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Global Trends and Scholarly Patterns in Ethnophysics: A Hybrid Systematic Literature Review and Bibliometric Analysis

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ABSTRACT

Ethnophysics has emerged as a culturally responsive approach that integrates local wisdom with physics learning; however, existing studies remain fragmented and lack a comprehensive global mapping of research trends, collaboration patterns, and future directions. The absence of a bibliometric-based synthesis creates a gap in understanding the development and sustainability of Ethnophysics scholarship. This study aims to systematically analyze the global scientific landscape of Ethnophysics and evaluate its future research relevance. A hybrid method combining Systematic Literature Review (SLR) and bibliometric analysis was employed. Publications indexed in Scopus up to December 1, 2025, were analyzed using VOSviewer to identify trends in publication, keyword co-occurrence, authorship networks, and thematic evolution. The findings indicate a significant growth in Ethnophysics research, predominantly concentrated in Indonesia, with emerging international collaborations. Major themes include contextual learning, integration of local wisdom, and problem-solving skills, while gaps remain in cross-cultural comparative studies and in large-scale empirical validation. The study confirms that Ethnophysics continues to hold strong scholarly significance and offers substantial opportunities for interdisciplinary expansion. The novelty of this research lies in providing the first comprehensive bibliometric mapping of Ethnophysics, offering strategic insights to strengthen the global knowledge ecosystem of culturally grounded science education.

INTRODUCTION

Ethnophysics is an interdisciplinary approach that integrates environmental education with physics, specifically by incorporating local cultural elements. This approach aims to enhance students' understanding of scientific concepts by making physics education more inclusive and contextually relevant (Deta et al., 2025). Ethnophysics is a branch of ethnoscience that connects scientific principles to traditional practices, providing a culturally relevant context for learning. It enhances students' critical thinking and contextual understanding by integrating local knowledge into science education (Jufrida et al., 2025). According to Dewi (2024), it is an instructional approach that connects local culture, traditions, and scientific knowledge, transforming original physics with people's beliefs or culture to apply it to scientific concepts. It is a form of contextual learning that incorporates indigenous science derived from hereditary beliefs and cultures. Sunarti (2025) highlights the importance of refining the delivery of Ethnophysics to enhance learning outcomes, suggesting clearer explanations and deeper cultural integration. Overall, Ethnophysics seeks to address the challenges of low science literacy and problem-solving skills among students by fostering engagement and understanding through culturally relevant pedagogy.

The growing relevance of Ethnophysics is increasingly evident in current global educational developments, as demonstrated by numerous studies conducted in various countries, including Indonesia (Nisa et al., 2024; Prakoso et al., 2025; Yuliana et al., 2025; Lestari et al., 2025; Tanjung et al., 2025). Despite the growing interest in Ethnophysics research, existing studies remain fragmented and do not provide a comprehensive picture of the field's global development. Most studies focus on specific local contexts, employ diverse methodologies, and have a narrow scope, contributing to knowledge gaps

regarding trends, publication patterns, scientific collaborations, and the overall trajectory of Ethnophysics at the international level. In fact, no researcher has yet focused on bibliometric mapping to identify research trends related to Ethnophysics.

In response to this gap, this study aims to provide a systematic and holistic understanding of the scientific landscape of Ethnophysics. Specifically, it focuses on analyzing Ethnophysics research and evaluating the relevance of future research topics. This study also discusses how the findings can contribute to strengthening the knowledge ecosystem that supports the development of culturally grounded science education at the global level. The research questions posed are:

RQ1: Is the exploration of Ethnophysics a subject that continues to hold significance for future scholarly inquiry?

RQ2: What is the allocation of research investigations related to Ethnophysics?

RQ3: What are the theoretical and practical implications from the perspective of future research?

This study uses Systematic Literature Review (SLR) and Bibliometric Analysis to answer three research questions. This systematic literature review method is appropriate for synthesizing existing research, identifying gaps, trends, and future research directions, and providing evidence-based insights that can influence policy, practice, and further research. This ensures that conclusions are drawn from a broad and representative sample of studies and highlights areas for further investigation (Agazu & Dabela, 2024; Arar et al., 2022; Said & Sharif, 2023; Sayder, 2019). The bibliometric analysis will complement Ethnophysics. Using VOSviewer and the Scopus database, this study will analyze publications up until December 01, 2025. This methodology enables a comprehensive understanding of its growth and future research directions.

RESEARCH METHOD

A systematic literature review employing a bibliometric approach quantitatively assesses literature to discern trends, patterns, and key research entities within a discipline. Using frameworks such as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), this approach ensures a comprehensive and replicable literature review, providing a clear and transparent picture of the topic under study (Chotisarn & Phuthong, 2025; Hadi et al., 2020; Suprapto et al., 2025). The inclusion criteria established were: (1) articles published up until December 01, 2025, (2) publication in English, and (3) focusing on the topic of Ethnophysics. Bibliometric analysis was performed using VOSviewer to visualize bibliographic data, including citation networks, author collaborations, and co-occurring keywords, revealing the intellectual structure and dynamics of the research field. The combination of bibliometric analysis and systematic review helps researchers synthesize empirical findings and map the landscape of research activity, including identifying key contributors and emerging trends (Ni & Abdullah, 2025). The integration of both approaches provides a comprehensive understanding of the development, historical evolution, and future direction of the research field, making it highly beneficial for interdisciplinary studies to gain deeper insights (Marzi et al., 2025; Wang & Yi, 2025). Bibliometric analysis is also used for strategic purposes in scholarly publication, introduced by Betrand et al. (1970) to evaluate scientific journals based on their economic weight.

The preliminary phase of this scholarly examination involves selecting keywords, which can be done through a macro methodology (top-down), progressing from expansive search trajectories to more narrowly defined studies and topics. Consequently, after evaluating the limitations inherent in prior research and the scarcity of studies addressing Ethnophysics, this investigation incorporates the keyword "Ethnophysics" as a focal point within the article's title, abstract, and keyword sections. Furthermore, the Scopus database is used by researchers for a myriad of investigative purposes, including conducting literature reviews, identifying subject-matter experts, and monitoring research trends.

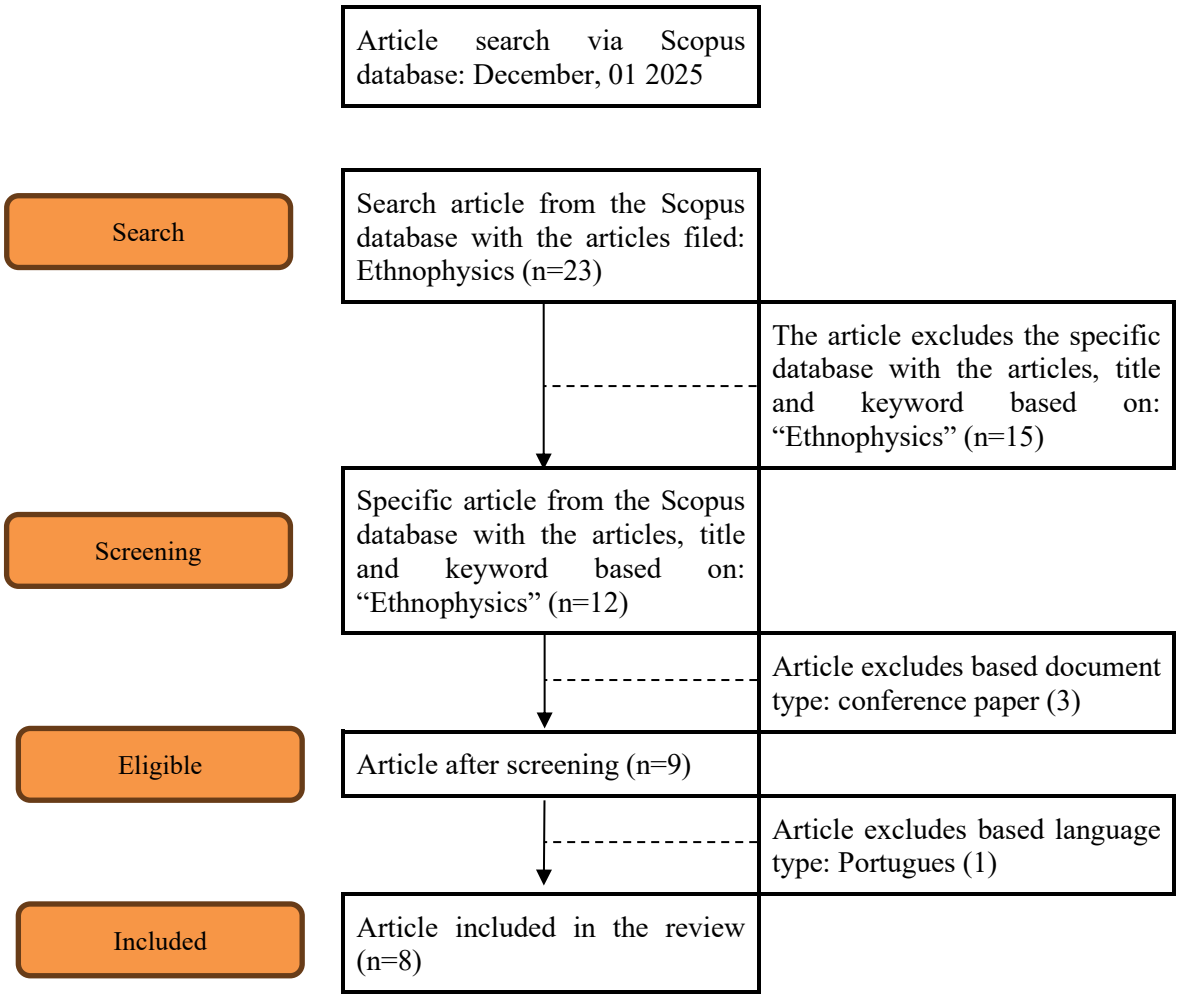


Figure 1. Systematic Literature Review Information Flow Using PRISMA

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart in Figure 1 illustrates the search and selection process for articles for a systematic review conducted using the Scopus database on December 1, 2025. In the initial search stage (Search), articles were retrieved based on title, abstract, and the keyword "Ethnophysics", yielding 23 articles. Subsequently, in the initial screening stage (Screening), 13 articles were excluded because they did not contain the specific keyword "Ethnophysics", leaving 10 relevant articles. The next stage was further screening to ensure the articles were eligible (Eligible). At this stage, exclusions were made based on document type: review articles (1), conference papers (1), and conference reviews (1), resulting in the elimination of 3 articles. After this screening, 9 articles remained. Then, one additional article was excluded because it was written in Portuguese, leaving 8 final articles included in the systematic review (Included). Overall, this diagram illustrates a systematic and step-by-step selection process for identifying the most relevant articles that meet the criteria for analysis in a scientific review of artificial intelligence in education. These documents were then further analyzed in this study to answer the following questions:
RQ1: Is the exploration of Ethnophysics a subject that continues to hold significance for future scholarly inquiry?
RQ2: What is the present allocation of research investigations related to Ethnophysics?
RQ3: What are the theoretical and practical implications from the perspective of future research?

RESULTS AND DISCUSSION

Result

The result of this study focuses on findings from 23 articles in the Scopus database on Ethnophysics. This data is sourced from articles published over the years, publications, and journal sources. This study

will also highlight the most influential elements in Ethnophysics, including the authors, affiliations, and the countries involved.

RQ1: Is the exploration of Ethnophysics a subject that continues to hold significance for future scholarly inquiry?

Based on data retrieved from the Scopus database, scholarly work on Ethnophysics comprises 23 articles; this suggests that investigations into Ethnophysics remain comparatively scarce, as illustrated in Figure 1. The exploration of Ethnophysics commenced its progressive development during the last years, specifically from 2023. The inaugural study was executed by Gunter H. Lenz (2016) and was entitled "A Critical History of the New American Studies" which signified the advent of the term now recognized as Ethnophysics.

A significant turning point occurred in 2023, when the number of publications began to increase more consistently. This upward trend became more evident in 2024 and reached its peak in 2025 with nine publications-the highest growth recorded in the observed period. This surge reflects the growing academic recognition that Ethnophysics represents a relevant and promising research area, particularly as modern educational frameworks increasingly emphasize cultural contextualization, inclusivity, and the integration of local knowledge into science learning (Suprapto et al., 2024; Nisa' & Suprapto, 2024; Nisa' et al., 2024; Dewi et al., 2024; Arisanti et al., 2024; Adam et al., 2024).

Furthermore, the development of Ethnophysics research has begun to attract the interest of many scholars, with a strong focus on enhancing the relevance of physics learning by integrating abstract and conceptually demanding ideas into more comprehensible forms through the incorporation of local cultural practices into physics concepts (Widyaningsih et al., 2025; Simanuntak et al., 2025; Yuliana et al., 2025; Sunarti et al., 2025; Rizki et al., 2025; Prakoso et al., 2025; Lestari et al., 2025; Jufrida et al., 2025; Tanjung et al., 2025).

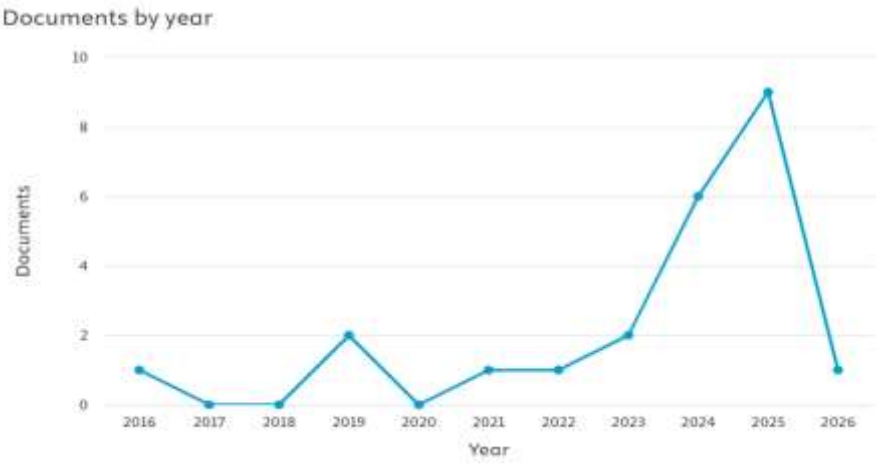


Figure 2. Number of Ethnophysics Publications

Figure 1 shows that Since 2016, the body of literature on Ethnophysics has remained limited due to the scarcity of studies published in reputable journals, thereby presenting opportunities for future researchers to address this gap. Research in this area is essential for providing insights into how Ethnophysics influences students' understanding of physics concepts. Such studies can facilitate a deeper comprehension of how Ethnophysics-based learning integrates local cultural potentials with physics content taught in schools. Furthermore, the incorporation of Ethnophysics into education offers additional benefits, including the preservation of regional cultural heritage, the creation of more meaningful and engaging learning experiences, and the enhancement of students' conceptual understanding.

RQ2: What is the allocation of research investigations related to Ethnophysics?

The analysis of the distribution of Ethnophysics research in the 23 articles was executed by category the articles according to classifications such as nation, region, affiliation, source, and author, with a constraint of solely the top 10 articles in each classification. Acumen regarding the allocation of scholarship

pertinent to Ethnophysics will be advantageous for scholars and practitioners in elucidating the forthcoming research agenda, particular in the sustainable advancement of the Ethnophysics paradigm.

First, the allocation of scholarly inquiry pertinent to Ethnophysics categorized by nation or geographical area is dominated by Indonesia with 21 articles and Taiwan with 2 articles, Brazil with 1 article, Finland with 1 article, Malaysia with 1 article, New Zealand with 1 article, Nigeria with 1 article, and Thailand with 1 article (see Figure 3).

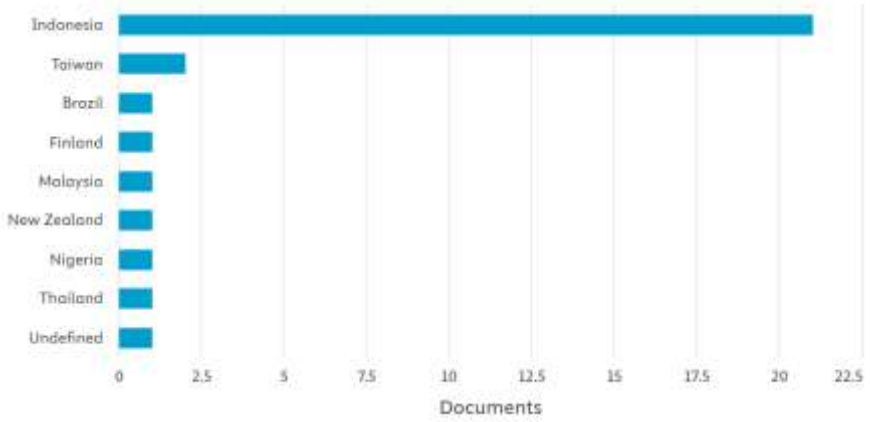


Figure 3. Number of Articles by Country or Territory

The allocation of scholarly inquiries pertinent to Ethnophysics governance as categorized by nation or territory reveals the preeminence of Indonesia with 21 manuscripts, succeeded by Taiwan with 2 manuscripts, Additionally, several other countries that have made significant contributions t this research include the Brazil, Finland, Malaysia, New Zealand, Nigeria, and Thailand with 1 manuscript. These findings indicate that the issue of Ethnophysics has gained attention not only in countries with archipelagic countries such as Indonesia, which is known for its rich cultural diversity, but also in various Western and non-Western nations, reflecting the broader relevance of this topic.

Researchers will also analyze the relationship between the countries involved in Ethnophysics research using VOSviewer software. This phase is imperative in formulating a systematic prospective research agenda. The examination's VOSviewer findings demonstrate the interrelations among investigating the Ethnophysics subject (see Figure 4).

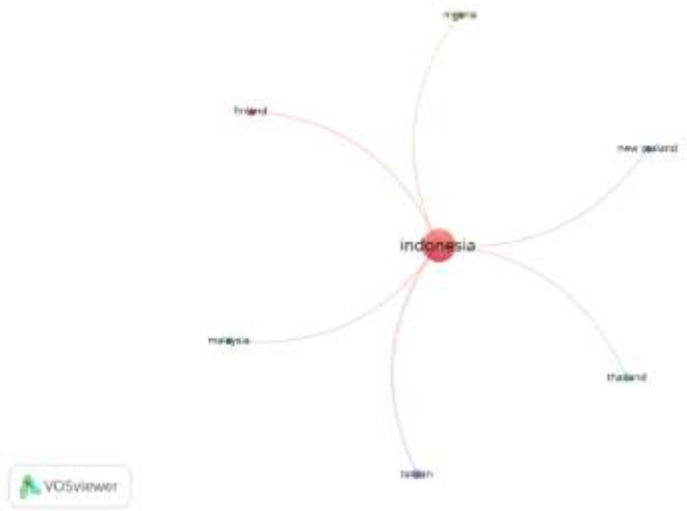


Figure 4. Network Country Visualization

The bibliometric visualization shows that Ethnophysics research is not only concentrated in Indonesia but has also expanded to several other countries such as Taiwan, Finland, Malaysia, New Zealand, Nigeria, and Thailand. The involvement of various countries from different continents (Asia, Europe, Oceania,

Africa) demonstrates that Ethnophysics has gained global attention as a relevant and developing field of research.

The network of inter-country relationships depicted in the map illustrates that Indonesia serves as the central hub for the development of Ethnophysics; however, the research network has spread to many other countries, thereby fostering collaboration and the dissemination of knowledge internationally. This fact confirms that Ethnophysics is no longer a local phenomenon, but has evolved into a scientific study on an international scale.

Second, the allocation of scholarship pertinent to Ethnophysics predicated on institutional affiliations is predominantly characterized by Universitas Negeri Surabaya with 9 articles, Universitas Negeri Medan with 4 articles, National Dong Hwa with 2 articles, Universitas Negeri Malang with 2 articles, Universitas Jambi with 2 articles, Universitas Papua with 1 articles, Universitas Negeri Surakarta with 1 articles, Universitas Negeri Padang with 1 articles, SMA Negeri 2 Tanjung Balai with 1 articles, and Institut Agama Islam Negeri Padang with 1 articles (see Figure 5).

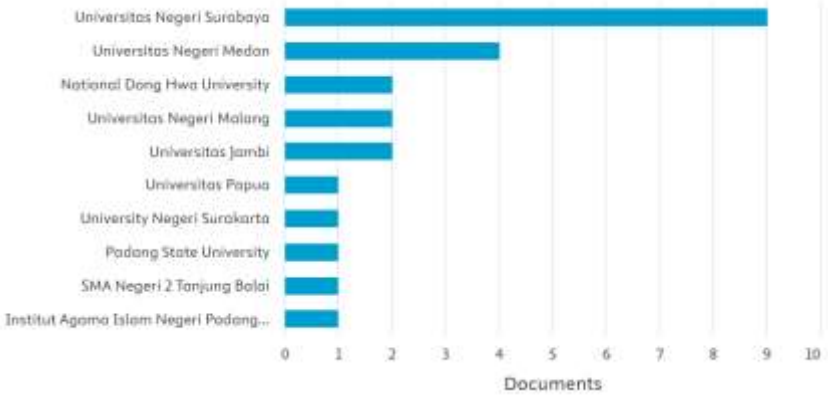


Figure 5. Number of Articles by Affiliation

The dissemination of Ethnophysics scholarship in the top 10 publications, as reflected in affiliations, indicates that it is not solely of scholarly interest within academic institutions; Ethnophysics research is not confined to Indonesia but has also expanded to several other countries, including Taiwan, Finland, Malaysia, New Zealand, Nigeria, and Thailand. The involvement of various countries from different continents (Asia, Europe, Oceania, and Africa) demonstrates that Ethnophysics has gained global attention as a relevant and developing field of research.

Third, the allocation of inquiries about Ethnophysics based on the source is predominantly characterized by educational science theory and practice, with 1 article, AIP conference proceedings with 2 articles, E3s web of conferences with 2 articles, and a multidisciplinary science journal with 1 article (see figure 6).

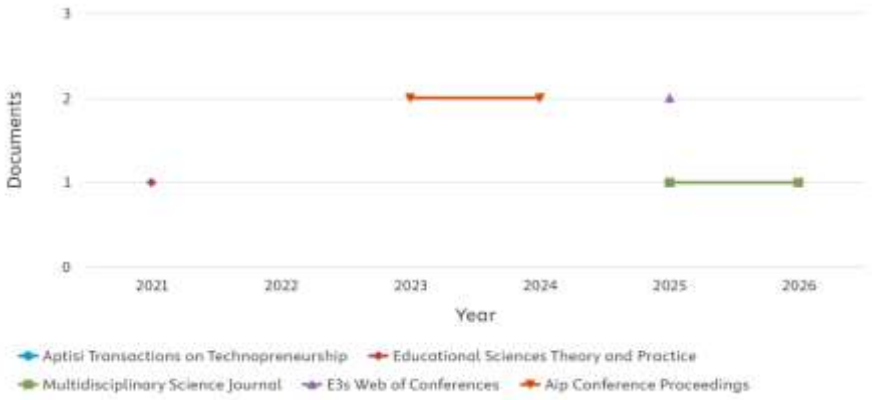


Figure 6. Number of Articles by Source

The allocation of scholarly inquiries pertinent to Ethnophysics governance, by nation or territory, reveals Indonesia's preeminence with 21 manuscripts, followed by Taiwan with 2. Additionally, several other countries that have made significant contributions to this research include Brazil, Finland, Malaysia, New Zealand, Nigeria, and Thailand, with 1 manuscript. These findings indicate that the issue of Ethnophysics has gained attention not only in archipelagic countries such as Indonesia, known for its rich cultural diversity, but also in various Western and non-Western nations, reflecting the broader relevance of this topic.

Fourth, the distribution of research related to Ethnophysics based on authorship is dominated by Suprapto, N., with 5 publications, followed by Prahani, B.K., with 3 publications. Several authors contributed 2 publications each, including Admoko, S.; Anwar, K.; Derlina; Deta, U.A.; Hidayatullah, H.N.; Kurniawan, W.; Lestari, N.A.; and Sahyar. (see Figure 7).

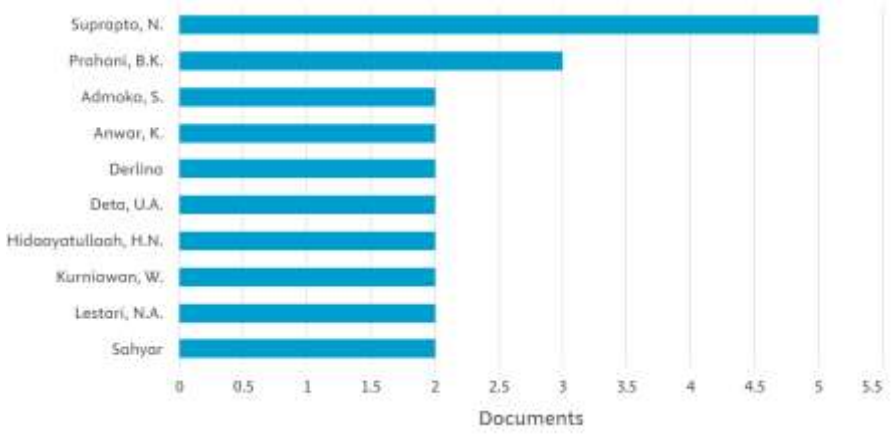


Figure 7. Count of Publications by Author

The VOSviewer visualization further illustrates clear collaborative clusters among these authors. Suprapto, N. appears as the central node in the network, indicating his pivotal role in bridging multiple author groups. The strong linkages connecting Suprapto, N., with Admoko, S., and Hidayatullah, H.N., demonstrate a well-established research partnership, while another dense cluster — comprising Prahani, B.K., Lestari, N.A., Nisa', Khoirun, and Deta, U.A.— reflects an active collaborative community contributing significantly to the development of Ethnophysics research. These interconnected clusters reveal that Ethnophysics is being advanced not only through individual scholarship but also through robust collaborative networks, which play a substantial role in shaping the field's research landscape. (see Figure 8)

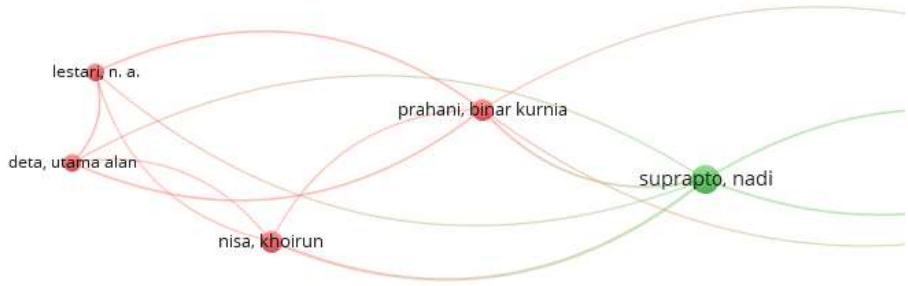


Figure 8. The VOSviewer Visualization Count of Publications by Author

RQ3: What are the theoretical and practical implications from the perspective of future research?

The examination was undertaken on 23 manuscripts amassed from the Scopus repository. VOSviewer was employed to illustrate that the result may possess theoretical and pragmatic ramifications for forthcoming inquire into Ethnophysics. The result of the metadata analysis using VOSviewer will help

researchers and practitioners better understand the assumptions and findings related to Ethnophysics. The bibliometric analysis results from VOSviewer can show which variables have been extensively researched and which have not been explored much, providing a foundation for future studies. From a practitioner's perspective, the literature analysis result using VOSviewer will assist practitioners in implementing Ethnophysics sustainably in the future and promoting the Ethnophysics style for global trends and scholarly patterns.

Figure 9 presents the results of the visualisation of research trends in Ethnophysics. This visualisation illustrates new innovations and research directions informed by the research conducted (Prahani et al., 2023). The colour differences in the circles indicate variations in keyword usage in research for specific years (Safitri & Admoko, 2024). These colour differences demonstrate that some research topics have long been a focus of study (indicated by a combination of purple and green colours) (Dawana et al., 2024). Previous research has focused on topics such as ethnoscience, critical thinking, and problem solving. Meanwhile, the yellow colour indicates that research on certain topics is currently developing, such as Ethnophysics, scientific literacy, and quality education. This aligns with research by Yuliana et al. (2025), which states that ethnoscience is rapidly developing today and has become a trend in education.

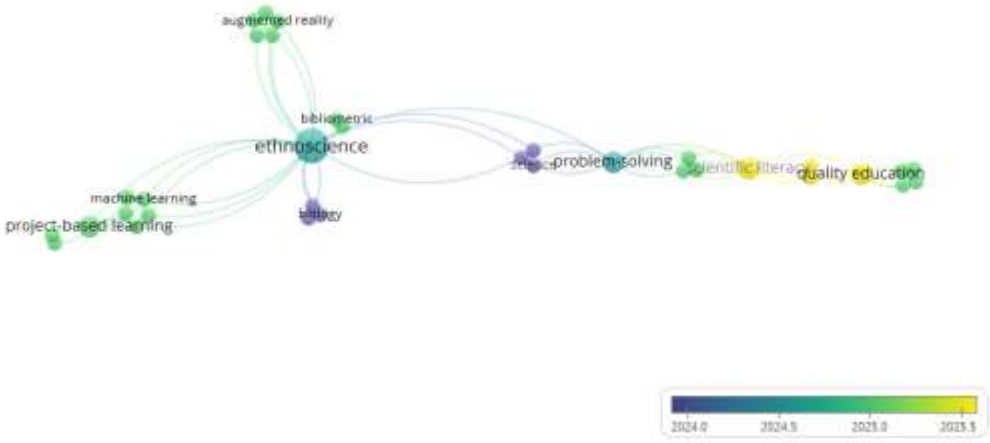


Figure 9. Keyword Visualization Results of Ethnophysics

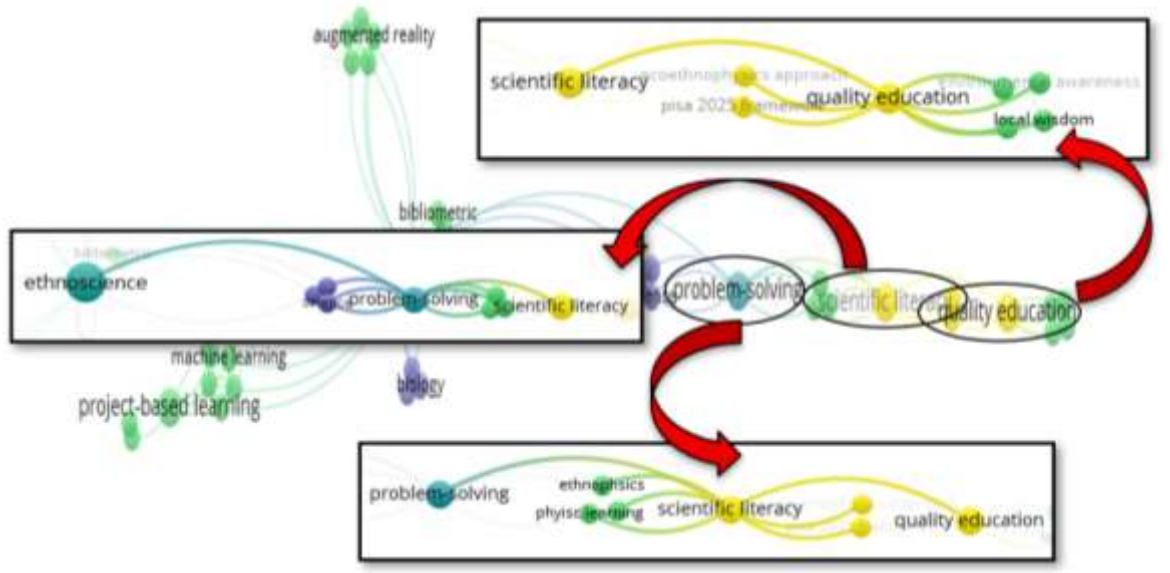


Figure 10. Visualization Results of More Specific Keyword Mapping to the Topic of Ehnophysics

The visualisation results are shown in Figure 10, based on several more specific keyword mappings such as problem solving, Ethnophysics, local wisdom, and scientific literacy. Based on the visualisation, there is a relationship between problem solving and physics learning, Ethnophysics, Structural Equation Modeling (SEM), and student worksheets. The relationship between physics learning and problem solving is very close, as one of the essential skills students need to deeply understand physics concepts is problem-solving ability. Problem solving serves as a means for students to better understand issues arising from local phenomena and to apply physics concepts as solutions or explanations for these phenomena (Faizah, Yuliati, & Pristiani, 2025; Jatmiko et al., 2025). Furthermore, problem solving is also related to SEM, which can be understood from the perspective of research and data analysis. According Sunarti et al (2025) SEM is often used to test complex theoretical models, while problem solving serves as a variable within SEM.



Figure 11. Word Clouds

Ethnophysics can be an essential part of ethnoscience because it is developed from ethnoscience, which is an approach to learning aimed at connecting the study of knowledge with local wisdom. Additionally, Ethnophysics is often linked to the PISA 2025 framework in the context of its contribution to achieving the competencies outlined in the PISA 2025 framework, such as requiring students to explain natural phenomena through inquiry. Ethnophysics directly provides local wisdom problems that can be used as exercises or student activities in classroom learning. According to Admoko (2025), Ethnophysics encourages students' active participation and makes learning more meaningful.

The visualisation also links quality education with Ethnophysics. Ethnophysics supports quality education by making learning relevant, engaging, and contextual; developing problem-solving, critical thinking, and creativity skills; and preserving national culture through education. Therefore, Ethnophysics supports problem solving, quality education, and scientific literacy.

Table 1. Keyword by Authors

Rank	Keyword	Total Link Strength
1	Ethnoscience	21
2	Indonesia	17
3	Ethnophysics	12
4	Culture	12
5	Concept Physics	12
6	Educational Applications	12
7	Fundamental Physics	12
8	Indigenous	10
9	Project-Based Learning	9
10	Problem Solving	8

A review of mapping outcomes and prior studies reveals a clear research gap. The number of indexed publications on Ethnophysics or ethnoscience remains limited, highlighting an insufficient research volume essential for a comprehensive understanding of the field. Further studies are needed to examine how traditional knowledge can be effectively integrated with modern scientific paradigms to promote a more inclusive understanding. Additionally, expanding research across diverse geographical contexts is crucial to strengthen the field's contribution to addressing global challenges.

Discussion

Ethnophysics, as an emerging field within the broader scope of ethnoscience, combines the study of physical phenomena with local knowledge and cultural context. Based on the results of the hybrid systematic literature review and bibliometric analysis, the field has shown significant growth in recent years, with research trends evolving from foundational studies on ethnoscience and problem-solving toward topics such as scientific literacy, quality education, and the integration of Ethnophysics into formal curricula (Prahani et al., 2023; Yuliana et al., 2025). The bibliometric mapping indicates that older, well-established topics, such as ethnoscience, critical thinking, and problem-solving, remain highly cited, suggesting their continued relevance as foundational elements of Ethnophysics research. In contrast, emerging themes, highlighted in recent publications, include the application of Ethnophysics to enhance scientific literacy, culturally responsive teaching, and local knowledge-based learning materials (Safitri & Admoko, 2024; Dawana et al., 2024).

The review reveals strong interconnections between problem-solving and physics learning within the context of Ethnophysics. Problem-solving serves as a core competency that enables students to analyze local phenomena and apply physics concepts in culturally relevant ways. This linkage is further supported by studies that utilize structural equation modeling (SEM) to examine the relationships between learning outcomes, problem-solving skills, and Ethnophysics interventions. SEM provides a rigorous framework for evaluating complex theoretical models, positioning problem-solving as both a learning outcome and an analytical variable within research designs.

Ethnophysics also plays a central role in promoting active, meaningful learning. By connecting physical concepts to local cultural practices, students are able to engage in inquiry-based learning that is contextualized and relevant to their everyday experiences. For example, activities rooted in local wisdom allow students to investigate natural phenomena and construct explanations that are simultaneously scientifically accurate and culturally grounded (Admoko, 2025). This approach aligns closely with international frameworks such as the PISA 2025 competency framework, which emphasizes the ability to explain natural phenomena through inquiry and evidence-based reasoning (Deta et al., 2025).

Moreover, Ethnophysics supports quality education by fostering student engagement, critical thinking, creativity, and cultural literacy. The integration of Ethnophysics in classroom practice has been shown to enhance students' motivation and participation, as the learning process becomes more meaningful and contextually relevant. By linking physical concepts with local knowledge, students can actively explore, hypothesize, and test ideas, thereby reinforcing higher-order cognitive skills while preserving and valuing cultural heritage. This dual focus on academic and cultural competencies underscores Ethnophysics' contribution to holistic and inclusive education (Nisa' & Suprapto, 2024)

The bibliometric analysis further highlights global scholarly patterns, showing that Ethnophysics research is gaining traction internationally, with collaborations across regions and disciplines. Authors and institutions contributing to the field are increasingly adopting interdisciplinary approaches, combining physics education research, ethnoscience, curriculum studies, and cognitive skill development. These trends suggest that Ethnophysics is not only expanding its theoretical base but also its practical applications, particularly in curriculum design, teacher professional development, and culturally responsive pedagogy.

In conclusion, the discussion indicates that Ethnophysics serves as a bridge between scientific knowledge and cultural understanding. Its global growth reflects a shift toward research that is both contextually grounded and academically rigorous. Problem-solving remains a central element, supported by methodological tools such as SEM, while emerging topics, such as scientific literacy and quality education, highlight the field's relevance to contemporary educational challenges. Ethnophysics demonstrates a significant potential to enhance learning outcomes, foster cultural appreciation, and contribute to international education frameworks, thus positioning itself as a key area of study for researchers, educators, and policymakers alike.

CONCLUSION

This study provides a comprehensive overview of global research trends and scholarly patterns in Ethnophysics through a hybrid systematic literature review and bibliometric analysis. The findings reveal a consistent growth in Ethnophysics publications, indicating its increasing relevance as an interdisciplinary approach that integrates physics education with local wisdom and cultural contexts. Indonesia emerges as the most productive contributor, highlighting the strong role of developing countries in advancing culturally responsive science education.

The thematic analysis shows that Ethnophysics research primarily focuses on contextual learning, scientific literacy, problem-solving skills, and students' conceptual understanding. These themes align closely with global educational priorities, particularly SDG 4 (Quality Education), which emphasizes inclusive, equitable, and meaningful learning experiences. By embedding physics concepts within culturally familiar phenomena, Ethnophysics enhances student engagement, motivation, and critical thinking, while simultaneously preserving local knowledge.

Moreover, Ethnophysics supports the PISA 2025 science framework, which prioritizes students' ability to explain phenomena scientifically, interpret data, and apply scientific knowledge in real-life contexts. Despite its growing impact, further research is needed to expand international collaboration, diversify data sources, and explore the integration of Ethnophysics with digital and inclusive learning models. Overall, Ethnophysics demonstrates strong potential as a transformative approach to physics education, promoting scientific literacy, cultural relevance, and sustainable educational development.

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