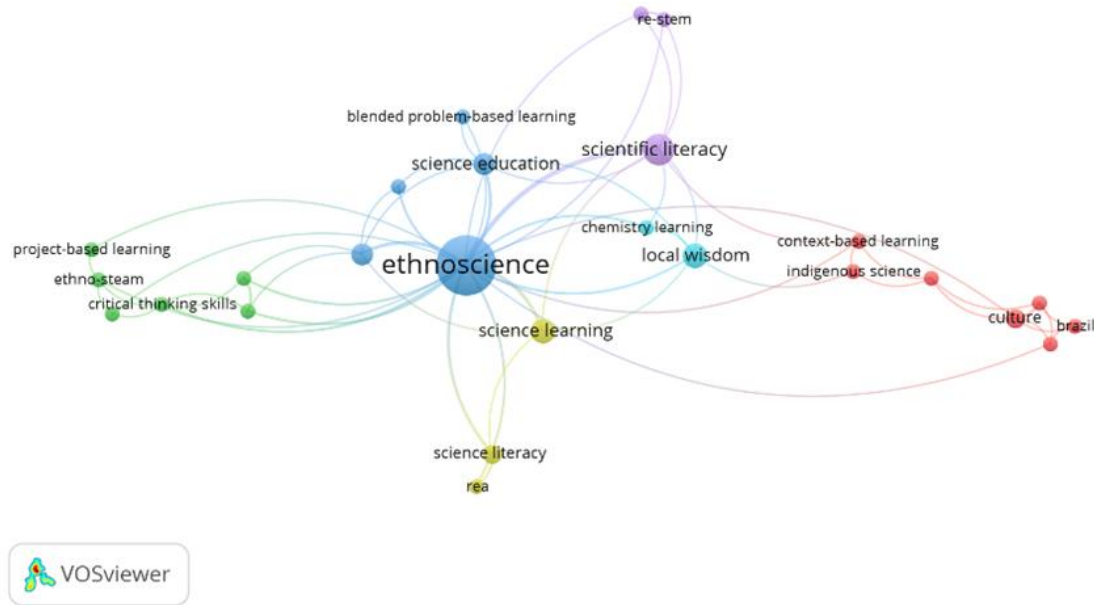


Figure 8 Keyword co-occurrence network map of ethnoscience research in science education

Figure 8 shows that the keyword network is divided into five main clusters. The blue cluster is centered on the keyword “ethnoscience” and is associated with “science education” as well as “blended problem-based learning.” This cluster indicates that ethnoscience is most strongly linked to the context of science education and the development of instructional models. The connection between “ethnoscience” and “science education” confirms that, within this dataset, ethnoscience is not only positioned as cultural content but also as part of a contextual science learning strategy (Gumbo et al., 2021; Sulistri et al., 2020; Uslan et al., 2024).

The green cluster contains the keywords “project-based learning,” “ethno-STEM,” and “critical thinking skills.” The presence of these keywords indicates that ethnoscience research is beginning to move toward strengthening 21st-century competencies (Lestari & Suyanto, 2024; Sotero et al., 2020; Zidny et al., 2020). Within this cluster, local culture is not only used as a contextual learning resource but also as a foundation for designing project-based learning activities, strengthening STEM integration, and developing critical thinking skills (Fahrudin et al., 2023; Guerrero & Sjöström, 2024).

The purple cluster is centered on “scientific literacy” and is associated with “re-STEM.” This cluster indicates that scientific literacy is one of the key focuses in the ethnoscience research (Atmojo et al., 2025; Sotero et al., 2020). The connection between “scientific literacy” and “ethnoscience” suggests that ethnoscience is viewed as a means to help students understand science concepts through phenomena that are close to their everyday lives and local culture.

The red cluster contains the keywords “context-based learning,” “indigenous science,” “culture,” and “Brazil.” This cluster highlights the social, cultural, and geographical dimensions of ethnoscience research. Meanwhile, the appearance of “Brazil” suggests that ethnoscience research is not limited to Indonesian or Asian contexts but also emerges within broader international multicultural research landscapes (Sudarmin et al., 2019; Wijayanti et al., 2025).

The yellow cluster consists of the keywords “science learning,” “science literacy,” and “REA.” Although this cluster is smaller in size compared to the others, its position remains

important as it indicates a direct connection between ethnoscience and science learning practices. This cluster emphasizes that ethnoscience is not only discussed as a conceptual idea but is also linked to instructional processes and students' scientific literacy outcomes (Rahmat et al., 2024; Gunawan & Indrawan, 2025).

Overall, the co-occurrence map in Figure 8 shows that ethnoscience research in science education develops along five main directions: science education, innovative learning models, scientific literacy, cultural or indigenous science contexts, and science learning practices. These findings indicate a shift in research orientation from viewing ethnoscience merely as an integration of local culture toward a broader and more applied approach (Verawati et al., 2025; Widarti et al., 2025; Yuliana et al., 2021). In other words, within this dataset, ethnoscience has evolved into a science education approach that not only emphasizes cultural relevance but also supports the development of active learning models, scientific literacy, and students' critical thinking skills.

Implications of the Findings

The findings of this study indicate that ethnoscience in science education has developed into a field that is increasingly strong and well-structured. The first implication is that ethnoscience can no longer be viewed merely as a complementary approach in learning but rather as an important stream in science education innovation. The increasing trend in publications, particularly in recent years, shows that the integration of local knowledge into science learning is increasingly recognized as an academic and pedagogical necessity. This implies that the development of curricula, teaching materials, and learning strategies needs to provide a more systematic space for local cultural contexts as legitimate and meaningful learning resources (Budiarti et al., 2026; Cabral, 2021).

The second implication relates to Indonesia's position as the dominant hub in the publication landscape. This dominance indicates that Indonesia possesses strong academic and socio-cultural capital to serve as a key reference point in the development of ethnoscience in science education. With its rich cultural diversity, traditions, and local knowledge systems, Indonesia has a strong opportunity not only to remain the largest producer of publications but also to become a conceptual leader in the global discourse on culturally responsive science education. Therefore, the next challenge is not merely to increase publication quantity but also to strengthen theoretical and methodological quality as well as international reach so that Indonesia's contributions gain greater global recognition (Choirunnisa et al., 2026; Fitria et al., 2025).

The third implication is reflected in the concentration of publications within a limited number of journals. This finding indicates that ethnoscience research is still strongly situated within relatively specific publication venues, particularly science education and contextual learning journals. This condition suggests that the field already has a clearly defined academic home, but it also highlights the need for diversification of publication outlets. Future researchers are encouraged to expand their publications to a wider range of reputable international journals, including those focusing on culturally based education, curriculum studies, 21st-century learning, and STEM education. Such efforts are important to ensure that ethnoscience develops not only within national or regional contexts but also becomes part of a broader international scholarly discourse.

The fourth implication relates to authorship and citation patterns. The findings show that scientific influence is still concentrated among a limited number of authors, while document productivity is relatively more dispersed. This suggests that the development of ethnoscience research is still strongly shaped by a core group of key scholars. From an academic perspective, this condition highlights the need to strengthen a broader research community so that knowledge production is not overly dependent on a small number of intellectual actors. Inter-institutional collaboration, support for early-career researchers, and the development of cross-country research networks are essential to expand the centers of scientific influence in this field.

The fifth implication arises from the keyword map, which shows that ethnoscience is closely connected with science education, project-based learning, critical thinking skills, scientific

literacy, indigenous science, and context-based learning. This structure indicates that ethnoscience has shifted from a general cultural integration theme toward a more multidimensional approach. In other words, ethnoscience is now understood not only as an effort to bridge culture and science, but also as a means to strengthen critical thinking skills, scientific literacy, project-based learning, and contemporary pedagogical innovation. For educators, this opens opportunities to design science learning that is not only contextual but also challenging, collaborative, and relevant to 21st-century competency needs.

The sixth implication concerns future research development. Although publication trends are increasing, the distribution of countries and affiliations indicates that the internationalization of ethnoscience research is still uneven. Therefore, future research agendas should be directed toward three main areas. First, expanding cross-cultural and cross-country comparative studies so that ethnoscience is not only understood within specific local contexts. Second, developing stronger research designs, such as experimental studies, longitudinal studies, or mixed-method approaches, to more rigorously demonstrate the effectiveness of ethnoscience in science education. Third, strengthening the integration of ethnoscience with contemporary issues such as STEM, sustainability, environmental literacy, digital technology, and inclusive education.

In practical terms, the results of this study also provide directions for teachers, curriculum developers, and educational institutions. Science teachers can utilize ethnoscience as a strategy to create learning experiences that are closely connected to students' real-life contexts, while curriculum developers can use these findings as a basis for more explicitly integrating local contexts into instructional materials. For universities, these findings highlight the importance of establishing research centers or research groups focused on ethnoscience and culture-based science education. Thus, the implications of this study go beyond bibliometric mapping and also have the potential to strengthen academic policy directions and educational practice in a tangible way.

CONCLUSION

This study shows that ethnoscience research in science education has experienced increasingly strong development, although its growth has been fluctuating. The upward trend in publication output, particularly in recent years, confirms that ethnoscience has gained a more significant position within the science education landscape. This field is no longer understood merely as an effort to integrate local knowledge into instructional content but has evolved into a broader pedagogical approach encompassing contextual learning, scientific literacy, critical thinking skills, project-based learning, and interdisciplinary approaches.

Bibliometric findings also show that the development of this field is strongly dominated by Indonesia, both in terms of country output and institutional affiliation. This indicates that Indonesia plays a central role in shaping the direction of ethnoscience research in science education, supported by its rich local cultural heritage and a strong need for contextually relevant science learning. At the same time, this dominance also suggests that opportunities for internationalization remain wide open and need to be strengthened through cross-country collaboration, improved publication quality, and broader dissemination channels.

From the perspective of publication sources and authorship, ethnoscience research remains concentrated in a limited number of journals and authors. This condition indicates that the field already has a relatively well-defined academic base, but it still requires an expansion of the scholarly community to prevent knowledge development from relying on only a few centers of influence. Meanwhile, keyword analysis confirms that ethnoscience is a central theme connecting pedagogical, cultural, and scientific literacy and learning innovation dimensions. The dense and multidimensional keyword network structure shows that ethnoscience is increasingly understood as a transformative approach in science education.

Nevertheless, the findings of this study should be interpreted by considering several limitations. First, this research uses only one database, namely Scopus, meaning that relevant publications indexed in other databases such as Web of Science, ERIC, Dimensions, Google Scholar, or national databases are not included in the analysis. Second, the relatively small

dataset size means that the bibliometric mapping does not fully represent the overall development of ethnoscience research in science education. Third, the quality of the analysis depends heavily on the completeness and accuracy of Scopus metadata; possible inconsistencies or errors in author names, affiliations, countries, publication sources, or citation counts may influence the mapping results. Fourth, the keyword analysis relies on author keywords, so variations in terminology, inconsistent keyword usage, and the absence of keywords in some documents may limit the depth of thematic interpretation. Fifth, data from 2026 do not yet represent a complete publication year, meaning that trends in the current year cannot be interpreted as final.

Overall, it can be concluded that ethnoscience in science education is a field that is currently experiencing conceptual strengthening, thematic expansion, and increasing practical relevance. Therefore, future research should be directed toward improving methodological quality, expanding international collaboration networks, and developing more innovative, applicable, and impactful ethnoscience-based learning models. In addition, future bibliometric studies are recommended to use more than one database, increase dataset coverage, apply stricter metadata validation and normalization, combine author keywords with abstracts or index keywords, and consider data completeness for the current year. In this way, ethnoscience has the potential not only to enrich science education academically but also to contribute to more humanistic, inclusive, and culturally grounded science learning.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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