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The Development of Ethnoscience in Chemistry Learning in Indonesia: A Bibliometric Analysis of Literacy and Cultural Relevance

Vika Puji Cahyani [1*], Dewiyanti Fadly [2]

[1, 2] Universitas Negeri Makassar, Indonesia

* vika.puji.cahyani@unm.ac.id

Abstract

The main issue in this study is the lack of comprehensive understanding and mapping of the patterns and progress in ethnoscience research within the context of chemistry education in Indonesia. Investigating the patterns and advancements in ethnoscientific research in Indonesian chemistry education is the aim of this study. This study uses a bibliometric technique and is quantitative descriptive in nature. he stages include Selection of Topic and Research Objectives, Data Collection, Data Cleaning and Processing, Data Analysis, Data Visualisation, Interpretation and Discussion. Data collection was carried out by searching for journal articles indexed by Google Scholar through Publish or Perish (PoP) with the keyword 'chemical ethnoscience'. Data from Publish or Perish (PoP) was filled in and completed in the author's keywords section manually using Mendeley desktop software then integrated into VOSviewer software for mapping. The results of the analysis of keyword mapping in Google Scholar indexed scientific articles from 2014-2024, it is known that in the last 10 years, there are 137 keywords that are interrelated. The top 7 keywords with the strongest links include: ethnoscience (40), chemical literacy (9), chemistry learning (6), chemistry (4), problem based learning (4), local wisdom (3), STEM (3). Recent keywords in chemistry education that are still rarely discussed in scientific articles are podcast-based ethnoscience, common knowledge construction, chemical bonding, CKCM learning model, Flipped Classroom, knowledge, references, implementation, culture, character values, ethnoscience-based chemistry, need analysis, independent curriculum, 4-D development.

Keywords: *Ethnoscience; Chemistry Learning; Bibliometric Analysis; Literacy; Cultural Relevance*

Introduction

Chemistry education in Indonesia faces significant challenges in enhancing scientific literacy while ensuring that the material taught is relevant to the cultural context and daily lives of students. One approach that has gained popularity to achieve this goal is the integration of ethnoscience into the curriculum. Ethnoscience, which focuses on the traditional knowledge of indigenous communities, can serve as a bridge connecting scientific concepts with local practices that have existed for generations (Wulandari et al., 2024). Indonesia, with its ethnic diversity encompassing more than 300 ethnic groups and hundreds of languages and traditions, provides ample opportunities for educators to integrate this local knowledge into chemistry lessons (Ramadhani et al., 2022). This approach not only enriches students' scientific understanding but also strengthens their respect for and identity with the local cultures around them (Hasanah et al., 2024).

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The integration of ethnoscience into chemistry education provides a valuable opportunity for students to see how the knowledge they learn in class can be applied in their daily lives (Al Husaeni et al., 2022). One effective way to achieve this is by linking basic chemistry concepts, such as acid-base reactions, chemical changes in food processing, or the processing of local materials, with traditional practices in the community, for example, many communities in Indonesia have long recognized and utilized natural substances, such as medicinal plants, for healing purposes. Although the use of these medicinal plants is often not based on formal scientific knowledge, they contain valuable local wisdom that can be explained through chemical principles (Prabowo et al., 2024).

One particularly interesting example is the use of medicinal plants in traditional medicine. Many plants contain chemical compounds that are beneficial to health, such as alkaloids, flavonoids, or other compounds. Although indigenous communities may not be fully aware of the chemical structure of these compounds, they have long used these plants based on generational experience. Chemical concepts such as chemical reactions or the process of compound extraction by linking this knowledge, students can gain a deeper understanding of how chemical principles are present in their everyday lives, particularly in the context of local culture (Santiani et al., 2024). The application of ethnoscience in chemistry education also opens up opportunities for students to better appreciate the local wisdom around them (Iriani et al., 2024). When they learn that many traditional practices they consider everyday habits actually have a strong scientific basis, they will have a greater appreciation for the knowledge passed down by their ancestors. This not only makes chemistry learning more interesting but also enhances their sense of connection to local culture, which is often seen as separate from the scientific world. Chemistry education becomes more relevant by linking scientific theories with the realities they face in everyday life (Fahrudin et al., 2023).

This approach can also help break the common perception among students that science, particularly chemistry, is a subject detached from their lives (Yasir et al., 2023). Many students feel that chemistry is only about theories and formulas that are hard to understand, without realizing that chemistry plays an important role in many aspects of their lives. Students can more easily relate chemistry lessons to their real-life experiences by seeing how chemical reactions and other scientific processes are used in food processing, traditional medicine, or the use of natural materials (Lestari et al., 2024). This will make them more interested in studying chemistry, as they can directly see its relevance in their daily lives.

The integration of ethnoscience into chemistry education not only makes learning more engaging and relevant for students but also creates an opportunity to build a stronger connection between science and local culture (Amida et al., 2024). Students not only learn about chemical concepts but also learn to appreciate and preserve the local wisdom around them. This is an important step toward more inclusive education that values and integrates scientific knowledge with the cultural richness present in every region. The application of ethnoscience in chemistry education can also enhance students' interest in science as a whole (Sunarti et al., 2024). Many students find it difficult or unappealing to study chemistry because they do not see its relevance to their lives. The connection between chemical theory and local traditions, such as fermentation in tempeh production or the processing of natural materials in the textile industry, allows students to see how science plays a role in their everyday activities (Jannah et al., 2023). They can learn about the chemical properties of natural dyes used in batik or the raw ingredients in the food they consume. Introducing chemistry concepts within the context of their culture, students not only understand scientific theories but also realize

that science is a tool they can use to understand and improve their lives. This, in turn, can increase their motivation to delve deeper into chemistry and other scientific subjects.

The vast potential of integrating ethnoscience into chemistry education, its implementation faces various challenges (Jumini et al., 2024). One of the main obstacles is the lack of teacher training to understand and integrate ethnoscience into their teaching practices. Many teachers, particularly those in remote areas, may not have a sufficient understanding of ethnoscience concepts or may not know how to connect local knowledge with the chemistry content taught in schools. More professional development and resources are needed to support ethnoscience-based teaching. Additionally, the national education curriculum, which often focuses on standardized content and assessments, may limit the flexibility needed to incorporate local cultural knowledge effectively. While many teachers wish to integrate ethnoscience into their lessons, they are often faced with challenges in finding appropriate teaching materials or effective ways to connect local knowledge with formal scientific concepts.

Research on ethnoscience in chemistry education in Indonesia remains limited. Most existing research focuses on conventional chemistry approaches that are disconnected from cultural and local contexts. Therefore, more studies are needed to explore how ethnoscience can be effectively applied in the chemistry curriculum and its impact on students' learning outcomes. Research can help identify effective teaching methods as well as the challenges faced by educators in implementing this approach in the classroom. The bibliometric study conducted in this article aims to fill this gap by analyzing the existing literature on ethnoscience in chemistry education in Indonesia. Through this analysis, it is hoped that current research trends can be identified, providing insights into how ethnoscience has been applied in chemistry teaching and its effect on enhancing scientific literacy and appreciation for local cultures.

This bibliometric analysis aims to provide deeper insights into the development and current trends in ethnoscience research, particularly in the context of chemistry education. This study will identify areas that are still underexplored and require further attention in terms of research and development by analyzing the existing literature. This is crucial to ensure that research on ethnoscience can evolve more comprehensively and make a significant contribution to the development of chemistry education that is more relevant to local conditions. Furthermore, by identifying gaps in the existing literature, this study hopes to encourage more research related to the integration of local knowledge, particularly those related to local culture and traditions, into the chemistry curriculum. Local knowledge, which is often part of a rich cultural heritage, can be a valuable learning resource if integrated appropriately. Therefore, one of the main objectives of this research is to stimulate discussions and further research on how ethnoscience can be used as a bridge to connect scientific knowledge with local wisdom within the context of chemistry education.

The findings of this analysis are expected to provide useful recommendations for policymakers in formulating educational policies that support the integration of local knowledge into the chemistry curriculum. This will help create a more inclusive education system that not only focuses on global scientific understanding but also values and preserves local knowledge found across various regions of Indonesia. In this way, chemistry education will not only serve to teach scientific concepts but also act as a means to celebrate the cultural diversity present in Indonesia.

This more inclusive approach, it is hoped that a generation will emerge that is not only skilled in science and technology but also holds a deep respect and love for their culture and traditions. This generation will be individuals who can apply scientific knowledge in their daily lives while preserving and maintaining their local cultural heritage. Through the integration of ethnoscience in chemistry education, we can create a balance between mastering modern scientific knowledge and preserving cultural heritage, which is vital for the sustainability of Indonesian society.

The findings of this study are expected to provide valuable guidance for educators, policymakers, and curriculum developers in Indonesia. The current state of ethnoscience in chemistry education, stakeholders can develop strategies to enhance its implementation and effectiveness. The study may reveal the need for targeted professional development programs for teachers, the creation of culturally relevant teaching materials, or the development of policies that encourage the integration of local knowledge into the formal curriculum. The goal of this research is to contribute to the creation of an education system that respects and celebrates cultural diversity while also equipping students with the scientific knowledge and skills needed to thrive in the modern world. Through the use of ethnoscience in chemistry education, Indonesia can foster a generation of students who not only excel in science but also appreciate the importance of their cultural heritage in shaping scientific knowledge and practices.

Method

This research is a quantitative descriptive research with a bibliometric approach. The bibliometric method is an analytical technique used to evaluate and analyse scientific literature in a particular field of research. Bibliometrics allows researchers to identify trends, patterns, and developments in a particular field of study, as well as understand their impact on future research. Bibliometric analysis is conducted by collecting and analysing data from scientific publications, including journal articles, conferences, and research reports. The data analysed may include the number of publications, citations, authors, affiliations, and keywords used in the research (Rizki, 2022). Using software such as VOSviewer and Harzing's Publish or Perish, researchers can visualise data and identify relationships between different elements in the literature under study (Romli et al., 2024). Bibliometric analysis is a method used to evaluate and analyse scientific literature in a particular field of research. This analysis process can be divided into several systematic stages, Figure 1.

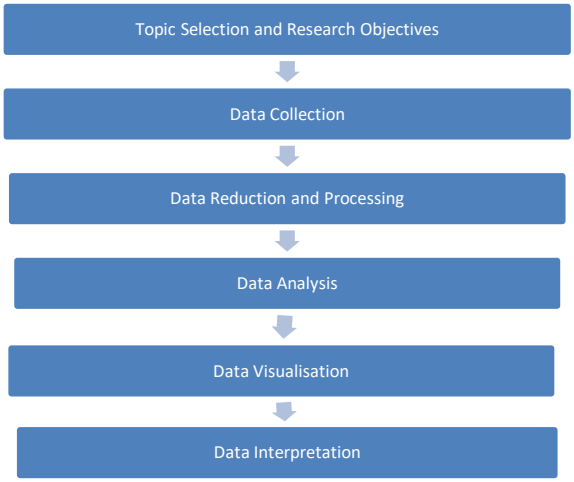

Figure 1. *Research stages*

Bibliometric analysis is a method used to evaluate and analyze scientific literature in a specific field of research. The analysis process begins with selecting the topic and research objectives. Researchers formulate clear research questions, such as what trends they want to identify or which aspects of the literature they will explore, for example, in the context of this study, the formulated research problem is "What is the development of ethnoscience research trends in chemistry education in Indonesia based on bibliometric analysis?" The main objective of this study is to explore the trends and developments in ethnoscience-related research in chemistry education in Indonesia.

After determining the topic and objectives, the next step is data collection from relevant sources. This process involves searching various academic databases, such as Google Scholar, to identify publications that match the predetermined criteria. The collected data may include articles, citations, authors, affiliations, and keywords related to the research topic. Next, the collected data needs to be processed to ensure accuracy and consistency. This stage includes data cleaning, such as removing duplicates, correcting typos, and categorizing the data into relevant groups, ensuring that the analysis is valid and reliable.

The next step is to conduct an analysis using statistical and mathematical techniques. Researchers use software such as VOSviewer to analyze the data and identify emerging patterns or trends. The results of the analysis are then visualized to facilitate understanding and interpretation. Visualizations, such as network maps showing relationships between publications, authors, and keywords, help identify patterns and trends in the literature studied. Finally, after the results of the analysis are visualized, researchers interpret the findings, discuss how these results relate to the existing literature, and explore the implications of the analysis for the research field in question. Bibliometric analysis not only provides an overview of current research trends but also opens up opportunities for further development in the field.

Results & Discussion

Publication trend of "ethnoscience of chemistry" articles from 2014-2024

This bibliographic data search was limited in three aspects, namely: (1) the selected scientific papers are only articles from 2014-2024; (2) in the Publish or Perish (PoP) software for title search the word entered is 'chemical ethnoscience'; (3) the scientific articles taken are articles sourced from Google Scholar. The search on the PoP application was conducted on Thursday, 10 October 2024 and obtained data in the form of 88 scientific articles related to chemical ethnoscience. Figure 2 below is the process of presenting data search through PoP software.

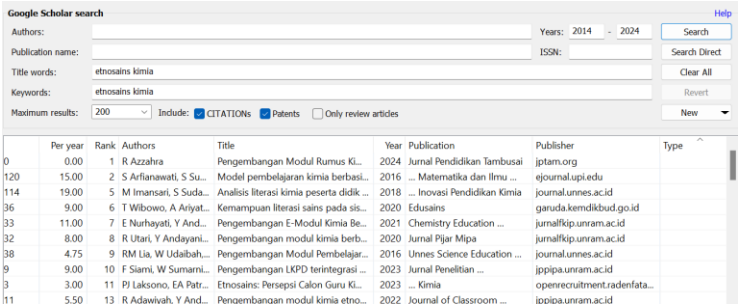

Figure 2. *Data search process through PoP software Data search process through publish or perish (POP) software*

The next stage after the data is obtained is to check or recheck and manually fill in the incomplete data on bibliographic attributes with the help of Mendeley desktop. Checking the completeness of attributes includes author's name, article title, keywords, abstract, year, volume, DOI or issue number, page, and journal publisher. The bibliographic keywords or author keywords section was filled in and completed manually with the help of Mendeley desktop manager so that it could be mapped and analysed using VOSviewer. From the checking results, 26 data were reduced so that the remaining 60 data were caused by data that was difficult to access so that the author could not complete the attributes. In addition, it was caused by duplication of data so that the author only sorted out one data for the same data but multiple. The stage after checking, filling in bibliographic attributes and data reduction is complete, then proceed with saving the file in.RIS format, then bibliometric analysis is carried out with Vos Viewer software. The bibliometric analysis carried out in this study is based on publication trends or the development of publications of scientific articles indexed by Google Scholar based on keywords.

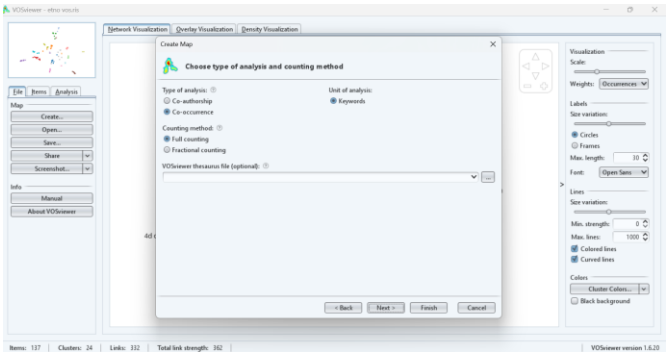

Figure 3. *The bibliometric analysis process using Vos Viewer software*

The results of the analysis of publication trends or the development of publications related to chemical ethnoscience from 2014-2024 can be seen in Table 1.

Table 1. *Number of references based on document type*

Type of Reference	Percentage (%)
Books	2
Thesis	40
Conference paper	5
Journal	53
Total	100

The percentage of google scholar indexed articles that discuss chemical ethnoscience, and are published in the form of books is 2%; Thesis 40%, conference papers 5% and Journals as much as 21.5%. The pie chart in Figure 4 below is a visualisation of the Percentage of Number of references by document type.

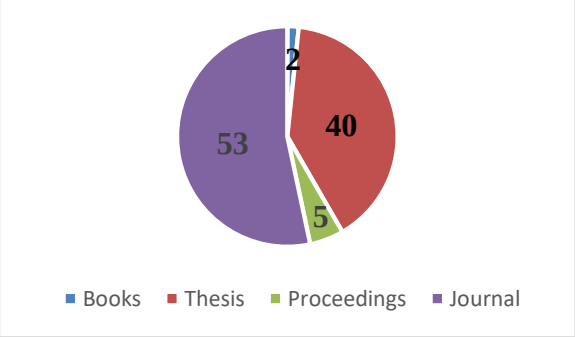

Figure 4. *Percentage of number of references by document type*

Table 2. below is the trend of the percentage of publications of chemical ethnoscience articles indexed by Google Scholar from 2014-2024. The highest number of article publications was in 2021 with 12 articles. The lowest data is in 2017 with 1 article.

Table 2. *Distribution of articles based on publication year*

Year of Publication	Number of Articles
2024	10
2023	11
2022	9
2021	12
2020	7
2019	2
2018	4
2017	1
2016	4
Total	60

The graph in Figure 5 below is a visualisation of the development of the publication trend of “ethnoscience of chemistry” articles from 2014-2024.

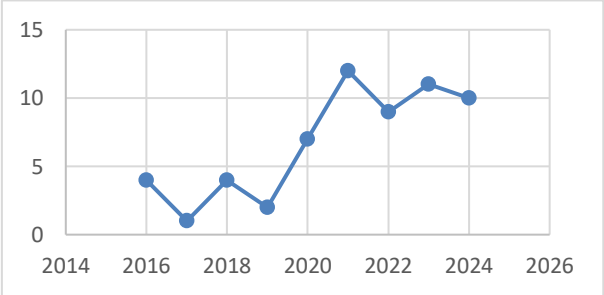

Figure 5. *Trend of “ethnoscience of chemistry” articles from 2014-2024*

Visualisation of Bibliometric Mapping on Inter-Key Networks

Network visualization is a powerful tool in bibliometric analysis that allows researchers to visually represent relationships and interactions among various entities, such as keywords. There are 137 keywords that are connected to each other as shown in Table 3.

Table 3. *Vos viewer’s output*

Output Category	Amount
Items	137
Clusters	24
Links	332
Total Link Strength	362

Most Frequently Discussed Topics

Based on the search terms used with the term 'chemical ethnoscience,' it seems reasonable that the keyword with the highest link frequency is 'chemical education.' According to VOSviewer, the following terms have strong links, as shown in Table 4. Link strength in VOSviewer is a metric that describes the strength of the relationship between two nodes in a bibliometric network. These nodes can be authors, institutions, or keywords involved in scientific publications. Link strength has several important aspects. First, link strength indicates how often two nodes are related to each other. For example, if two authors frequently collaborate on publications, the link strength between them will be high, providing an indication of the strength of collaboration among authors or institutions in a particular research field (Ariani et al., 2024). Link strength also reflects the frequency of co-occurrence

between two elements, such as keywords in publications. The more often two keywords co-occur in the same article, the higher the link strength, helping to identify interrelated themes in the literature (Latip et al., 2024). Link strength can also be used as a quantitative index to describe the relevance between two nodes. Nodes with high link strength indicate that they have a significant relationship in the research context, while nodes with low link strength may be less relevant to each other (Suprapto et al., 2024). Link strength helps in understanding the structure and dynamics of the network. Researchers can identify key nodes that serve as collaboration hubs or themes in the research network, which can help in formulating strategies for further research or collaboration (Syahana et al., 2023). Finally, VOSviewer allows the visualization of link strength in the form of a network map, where the thickness of the lines connecting nodes reflects the strength of the relationship. This visualization makes it easier for researchers to interpret data and understand complex relationships in the scientific literature.

Table 4. *Top 7 keywords from ethnoscience of chemistry related publications*

Keyword	Occurrences	Total Link Strength
ethnoscience	40	116
chemical literacy	9	27
chemistry learning	6	22
chemistry	4	15
problem based learning	4	14
local wisdom	3	13
STEM	3	10

As a depiction of research and activities, the visualization map in Table 4 illustrates the connections or interactions between keywords. The following connections can be inferred from the keywords with the strongest links: 'The integration of ethnoscience and local wisdom in Science, Technology, Engineering, and Mathematics (STEM)-based chemistry learning has been proven effective in improving students' chemical literacy, especially through a problem-based learning (PBL) approach. Ethnoscience provides a relevant cultural context in chemistry learning, which allows students to relate scientific concepts to their daily lives. Previous research shows that the combination of PBL and STEM based on local wisdom can facilitate students' deeper understanding, as well as strengthen science literacy in their own cultural context (Sarini et al., 2024).

That density visualization uses color density to illustrate the relationship between each topic; the more yellow the color, the larger the circle's diameter, or vice versa, the more frequently that issue is the subject of research (Prayogi et al., 2024). The research's common and infrequent sections can be identified using density visualization as seen in Figure 6, the keywords:

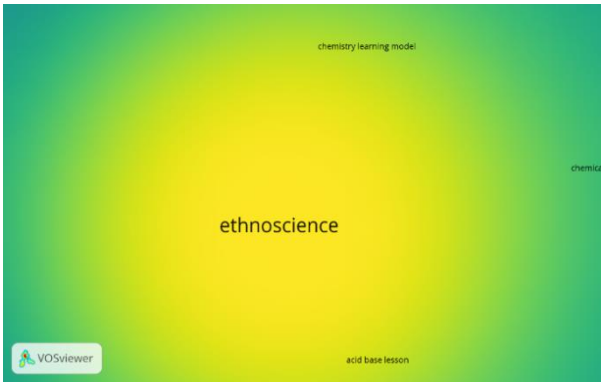

Figure 6. *Results of density visusalization*

Recommended Research Opportunities on Chemistry Education Topics

An overlay visualization or keyword mapping from VOSviewer, colored by year of publication, is shown in Figure 7. The colors vary from purple (the oldest year) to green to yellow (the most current publishing year). The variable or keyword is relatively new or has been addressed recently if the circle's color is lighter. Researchers can view the map on the overlay visualisation with tiny, light-coloured circles if they are interested in knowing the factors or phrases that are still infrequently mentioned in relation to chemical ethnoscience.

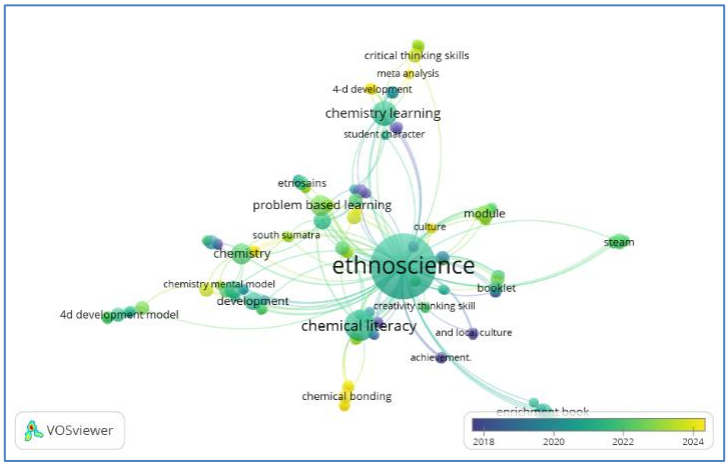

Figure 7. Results of overlay visusalization

Bright yellow keywords with small node sizes indicate that keywords that are trending in 2024 and rarely discussed are podcast-based ethnoscience, common knowledge construction, chemical bonding, CKCM learning model, Flipped Classroom, knowledge, references, implementation, culture, character values, ethnoscience-based chemistry, need analysis, independent curriculum, 4-D development.

Conclusion

The results of keyword mapping analysis in google Scholar indexed scientific articles from 2014-2024, it is known that in the last 10 years, in Google Scholar indexed journals there are 137 different keywords and 362 total link strength. Over the last ten years there has been an increase in the number of publications addressing chemical ethnoscience. The keywords with the strongest linkages based on VOSviewer include: ethnoscience (40), chemical literacy (9), chemistry learning (6), chemistry (4), problem based learning (4), local wisdom (3), STEM (3). This shows that over the past ten years, the keyword has been strongly associated with chemical ethnoscience. Recent keywords in chemistry education that are still rarely discussed in scientific articles are podcast-based ethnoscience, common knowledge construction, chemical bonding, CKCM learning model, Flipped Classroom, knowledge, references, implementation, culture, character values, ethnoscience-based chemistry, need analysis, independent curriculum, 4-D development. Bibliometric analysis, this research is expected to provide a comprehensive mapping of the development of research trends, literacy levels, and the impact of cultural relevance in ethnoscience-based chemistry learning.

Acknowledgment

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References

Al Husaeni, D. N., & Al Husaeni, D. F. (2022). How to calculate bibliometric using vosviewer with publish or perish (using scopus data): Science education keywords. *Indonesian Journal of Educational Research and Technology*, *2*(3), 247-274. https://doi.org/10.17509/ijert.v4i1.57213

Amida, N., Nahadi, N., Supriyanti, F. M. T., Liliasari, L., Maulana, D., Ekaputri, R. Z., & Utami, I. S. (2024). Phylogenetic analysis of Bengkulu citrus based on DNA sequencing enhanced chemistry students' system thinking skills: Literature review with bibliometrics and experiments. *Indonesian Journal of Science and Technology*, *9*(2), 337-354. https://doi.org/10.17509/ijost.v9i2.67813

Ariani, T., & Hariyadi, B. (2024). Integration of Ethnoscience Approach in Physics Learning Based on Laboratory Practice: A Systematic Literature Review. *Jurnal Penelitian Pembelajaran Fisika*, *15*(3), 252-262. https://doi.org/10.26877/jp2f.v15i3.18765

Fahrudin, D., & Saputro, S. (2023). Ethnoscience in science learning research trend: a systematic literature review from 2013-2022. *Jurnal Penelitian Pendidikan IPA*, *9*(8), 458-467. https://doi.org/10.29303/jppipa.v9i8.3813

Hasanah, I., Anwar, S., & Musthapa, I. (2024). A Bibliometric Analysis Of Research Trends On Contextual Learning In Science Education. *Paedagoria: Jurnal Kajian, Penelitian dan Pengembangan Kependidikan*, *15*(3), 329-338. https://doi.org/10.31764/paedagoria.v15i3.22999

Iriani, R., Risna, R., Bakti, I., Saadi, P., Abrori, F. M., & Leny, L. (2024). Development of E-Modules To Improve Students' Problem Solving Abilities on Ethnoscience Integrated Colloidal Material with the Problem Based Learning Model. *Jurnal Pendidikan Sains Indonesia*, *12*(3), 509-529. https://doi.org/10.24815/jpsi.v12i3.37850

Jannah, M., Noris, M., & Indriyani, I. (2023). Trends and Issues of Ethnoscience Research from 2008 to 2023: A Bibliometric Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 621-633. https://doi.org/10.29303/jppipa.v9i9.4771

Jumini, S., Parmin, P., Samputri, A. V., & Hamzah, H. (2024). Analysis of Students' Problem-Solving Abilities in Learning with an Ethnoscience-Based Socio-Scientific Issues (SSI) Approach. *Jurnal Pendidikan Fisika dan Keilmuan (JPFK)*, *10*(1), 36-46. https://doi.org/10.25273/jpfk.v10i1.20235

Latip, A., Abdullah, N., Kadarohman, A., Hernani, H., & Musa'adah, S. (2024). Bibliometric Analysis of Entrepreneurial Thinking Research Trends in Science Education From 2014 to 2023. *Jurnal Inovasi Pendidikan IPA*, *10*(1). http://dx.doi.org/10.21831/jipi.v10i1.71495

Lestari, N., & Suyanto, S. (2024). A systematic literature review about local wisdom and sustainability: Contribution and recommendation to science education. *Eurasia Journal of Mathematics, Science and Technology Education*, *20*(2), em2394. https://doi.org/10.29333/ejmste/14152

Prabowo, D. W., Bramastia, B., Sarwanto, S., & Cohen, J. (2024). Connecting Indigenous Knowledge of Keris with Science Through an Ethnoscience E-module: A Case Study in Surakarta, Indonesia. *Jurnal Pendidikan Sains Indonesia*, *12*(3), 693-704. https://doi.org/10.24815/jpsi.v12i3.38652

Prayogi, S., & Verawati, N. N. S. P. (2024). Physics Learning Technology for Sustainable Development Goals (SDGs): A Literature Study. *International Journal of Ethnoscience and Technology in Education*, *1*(2), 155-191. https://doi.org/10.33394/ijete.v1i2.12316

Ramadhani, A. W., Maryani, I., & Vehachart, R. (2022). Literature Study on Self-Regulated Learning in Science Learning of Elementary School Students. *International Journal of Learning Reformation in Elementary Education*, *1*(02), 80-100. https://doi.org/10.56741/ijlree.v1i02.71

Rizki, I. A. (2022). Profile of Top 100 Cited in STEM Education for the Last Twenty Years. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *12*(1), 69-84. https://doi.org/10.26740/jpps.v12n1.p69-84

Romli, S., Suhandi, A., Muslim, M., & Kaniawati, I. (2024). Research trends in the development of learning models oriented to increasing scientific literacy: A systematic literature review. *Indonesian Journal of Science and Mathematics Education*, *7*(1), 66-79. https://dx.doi.org/10.24042/ijsme.v7i1.20517

Santiani, S., Reffiane, F., & Winarto, W. (2024). Science interdisciplinary learning approach: a study interdisciplinary thinking skills and literacy environment. *Journal of Education and Learning (EduLearn)*, *18*(4), 1454-1459. https://doi.org/10.11591/edulearn.v18i4.21416

Sari, D. R., Syahana, S., Asmiati, L., Pujiana, E., & Suyanta, S. (2023). Exploring the Revolutionary Potential of Contextual Approach in Increasing Students' Interest in Learning Chemistry. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 285-293. https://doi.org/10.29303/jppipa.v9iSpecialIssue.4710

Sarini, P., Widodo, W., Sutoyo, S., & Suardana, I. N. (2024). The Hypothetic OMIRE Learning Model to Improve The Scientific Literacy of Prospective Science Teachers. *International Journal of Current Educational Research*, *3*(1), 66-80. https://doi.org/10.53621/ijocer.v3i1.328

Sunarti, T., Suprapto, N., Satriawan, M., & Hidaayatullaah, H. N. (2024). Research Trends on Ethnoscience in Physics Learning (EPL): A Bibliometric Network Analysis. *Studies in Learning and Teaching*, *5*(1), 268-281. https://doi.org/10.46627/silet.v5i1.372

Suprapto, N., Shofiyah, N., & Cheng, T. H. (2024). How does ethnoscience-students' worksheet (ESW) influence in science learning?. *Journal of Education and Learning (EduLearn)*, *18*(2), 403-412. https://doi.org/10.11591/edulearn.v18i2.21178

Syahana, S., Suyanta, S., Sari, D. R., Asmiati, L., & Pujiana, E. (2023). Design Thinking as an Effort to Enhance Critical Thinking and Science Literacy in Chemistry Learning: A Systematic Review. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 275-284. https://doi.org/10.29303/jppipa.v9iSpecialIssue.4709

Wulandari, D. U., Mariana, N., Wiryanto, W., & Amien, M. S. (2024). Integration of ethnomathematics teaching materials in mathematics learning in elementary school. *IJORER: International Journal of Recent Educational Research*, *5*(1), 204-218. https://doi.org/10.46245/ijorer.v5i1.542

Yasir, M., & Dwiyanti, L. (2023). Analysis of critical thinking levels of prospective science teachers in ethnoscience learning based on reflective and impulsive cognitive styles. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, *11*(4), 808-825. https://doi.org/10.24815/jpsi.v11i4.31799