Quantifying Research Productivity: A Bibliometric Analysis of Ethnoscience

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Abstract

This study aims to investigate the progress of ethnoscience research published on Google Scholar between 1966 and 2023, utilizing a computational bibliometric analysis approach with the assistance of the Publish or Perish and VOSviewer applications. Parameters including title, publication type, keywords, Citation, and year range were utilized to select the relevant data obtained from the Publish or Perish applications, resulting in a compilation of 252 articles related to the chosen theme, each spanning a period of 10 years, starting from theory, society, culture, and education, up to chemistry and physic subjects, supported by highly cited journal findings. The trending topics in the field of education are approaches and learning media. Based on the gathered data, it is evident that there are still numerous opportunities for further research in the field of Ethnoscience. The utilization of the VOSviewer application can aid in identifying problematic areas that can be explored as potential research innovation topics within the field of ethnoscience. Future research should explore the integration of ethnoscience with sustainability, digital learning, and global challenges while addressing gaps in knowledge and underrepresented contexts.

1. INTRODUCTION

Ethnoscience refers to the study of indigenous knowledge systems that have been developed and preserved within specific cultural communities over generations. This knowledge includes classifications, understandings, and interpretations of the natural world, often based on close observation and cultural practices. Rather than being informal or purely anecdotal, ethnoscience contains systematic logic and internal consistency. It serves as a legitimate form of science grounded in cultural traditions, deeply embedded in language, worldview, and community experience (Jonathan, Lamm, Yessoufou, Suinyuy, & Olayiwola, 2025). Scholars emphasize that ethnoscience should not be seen as inferior to modern science but as complementary. Indigenous communities possess knowledge on subjects such as agriculture, health, ecology, and astronomy, developed through practical experience and spiritual beliefs. When integrated with modern scientific knowledge, ethnoscience offers more holistic solutions to global challenges, including sustainability, education, and conservation. This highlights the value of mutual respect and collaboration between knowledge systems.

Ethnoscience knowledge is often transmitted orally and shaped through lived experience and cultural adaptation. Knowledge is vital for sustainable land use and natural resource management, especially in rural and indigenous settings. Ethnopedology, for example, explores how traditional communities classify soil types and manage landscapes, contributing to sustainable agriculture. Such practices reflect a deep, place-based understanding that is often overlooked in formal science education and policy-making. Integrating ethnoscience into educational curricula promotes culturally relevant pedagogy and empowers students from indigenous or local communities. This approach increases student engagement, respects cultural identity, and broadens the scope of what is considered valid knowledge. Ethnoscience is an interdisciplinary field that examines how

indigenous communities conceptualize and categorize their surrounding environment through culturally embedded knowledge systems. This form of knowledge is derived from centuries of interaction with nature and is typically passed down through oral traditions, rituals, and lived experiences. It includes systematic understanding of agriculture, ecology, health, and local ecosystems, deeply tied to cultural beliefs and values (Jonathan et al., 2025). As explained in a recent systematic review, the integration of indigenous and scientific knowledge can produce more inclusive and contextually appropriate solutions, particularly in environmental management and education. Such integration requires mutual respect, equitable collaboration, and acknowledgment of indigenous knowledge as a legitimate and valuable science in its own right.

Ethnoscience is also aligned with the broader concept of indigenous knowledge, which encompasses elements of worldview, language, spirituality, and human-nature interactions. Ethnoscience practices include plant taxonomy, natural medicine classification, weather prediction systems, and land-use strategies developed through long-term observation and adaptation to local environments (Georgina, Ortiz-solorio, & Guti, 2023). The value of ethnoscience lies in its ability to connect scientific inquiry with cultural heritage, especially in education. Integrating ethnoscience perspectives into science education promotes culturally responsive pedagogy, enhances student engagement, and validates local knowledge systems that are often excluded from mainstream science curricula (Georgina et al., 2023). Indigenous scientific knowledge encompasses all knowledge related to societal facts, derived from beliefs passed down from generation to generation (H N Hidaayatullaah1, N Suprapto1, E Hariyono1, 2021). The scope of indigenous scientific knowledge includes fields such as science, agriculture, ecology, medicine, and the uses of flora and fauna (Jannah, Noris, & Indriyani, 2023). The ethnoscience approach as a learning approach refers to the process of reconstructing indigenous scientific knowledge that has developed within communities, in order to be transformed into scientific knowledge (Tresnawati, Saleh, Kurniawan, Sudarmin, & Wardani, 2020). Ethnoscience is defined as a body of scientific knowledge possessed by a specific community or ethnic group, acquired through specific methods and following particular procedures that are part of the traditions of that particular society. The "truth" of this knowledge can be empirically tested (Arif, Sudarmin, & Khusniati, 2015).

The term ethnoscience originates from the Greek word "ethnos," meaning "nation" or "people," and the Latin word "scientia," meaning "knowledge." Ethnoscience refers to the knowledge held by a particular nation or, more specifically, a specific ethnic group or social community, defines ethnoscience as a system of knowledge and cognition that is characteristic of a specific culture. It encompasses the unique knowledge and understanding, including ideas and thoughts, specific to a particular cultural context (Edy Tandililing, 2014). The first field of study in ethnoscience research focuses on culture, which is defined as the forms of things that people have in mind, their models for perceiving, which is interpreted in this context as models for classifying the environment or social situations they encounter. In the second type of ethnoscience research, researchers aim to uncover the structures used to classify the environment, both physical and social. Based on various ethnoscience studies that have been conducted, examples of research findings include the classification of plants, classification of various animal types, classification of diseases, and classification of colors. The third field of study in ethnoscience research concentrates on culture as a set of principles for creating dramas, writing scripts, and, of course, recruiting players and audiences. Research on the principles underlying various activities in everyday life is essential for understanding the unconscious structures that influence or determine everyday behavior, this area of study becomes the focus of scientific inquiry (Jurchiş & Adrian, 2016).

Recognizing the significance of local wisdom is essential in supporting the preservation of the environment, especially amidst its natural decline (Lamongan & Hermanto, 2021). Local wisdom serves as a valuable resource that holds traditional knowledge and practices passed down through generations (Setianingrum, Matahari, Jumadi, & Wilujeng, 2023). By acknowledging and integrating this wisdom into enviro mental efforts, we can tap into the wealth of indigenous knowledge and practices that can contribute to sustainable solutions. Embracing local wisdom empowers communities to become active participants in environmental conservation, leveraging their deep-rooted understanding of their surroundings to address pressing environmental challenges. Integrating ethnoscience into education plays a crucial role in enriching students' existing knowledge and fostering the development of indigenous knowledge within society (Nurhasnah, Lufri, & Asrizal, 2022). By incorporating local culture-based learning into the educational process, students are provided with opportunities to bridge their scientific knowledge acquired in schools with the wisdom embedded in their own cultural heritage (Damayanti, Rusilowati, & Linuwih, 2017).

Ethnoscience has gained increasing attention in science education research because it provides a bridge between indigenous knowledge systems and formal scientific understanding. Through bibliometric analysis, researchers can discern emerging themes, prevalent methodologies, and areas requiring further exploration. This insight not only guides current research efforts but also informs future directions, ensuring that scholarly endeavors remain relevant and impactful. Assessing the impact of ethnoscience research is equally crucial. Ethnoscience has broad relevance across fields such as education, environmental management, and agriculture.

In education, it supports culturally responsive teaching by connecting students' local knowledge to scientific concepts, thereby enhancing engagement and understanding. Studies show that integrating indigenous practices such as herbal medicine, seasonal farming patterns, and traditional ecological knowledge into subjects like biology can improve student performance and self-confidence (Georgina et al., 2023). This integration helps students see science as relevant to their lives, particularly in rural or indigenous communities (Stewart, 2015). Beyond education, ethnoscience contributes to sustainable development by offering valuable insights into land use, biodiversity conservation, and ecological balance. Traditional practices such as intercropping, natural pest control, and soil classification are examples of applied indigenous knowledge in agriculture (Georgina et al., 2023). Environmental scientists have increasingly recognized these practices as essential for creating sustainable and locally adapted solutions (Kujawska, 2019). Thus, ethnoscience not only preserves cultural identity but also serves as a practical knowledge system for addressing modern global challenges.

Integrating local cultural knowledge into science learning allows students to contextualize abstract scientific concepts within their daily experiences. Previous studies have shown that incorporating local knowledge into science education can strengthen students' conceptual understanding and encourage meaningful learning experiences (Kujawska, 2019). In addition, ethnoscience-based learning helps students appreciate cultural diversity while connecting scientific knowledge with community practices. Therefore, examining the development of ethnoscience research is important to identify current trends and potential research gaps in this field. Despite the growing number of studies on ethnoscience, systematic analyses that map the overall development of this field remain limited. Most previous studies have focused primarily on the implementation of ethnoscience in specific educational contexts rather than examining broader research productivity and collaboration patterns. Bibliometric analysis offers a powerful approach to identify publication trends, influential authors, and major research themes within a scientific field. However, comprehensive bibliometric studies on ethnoscience that analyze publication trends, citation impact, and research networks across a wider time span are still scarce (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). Therefore, a bibliometric investigation is necessary to provide a clearer overview of the development and direction of ethnoscience research.

The limited availability of information regarding journals registered in Google Scholar, the first published journals in the field, annual research trends, and the rankings of journals with the highest citations represents a significant gap in understanding ethnoscience research productivity. Addressing these limitations is essential for advancing the development and dissemination of ethnoscience knowledge. This research, titled *"Quantifying Research Productivity: A Bibliometric Analysis of Ethnoscience,"* aims to fill this gap by employing bibliometric methods to quantify and analyze research productivity in ethnoscience. The topic is particularly important as ethnoscience plays a crucial role in integrating indigenous knowledge with modern science, fostering sustainability, and enriching educational practices. However, a lack of comprehensive insights into research trends, publication impacts, and institutional contributions has hindered its broader application and recognition in the scientific community. This study contributes to the existing literature by providing a comprehensive bibliometric analysis of ethnoscience research, focusing on publication productivity, citation patterns, and collaboration networks. By systematically mapping scientific publications, this research offers a clearer understanding of the evolution and intellectual structure of ethnoscience studies. Bibliometric mapping can reveal dominant themes, emerging research topics, and influential scholars within a field (Aria & Cuccurullo, 2017). Such analysis is valuable for identifying research gaps and guiding future investigations in ethnoscience. Therefore, this study provides an important reference for researchers, educators, and policymakers interested in the development of ethnoscience research.

This study aims to analyze the development of ethnoscience research through a bibliometric approach. Specifically, it seeks to identify the quantity and types of scientific publications related to ethnoscience over a selected time period. In addition, the study examines citation patterns, influential authors, and institutional contributions that shape the development of ethnoscience research. Bibliometric mapping techniques are used to visualize research trends, collaboration networks, and emerging themes within the field (Jan & Ludo, 2010). The findings are expected to provide a comprehensive overview of the evolution and future direction of ethnoscience studies, valuate the impact and citation patterns of these publications, and identify major contributors, institutions, and collaborations shaping the field of ethnoscience research. To achieve these objectives, the study addresses three main research questions: (1) What are the results of the bibliometric mapping visualization on ethnoscience-based research trends? (2) What are the emerging research trends in ethnoscience? and (3) What are the recommendations for future ethnoscience research?. By utilizing bibliometric analysis, this research is significant for providing valuable insights into the scientific progress of ethnoscience, highlighting influential publications, impactful authors, and leading institutions. It also sheds light on underexplored areas and gaps in existing research, offering a foundation for future studies to address these challenges. Furthermore, understanding ethnoscience research trends and contributions enables policymakers,

educators, and researchers to leverage this knowledge for fostering sustainable development, enriching science education, and preserving indigenous knowledge systems. Through its findings, this study is expected to support the strategic development of ethnoscience and guide researchers toward impactful and innovative contributions in this field.

2. LITERATURE REVIEW

2.1. The Development of Ethnoscience Studies

Ethnoscience has developed as an interdisciplinary field that examines indigenous knowledge systems and their relevance to contemporary scientific and educational contexts. Over time, ethnoscience studies have expanded beyond anthropological documentation to include educational innovation, curriculum integration, and culturally responsive pedagogy. In educational settings, ethnoscience research has significant implications, particularly in the development of ethnoscience-based learning materials and the integration of local knowledge into formal curricula (Murwitaningsih & Maesaroh, 2023). Such integration not only enhances students' conceptual understanding but also promotes cultural awareness and contextualized science learning. As a result, ethnoscience has increasingly been positioned as a bridge between traditional knowledge systems and modern scientific frameworks.

The growth of ethnoscience research is also reflected in the increasing number of publications and the diversification of research themes. Previous studies indicate that ethnoscience research frequently addresses issues such as cultural preservation, indigenous knowledge systems, environmental sustainability, and community-based resource management. In addition, bibliometric investigations have begun to map the evolution of ethnoscience scholarship by identifying dominant keywords, influential authors, and collaborative research networks (Jannah et al., 2023). These analyses reveal not only areas of significant scholarly contribution but also domains that require further academic attention. By synthesizing existing literature, ethnoscience studies provide valuable insights for policymakers, educators, and researchers in formulating culturally grounded and sustainable educational strategies.
practices.

2.2. Research Trends and Gaps in Ethnoscience Studies

Understanding research trends within ethnoscience is essential for scholars to stay abreast of the field's evolution. The development of ethnoscience research demonstrates a significant upward trend, reflecting increasing scholarly interest in indigenous knowledge systems and their relevance to contemporary scientific and educational contexts. Bibliometric data indicate a steady growth in publications over recent decades, with a marked increase after 2015, suggesting a broader recognition of ethnoscience as an interdisciplinary field. Early studies primarily emphasized anthropological documentation and ethnographic perspectives, focusing on nature, culture, and traditional practices. However, more recent research has shifted toward educational integration, scientific modeling, and inquiry-based learning approaches, particularly in science education. This thematic transition confirms that ethnoscience is increasingly positioned as a pedagogical framework that connects indigenous knowledge with modern scientific concepts (Jannah et al., 2023).

Network, overlay, and density visualizations further reveal that keywords such as *education*, *model*, and *culture* dominate the current research landscape, indicating strong attention to culturally responsive science learning and interdisciplinary applications. The prominence of educational themes suggests that researchers increasingly view ethnoscience as a bridge between traditional wisdom and contemporary scientific understanding (Rahmawan & Rahayu, 2023). Despite this rapid growth and thematic diversification, comprehensive bibliometric analyses that systematically map publication patterns, collaboration networks, and intellectual structures remain limited. Most existing studies focus on implementation or case-based applications rather than providing a holistic overview of research development. Therefore, a more integrated bibliometric investigation is necessary to clarify emerging trends, identify influential contributors, and uncover underexplored areas within ethnoscience studies.

2.3. Bibliometric Analysis in Educational and Cultural Research

Bibliometric analysis has become an established approach for quantitatively evaluating scientific literature in fields such as education and cultural research. This method systematically examines publication trends, co-occurrence of keywords, citation counts, and collaboration networks to reveal the intellectual structure and evolution of a field. In educational research, bibliometric studies are frequently used to map research outputs and identify thematic focus areas; for example, mapping research trends in education using Scopus data reveals key research clusters and topic evolution (Andriani, Siahaan, & Edi, 2026). Similarly, bibliometric mapping of contemporary learning research highlights significant increases in publication output and thematic shifts over time, illustrating how quantitative visualization of scholarly networks can support comprehensive knowledge mapping (Rabbaniah, 2025).

In the context of educational and cultural research, bibliometric methods have been applied to various areas such as multicultural education, inclusive education, and technology trends in education, demonstrating the versatility of bibliometric tools like VOSviewer in revealing emerging research directions (Khanom, Islam, & Mahmudulhassan, 2025). These studies use bibliometric indicators such as keyword networks, thematic clusters, and citation patterns to analyze how research themes evolve, how collaborations form, and which areas need further investigation. Consequently, bibliometric analysis provides a powerful framework for assessing both quantitative growth and thematic development in interdisciplinary fields, offering insights that support research planning and policy development.

3. RESEARCH METHOD

This study employed a bibliometric analysis to examine the development and trends of ethnoscience research. Bibliometric analysis is a quantitative approach used to evaluate scientific publications by analyzing patterns such as publication productivity, citation impact, and collaboration networks. This method enables researchers to systematically map the intellectual structure and evolution of a research field. Bibliometric analysis has been widely applied to identify influential authors, institutions, and research themes within scientific literature (Donthu et al., 2021).
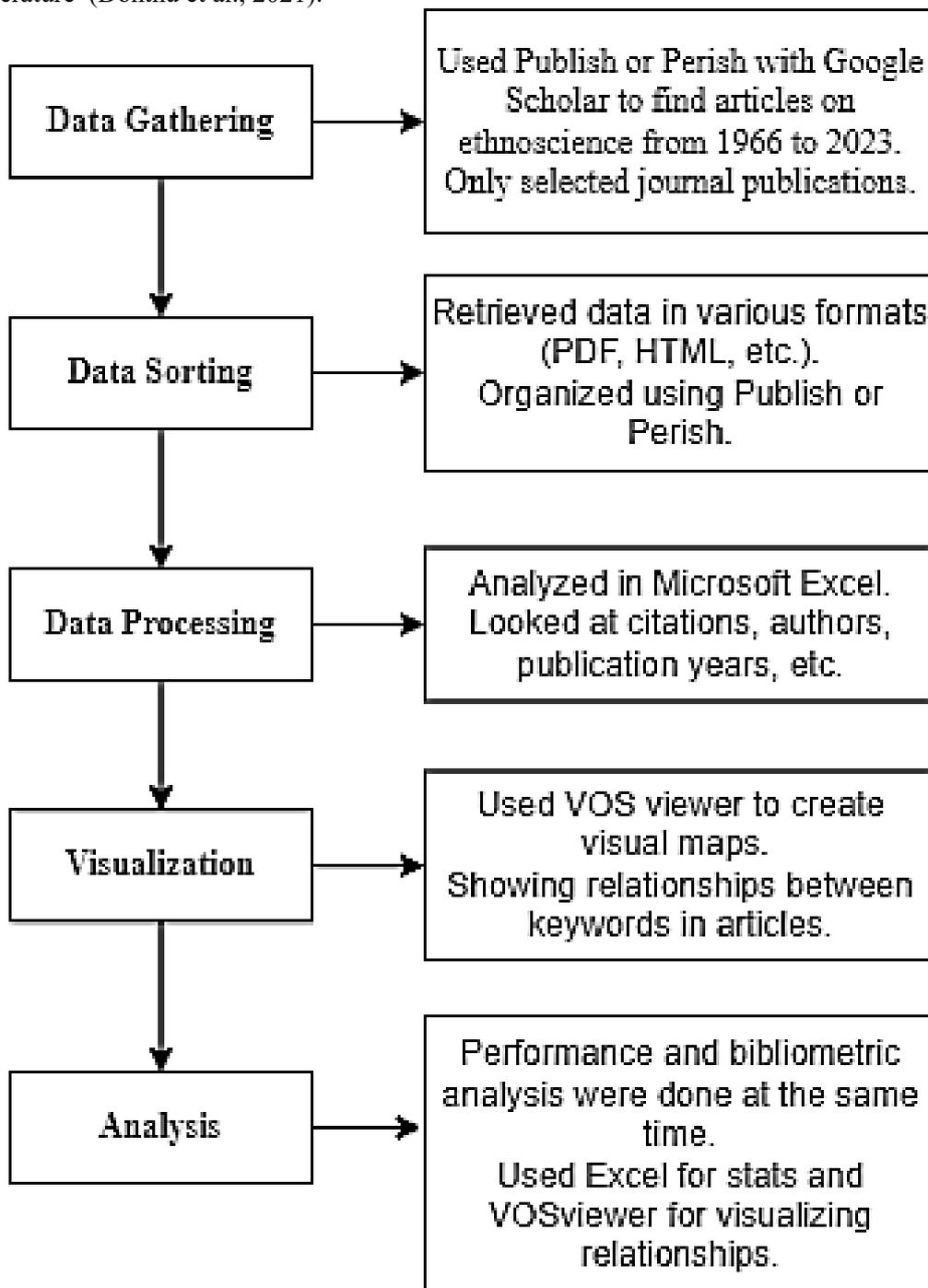

Figure 1. Path how the research was conducted

The data used in this study were obtained from the Google Scholar database using the Publish or Perish software. The keyword "ethnoscience" was used to retrieve relevant scientific publications within a specified time period. The search results included journal articles and other scholarly publications related to ethnoscience research. After the initial search process, duplicate and irrelevant documents were screened and excluded to ensure the relevance of the dataset. This data collection process ensured that the publications analyzed in this study were directly related to ethnoscience research. The data analyzed in this study were collected from journal publications indexed in the Google Scholar database. Google Scholar provides access to a wide range of academic publications and allows researchers to filter data using specific parameters. The selection of publications was limited to journal articles with titles containing the keyword "ethnoscience." The publication period analyzed in this study ranged from 1966 to 2023, and the data collection process was conducted in July 2023. The collected data were then processed using Microsoft Excel for statistical analysis and VOSviewer for bibliometric visualization.

The data analysis in this study employed two primary procedures: performance analysis and bibliometric analysis. Performance analysis was conducted using Publish or Perish and Microsoft Excel, which are commonly used tools for evaluating citation metrics and analyzing academic performance. This methodological rigor aligns with best practices in research, emphasizing simultaneous data processing to enhance reliability and reduce discrepancies in research outcomes (Aini, 2023). Bibliometric analysis, on the other hand, utilized the VOSviewer application, specifically designed for visualizing bibliometric networks and understanding relationships between publications. To ensure accuracy and minimize errors, both analysis stages were performed concurrently on the same day and at the same time. This methodological rigor aligns with best practices in research, emphasizing simultaneous data processing to enhance reliability and reduce discrepancies in research outcomes (Ali, Sak, & Zani, 2023).

The collected data were processed using Microsoft Excel to organize bibliographic information such as publication year, author names, article titles, and citation counts. Excel was also used to generate tables and graphs illustrating publication trends over time. Furthermore, bibliometric visualization was conducted using the VOSviewer software. This application enabled the creation of bibliometric networks that illustrate relationships among keywords and research topics. Through this visualization, major research clusters and thematic developments in ethnoscience studies could be identified.

4. RESULT AND DISCUSSION
1. The Results of The Bibliomtric Mapping Visualization on Ethnoscience-Based Research Trend

A total of 1,000 documents published between 1934 and 2023 were retrieved from the Google Scholar database using the Publish or Perish software. The search was conducted using the keyword "ethnoscience" to identify relevant scientific publications within the selected time range. The retrieved bibliographic data were then exported for further analysis and visualization. Bibliometric mapping was performed using the VOSviewer software to identify relationships among keywords and research themes. The resulting network visualization illustrates the structure and thematic distribution of ethnoscience research, as shown in Figure 2.

Figure 2. Ethnoscience Network

The network visualization in Figure 2 reveals five major thematic clusters in ethnoscience research, represented by different colors. Each cluster groups related keywords that frequently appear together in the literature, indicating specific research themes. The red cluster mainly includes terms such as education, theory, concept, and anthropology, suggesting a strong focus on ethnoscience within educational and theoretical contexts. This cluster highlights the growing interest in integrating ethnoscience concepts into science education. The dominance of this cluster indicates that educational applications are a central focus in ethnoscience research. The green cluster is associated with keywords such as models, inquiry, technology, chemistry, and physics. This cluster reflects the application of ethnoscience concepts in scientific learning models and inquiry-based approaches. The blue cluster contains terms related to society, culture, cognition, and informants, emphasizing the sociocultural dimensions of ethnoscience studies. Meanwhile, the yellow cluster includes terms such as nature and ethnography, highlighting the role of ethnographic approaches in documenting traditional ecological knowledge. A smaller purple cluster represents emerging or less frequently studied topics within the ethnoscience research network.

The visualization presented in Figure 2 depicts an ethnoscience network, showcasing five distinct color clusters each consisting of 1000 terms. The presence of five thematic clusters indicates that ethnoscience research has evolved into several interconnected domains, particularly education, cultural studies, and scientific modeling. This finding suggests that researchers increasingly view ethnoscience not only as an anthropological concept but also as a pedagogical approach for integrating indigenous knowledge into science education: Cluster 1 (Red): This cluster is associated with terms such as education, theory, concept, anthropology, and others. It highlights topics related to educational aspects, theoretical frameworks, conceptual understanding, and the field of anthropology. Cluster 2 (Green): The green cluster is linked to terms like models, inquiry, technology, chemistry, physics, etc. It signifies subjects related to models and methodologies, scientific inquiry, technological advancements, and areas like chemistry and physics. Cluster 3 (Blue): The blue cluster is composed of terms like society, informant, culture, cognition, etc. It indicates themes centered around society and its dynamics, the role of informants in research, cultural aspects, and the study of cognition. Cluster 4 (Yellow): The yellow cluster represents terms associated with nature, ethnography, and other relevant topics. It emphasizes themes related to the natural world, ethnographic research, and related subjects. Cluster 5 (Purple): The purple cluster stands out with a single result, namely "num." It is likely to represent a specific term or concept that has a unique association within the context of ethnoscience. Overall, Figure 1 provides a comprehensive visual representation of the interconnectedness and thematic distribution of terms within the ethnoscience network.

The clustering pattern shown in Figure 2 indicates that ethnoscience research is strongly interconnected with several academic disciplines, particularly education, anthropology, and environmental studies. The prominence of terms related to education and scientific models suggests that recent research has increasingly focused on integrating indigenous knowledge into formal science education. This finding aligns with previous bibliometric studies which reported that ethnoscience research has rapidly expanded within science education and interdisciplinary sustainability studies (Jannah et al., 2023). In addition, the presence of cultural and societal themes highlights the role of ethnoscience in understanding how local knowledge systems shape human interactions with natural environments. These results demonstrate that ethnoscience is evolving beyond traditional anthropological studies and is becoming an important framework for integrating cultural knowledge with modern scientific perspectives. Further analysis of the network indicates that the red cluster has the highest prominence within the ethnoscience research landscape. This prominence suggests that educational integration and conceptual discussions of ethnoscience are the most frequently explored topics in the literature. The strong connectivity between keywords within this cluster indicates an active research interest in incorporating ethnoscience perspectives into science education. Such integration is considered important for promoting culturally responsive learning and connecting scientific concepts with local knowledge systems. Therefore, the visualization highlights the central role of education in the development of ethnoscience research.

In addition to the network visualization, VOSviewer provides an overlay visualization that illustrates the temporal development of ethnoscience research. This visualization shows how research topics evolve over time based on the average publication year of keywords. More recent research trends appear in yellow, while earlier studies are represented by green and blue colors. Through this visualization, it is possible to observe the chronological development of research themes in ethnoscience. The overlay mapping of ethnoscience research trends is presented in Figure 3.
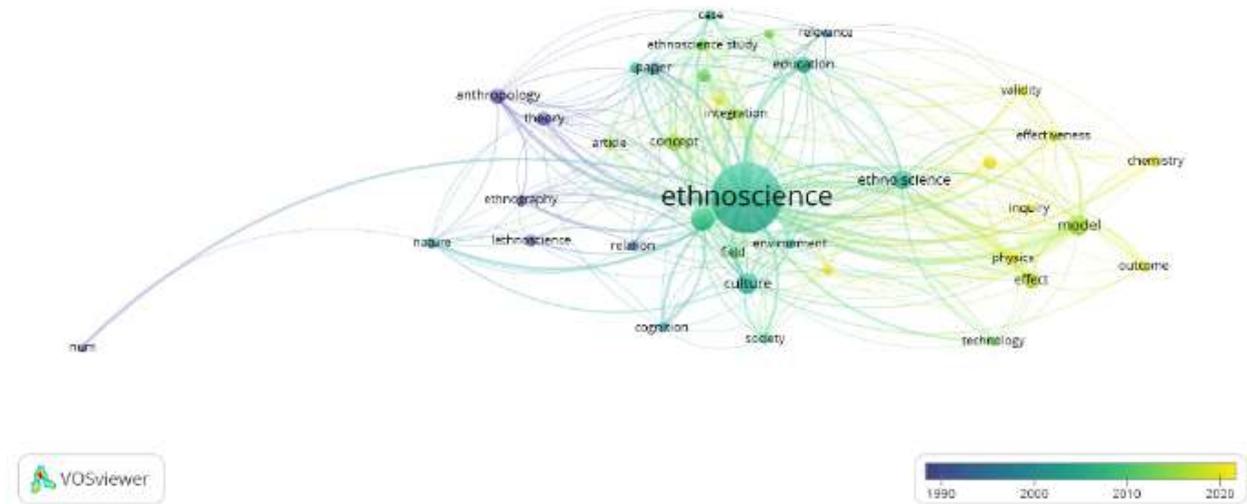
Figure 3. Overlay Visualization Ethnoscience

The color variation in the overlay visualization represents different time periods in ethnoscience research. Yellow-colored keywords indicate topics that have gained significant attention in recent years, particularly between 2020 and 2023. Meanwhile, green and blue colors represent earlier research periods around 2010 and before. This pattern indicates that ethnoscience research has gradually shifted toward more interdisciplinary and educational applications. The overlay visualization therefore helps identify emerging research directions within the field.
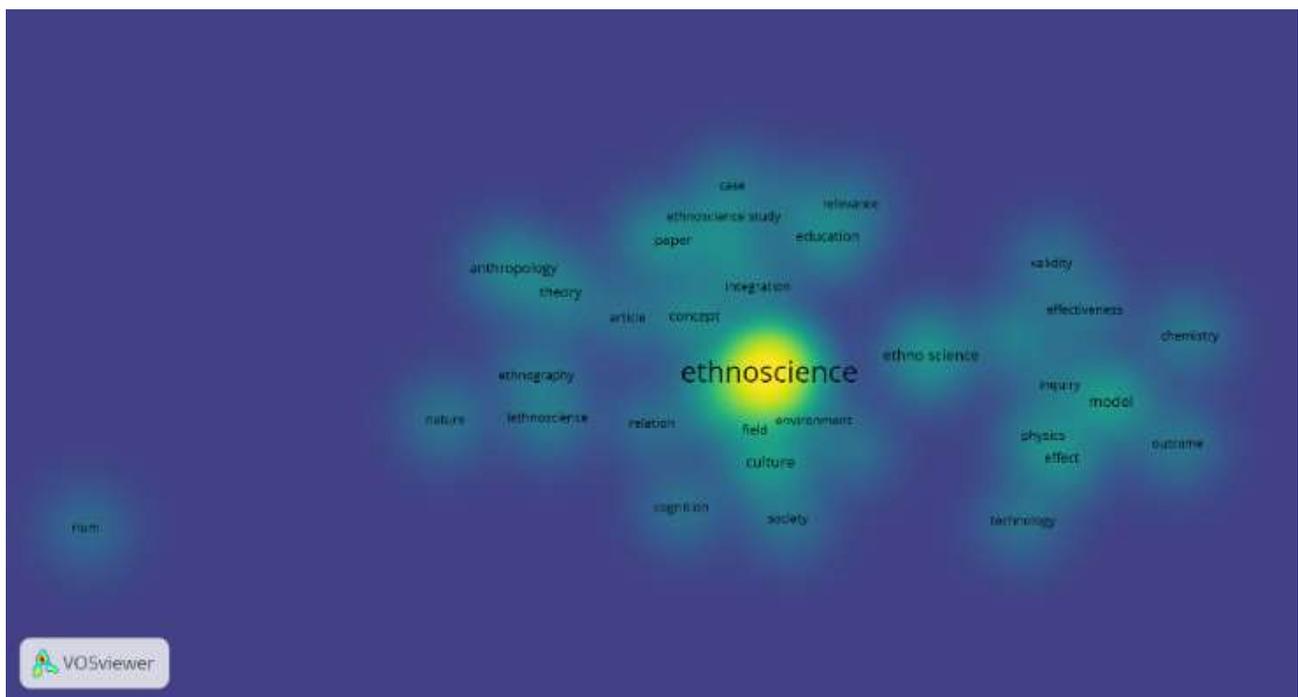
Figure 4. Density of Topics Ethnoscience

The density visualization presented in Figure 4 illustrates the intensity of research attention given to different topics in ethnoscience studies. Brighter areas represent keywords that frequently appear in the literature, indicating topics that receive significant research interest. The visualization shows that terms such as "education," "model," and "culture" have the highest density levels. This suggests that these topics are central themes in ethnoscience research. The density analysis therefore highlights the dominant research areas that shape the development of ethnoscience studies. The density visualization further confirms that several research themes dominate the current ethnoscience literature. Topics such as education, cultural knowledge, and scientific models appear with higher density values, indicating that these areas receive greater attention from researchers. Similar patterns have been reported in previous studies which highlight the growing interest in applying ethnoscience as a pedagogical approach in science education (Rahmawan & Rahayu, 2023). The

increasing emphasis on these themes suggests that ethnoscience is increasingly viewed as a bridge between indigenous knowledge and modern scientific understanding. Consequently, this trend supports the argument that ethnoscience can contribute significantly to the development of culturally responsive science education and sustainable environmental practices.

Overall, the bibliometric mapping indicates that ethnoscience research is structured around several interconnected thematic areas. The dominant presence of keywords related to education, culture, and scientific models suggests that recent studies increasingly focus on integrating indigenous knowledge into science learning and interdisciplinary research. This trend reflects a growing recognition of the value of traditional knowledge systems in supporting culturally responsive science education and sustainable environmental practices. Furthermore, the visualization highlights emerging opportunities for future research, particularly in strengthening the integration between local knowledge, scientific inquiry, and educational innovation. These findings demonstrate that ethnoscience research continues to expand as an important interdisciplinary field that connects cultural perspectives with modern scientific approaches.

2. Result the research trends in the ethnoscience

The analysis of publication trends shows a significant increase in ethnoscience research over time. Based on the bibliometric data retrieved from Google Scholar, the number of publications has grown steadily from 1966 to 2023. This upward trend indicates an increasing academic interest in traditional knowledge systems and their relevance to contemporary scientific and educational discussions. The growing number of studies also reflects a broader recognition of indigenous knowledge as an important component in addressing environmental sustainability and culturally responsive education. The increasing trend in ethnoscience publications demonstrates that the field is gaining broader recognition within the global academic community. Previous bibliometric studies have also reported a significant growth in ethnoscience-related research, particularly in interdisciplinary areas such as science education and environmental sustainability (Jannah et al., 2023). This pattern suggests that researchers increasingly acknowledge the value of indigenous knowledge as an important complement to modern scientific approaches. In addition, the growing number of studies indicates an effort to preserve traditional knowledge while simultaneously integrating it into formal scientific frameworks. Consequently, ethnoscience research is expected to continue expanding as scholars explore new applications of indigenous knowledge in education, environmental management, and sustainable development.
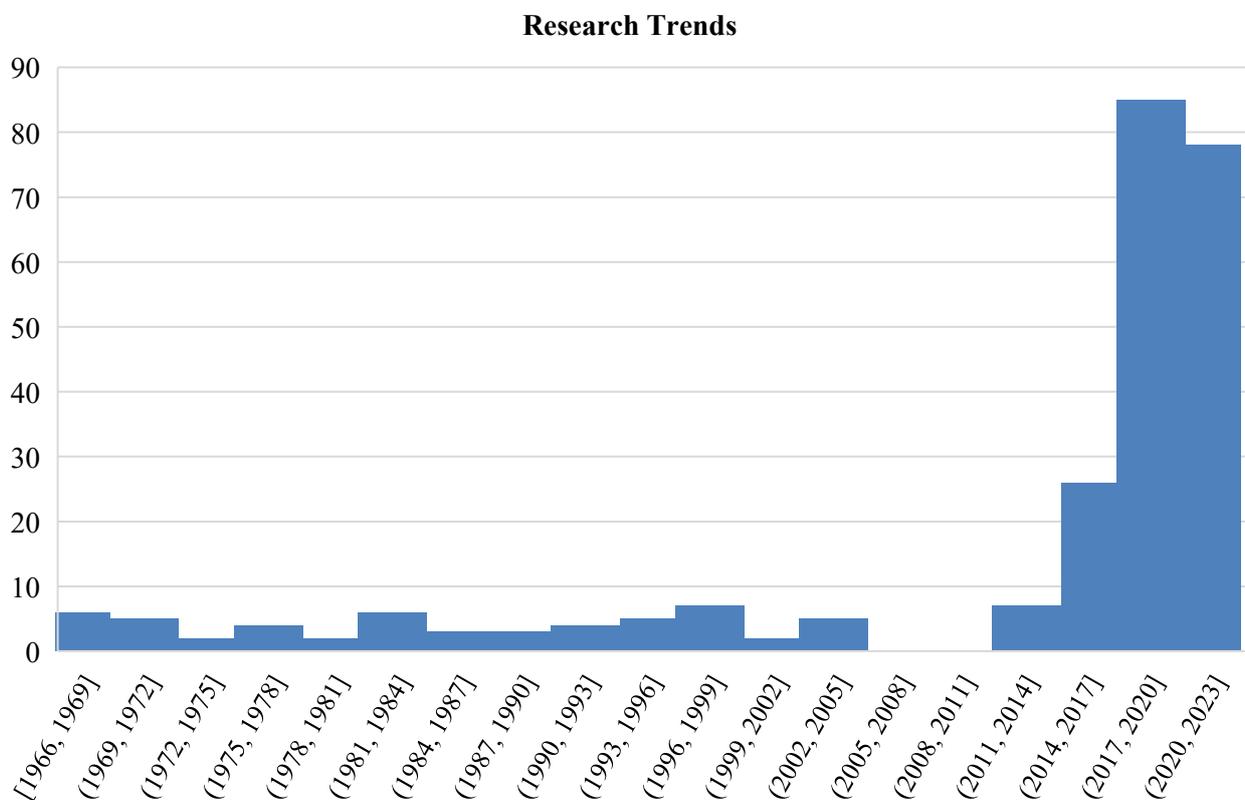

Figure 5. Research Trends

As illustrated in Figure 5, ethnoscience publications have increased consistently over the past decades. The most noticeable growth occurred after 2015, indicating a growing global interest in indigenous knowledge and its integration into modern scientific research. This increase may also be associated with the expanding focus

on interdisciplinary studies that combine anthropology, environmental science, and science education. The rising trend suggests that ethnoscience is gaining recognition as a valuable framework for understanding the relationship between culture, knowledge systems, and environmental practices.

Table 1. Theme Trends

Year	Theme
1990-2000	Nature
	Anthropology
	Theory
	Ethnography
	Relation
2001-2010	Culture
	Society
	Case
	Concept
	Environment
	Study
	Education
2011-2020	Concept
	Integration
	Inquiry
	Physics
	Chemistry
	Model
	Outcome
	Effectiveness
	Validity

Table 1 presents the thematic evolution of ethnoscience research across three different time periods. Between 1990 and 2000, research mainly focused on themes such as nature, anthropology, and ethnography, reflecting the early development of ethnoscience within anthropological and ecological studies. During the period 2001–2010, research themes expanded toward cultural and educational aspects, indicating a broader application of ethnoscience in social and educational contexts. In the most recent period (2011–2020), studies increasingly emphasized scientific models, inquiry-based learning, and interdisciplinary integration, suggesting a shift toward applying ethnoscience within science education and scientific research. Over the past three decades, ethnoscience research has experienced significant growth, evolving from its initial focus on natural and social relationships to a more profound exploration of cultural, societal, and interdisciplinary dimensions. This transformation underscores the growing emphasis on research validity and effectiveness, which are essential for appreciating, understanding, and preserving traditional knowledge. For instance, bibliometric analyses reveal a consistent rise in publications, with a notable peak in 2021 (Jannah et al., 2023). Studies have increasingly highlighted the interdisciplinary applications of ethnoscience, such as its integration into education to enhance critical thinking and foster a deeper connection to cultural heritage (Ilham, Wahyuni, & Muliana, 2023). Furthermore, systematic assessments of ethnoscience practices are gaining recognition as crucial for validating their practical benefits and bridging the gap between traditional wisdom and scientific innovation (Hardia, Pratama, & Muslihin, 2023). This evolution signifies ethnoscience's pivotal role in addressing contemporary challenges while fostering an inclusive approach to knowledge generation and cultural preservation.

The thematic transition presented in Table 1 also indicates a gradual shift in the orientation of ethnoscience research. Early studies primarily emphasized anthropological and descriptive perspectives, focusing on documenting indigenous knowledge and cultural practices. However, more recent research increasingly explores the integration of ethnoscience within formal science education and interdisciplinary scientific studies. This shift reflects a growing recognition that traditional knowledge systems can contribute to contemporary educational innovation and sustainability-oriented learning. Ethnoscience has become an important framework for contextualizing scientific concepts through local cultural knowledge. Therefore, the evolution of research

themes not only illustrates the expansion of ethnoscience as an academic field but also highlights its potential to support culturally responsive science education and sustainable knowledge development.

3. Result the recommendations for future ethnoscience research

The bibliometric findings presented in the previous sections reveal several important trends in ethnoscience research, including the rapid growth of publications and the thematic shift toward educational and interdisciplinary studies. These patterns provide an important foundation for identifying potential directions for future research. By analyzing the evolution of research themes and dominant keywords, it becomes possible to highlight several promising research areas that could further strengthen the development of ethnoscience as an academic field. Therefore, future research should not only continue documenting traditional knowledge but also explore new methodological approaches, interdisciplinary collaborations, and practical applications of ethnoscience in education and environmental sustainability.

The analysis of ethnoscience research trends presented in the table provides highly valuable information that can guide recommendations for further research in this area. As observed, there has been a noticeable shift in research emphasis from environmental features to cultural and sociological components, indicating a growing interest in understanding the complexity of human civilization and its interactions with the environment. Future research endeavors should continue to explore the integration of various disciplines to enrich the field of ethnoscience. The impact of traditional knowledge systems on communities and their environments can be better comprehended by scholars through the amalgamation of ideas from anthropology, sociology, and environmental science (Smythe, Clarke, Hammack, & Poitra, 2020). Anthropology, in particular, can contribute significantly to this understanding by offering insights into the cultural and social contexts within which traditional knowledge systems are formulated and utilized. Anthropologists can aid scholars in understanding how traditional knowledge systems are deeply embedded in the everyday lives of communities and how they serve as tools for navigating and managing their environments. For instance, anthropological research can underscore the significance of traditional ecological knowledge in high mountain communities, where local knowledge systems have evolved over generations to adapt to the unique environmental conditions of these regions (Ingty, 2017). On the other hand, environmental science can offer insights into the ecological aspects of traditional knowledge systems, such as how they are employed for the management and conservation of natural resources. Environmental scientists can aid scholars in understanding the role of traditional knowledge systems in preserving ecological balance and resilience, as well as their potential to inform and enhance modern conservation and management practices (Fenetiruma & Kamakaula, 2023).

Within the scope of ethnoscience, assessment studies present a promising avenue for research, emphasizing the evaluation of traditional practices and their impact. Despite being relatively underexplored, these studies hold significant potential to validate the effectiveness and applicability of indigenous knowledge. For instance, research such as *A Needs Assessment of Edutainment Module with Ethnoscience Approach* highlights the importance of incorporating ethnoscience into educational materials to cultivate cultural appreciation among students (Ardianti, Wanabuliandari, Saptono, & Alimah, 2019). Additionally, systematic evaluations, like those proposed in *Assessment in Science Learning Based on Ethnoscience*, offer frameworks for assessing the outcomes of ethnoscience-based learning, particularly higher-order thinking skills (Hastuti, Anjarsari, & Yamtinah, 2022). By rigorously analyzing the practical benefits of traditional knowledge, these studies can enhance its recognition within broader scientific discourse and inform policy developments, as exemplified by the integration of ethnoscience into Indonesia's *Kurikulum Merdeka* (Hasibuan, Syarifudin, Suherman, & Santosa, 2023). This approach not only underscores the relevance of indigenous wisdom in modern contexts but also provides a pathway for its integration into educational systems and scientific practices, ultimately bridging traditional knowledge with contemporary applications.

The exploration of biological themes within ethnoscience research offers significant opportunities for understanding how traditional cultures interact with their environments. By examining indigenous knowledge related to ecological dynamics, biodiversity, and ecosystem management, these studies unveil valuable insights into human-environment relationships. This research not only deepens our comprehension of local ecological practices that have evolved over time but also contributes to the development of sustainable practices. Such investigations are essential for advancing conservation efforts and integrating traditional wisdom into modern environmental policies, especially in areas where biodiversity is at risk. Moreover, the incorporation of ethnoscience into education frameworks can enhance students' awareness of environmental challenges, preparing them to address pressing ecological issues while respecting cultural heritage. This field holds considerable promise for informing both scientific and policy advancements in sustainability and biodiversity conservation (Murwitaningsih & Maesaroh, 2023).

Embracing assessment studies and exploring biological themes within ethnoscience can significantly enhance our understanding of traditional knowledge systems and our connection to the natural world. This

approach not only enriches academic inquiry but also fosters a holistic and sustainable stewardship of the planet. Ethnoscience, as an interdisciplinary field, facilitates innovative insights into how different cultures engage with their environments, often challenging traditional scientific paradigms. Moreover, future research must prioritize robust partnerships with local communities to ensure ethical and culturally sensitive engagement, thereby preserving indigenous knowledge and promoting mutual respect. In this way, ethnoscience can contribute to the development of sustainable practices that benefit both academic research and the communities involved, ensuring reciprocal advantages and the protection of cultural heritage (Bayani, Rokhmat, Hakim, & Sukarso, 2025). Future ethnoscience research should also prioritize the identification and documentation of traditional knowledge systems that are at risk of disappearing. Systematic documentation and collaboration with local communities are essential to ensure that valuable cultural knowledge is preserved for future generations. In addition, integrating traditional knowledge into scientific research and education can provide new perspectives for addressing global environmental challenges. By combining rigorous scientific methods with culturally grounded knowledge systems, ethnoscience research has the potential to contribute significantly to sustainable development, biodiversity conservation, and culturally responsive science education.

5. CONCLUSION

The bibliometric analysis conducted in this study demonstrates that ethnoscience research has experienced significant growth over the past decades. The increasing number of publications indicates a growing academic interest in traditional knowledge systems and their relevance to contemporary scientific discussions. The visualization results also reveal that ethnoscience research has gradually shifted from early anthropological and environmental observations toward interdisciplinary applications, particularly in science education and sustainability studies. These findings suggest that ethnoscience is increasingly recognized as an important framework for integrating indigenous knowledge with modern scientific perspectives. Despite this growth, several challenges remain in the development of ethnoscience research. One of the primary limitations lies in the integration of diverse methodological and epistemological approaches across disciplines. Differences in perspectives between social sciences, natural sciences, and indigenous knowledge systems may create difficulties in establishing a unified research framework. In addition, the interaction between cultural practices and ecological systems remains relatively underexplored, indicating the need for more interdisciplinary investigations. Ethical considerations are also crucial, particularly in ensuring that indigenous knowledge is documented and utilized in ways that respect community rights and intellectual property. Future research should focus on expanding interdisciplinary collaboration and exploring new applications of ethnoscience in education, environmental management, and sustainability studies. In particular, researchers should prioritize documenting endangered traditional knowledge and developing innovative approaches to preserve it in the face of globalization and climate change. Strengthening collaboration with local communities is also essential to ensure ethical and culturally sensitive research practices. By addressing these challenges and opportunities, ethnoscience research has the potential to contribute significantly to the development of culturally responsive science education and sustainable environmental practices   studies.

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