



Bibliometric Methods: Analysis of the Development Potential of Ethnoscience-based Science Literacy Modules in Chemistry Learning

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ABSTRACT

There still needs to be more research on the potential analysis of the development of ethnoscience-based science literacy modules in chemistry learning using bibliometric tools. Ethnoscience-based science literacy modules still need to be found and used in chemistry learning. This research aims to analyze the novelty and effectiveness of ethnoscience-based science literacy modules in chemistry learning. The subject of this research is a science literacy module based on ethnoscience in chemistry learning. In this study, the researchers also analyzed articles that have been filtered based on topics based on local wisdom-based science literacy modules. The analysis contains several components: title, year, doi, author, method, outcome, and conclusion. The research uses an approach that uses the method of Systematic Literature Network Analysis (SLNA) assisted by bibliometric tools as the medium used in analyzing the article. The data obtained was many articles from the SCOPUS database, which had previously defined some criteria for capturing it. The criteria are related to the year of publication, keyword, and language selection. The application used in this study is the VOS Viewers application. The results show that research related to ethnoscience-based science literacy modules in chemistry learning is still highly feasible, given the numerous constraints in some schools. However, it should be noted that ethnoscience-based science literacy cannot replace scientific literacy globally because of the global literacy capabilities needed in everyday life.

Keywords: Modules, Science Literacy, Chemistry Learning, Ethnoscience, Bibliometrics

BACKGROUND

The word ethnoscience comes from *ethnos* (Greek), meaning nation, and *scientia* (Latin), meaning knowledge (Dereck Moriolkosu et al., 2020). Ethnoscience is a multidisciplinary approach that combines science and anthropology to understand how indigenous peoples use natural materials in their cultural practices. The knowledge of ethnosciences has long been an invaluable asset for indigenous communities, such as used for traditional medicine, religious ceremonies, and other everyday needs, as well as reflecting the profound relationship between human beings and their environment (Quave & Pieroni, 2015).

Ethnoscience studies conducted in northern Peru provide an overview of the rich cultural heritage and layered traditional knowledge related to the use of medicinal plants for thousands of years that can open the door to discoveries of new potential in natural medicine (Bussmann & Sharon, 2006). Therefore, ethnoscience is the knowledge owned by a cultural community, emphasizing the original and typical knowledge of the cultural community (Suprpto et al., 2021). Besides, ethnoscience is also frequently connected to the world of education, especially integration in learning (Dewi et al., 2019; Jannah et al., 2022; Nurcahyani et al., 2021). By incorporating ethnoscience elements into education, educators can

create an inclusive learning environment that stimulates students' interest in their cultural heritage while building appreciation for the often neglected local wisdom.

IPA integrated learning model ethnoscience is a combination of culture and science that can be applied to the learning process and effectively applied in IPA learning to improve learning outcomes and research creative thinking ability (Damayanti et al., 2017). Ethnoscience is also applied to learning chemistry to improve students' critical thinking ability (Subekti & Fibonacci, 2014). In addition, using culture-based education, students can conduct direct observations to identify scientific problems, explain scientific phenomena, and draw conclusions about natural conditions and changes through human activity. (Nurcahyani et al., 2021).

Science literacy is the knowledge and understanding of scientific concepts as well as the ability to identify a question and draw some conclusions based on evidence that has been identified. (Rohmawati et al., 2018). The PISA evaluation results since 2000 showed that average Indonesian students score well below international standards. For example, in 2012, the average Indonesian student score was 382. Indonesia ranks 64 out of 65 participating countries. (Nurcahyani et al., 2021).

Some studies show that ethnoscience-based education can improve students' science literacy (Dewi et al., 2019, 2021; Sari et al., 2023). Ethnoscience-based learning is excellent and can improve students' perspective in evaluating the local culture in their surroundings. (Parmin & Fibriana, 2019). By integrating cultural knowledge of various ethnic groups into the science curriculum, students gain a deeper understanding of natural phenomena and develop critical skills in analyzing and comparing scientific and local approaches to scientific problems. It stimulates students' interests, associates learning with personal experiences, and creates an inclusive learning environment. Often, knowledge transfer during the learning

process is not maximum due to the abundance of materials to master and time constraints in a semester. Students must also learn independently, especially on concepts that do not require complicated calculations. Students are expected to be able to study anytime and anywhere. The use of modules in learning has a positive impact in that students can complete one or more learning competencies in an unlimited amount of time (Ulfa & Sutiani, 2021). The modules can help to cope with variations in each student's learning speed, enable self-learning, and facilitate deeper understanding through repetition and targeted practice.

In the growing digital information age, bibliometric analysis has become an essential tool for researchers, publishers, and institutions to measure impact, productivity, and trends in scientific literature. (Bussmann & Sharon, 2006). Bibliometrics helps identify research trends, cross-disciplinary collaboration, and paradigm changes in a field of science by analyzing patterns of citation, co-citation, and network collaboration of researchers. Bibliometrics also provides in-depth insight into the historical development of a field of research, identifying classical works that continue to influence the next generation of researchers. (Yang et al., 2017).

Bibliometrics can help educational and research institutions in strategic decision-making related to resource allocation, recruitment of researchers, and identifying research trends to pay attention to. (Waltman & van Eck, 2013). With increasingly advanced technology and analytical tools, bibliometric studies have become more effective in digging deep insights into the structure of science and the development of scientific literature. Bibliometric indicators, including research areas, document sources, publication outputs, document sources, language sources, country and institutional distribution, top authors, number of quotations, and authors' keywords, have been frequently used to analyze trends (Chen & Ho, 2015).

RESEARCH METHOD

This research gathers information data through various articles from existing research results to obtain new theories about the problem being analyzed, i.e., library research. (Colicchia et al., 2019). Research into the library requires accurate data from a variety of reliable sources. (Khitous et al., 2020). In library research, a qualitative approach is used because it requires researchers to identify the subject they want to study. (Fadli, 2021). It is therefore a must to study the current developing phenomena so that research can produce authentic data.

Qualitative research has various approaches, so the results of a qualitative approach can be descriptive data in written format. (Yusanto, 2020). In addition, the researchers described the categorization, relationship, and mapping of research development themes. Furthermore, the researchers also showed the most dominant word/topic (Edwards-Jones, 2014).

This study aims to find out the results of the analysis of mechanochemistry-based teaching materials in chemistry learning using bibliometric tools (Application of the SLNA Method). (Bibliometrik dan Vosviewer).

This research uses VOSviewer to visualize and evaluate all information about the publication that has been collected, such as the author's name, year of publication, and keyword. VOSviewer is software for network visualizations of terms commonly used in a particular field (Oyewola & Dada, 2022).

The research instrument for data collection is the search engine application of the journal in Scopus. The selection of a database is carried out to obtain articles that have tested their quality so that the validity of the data used can be held accountable. The research procedures include: 1. searching for journal articles on Scopus (<https://www.scopus.com>). 2. Data processing using the Open fineling application to filter data based on CSV data

from SCOPUS. 3. data processing using the Vosviewer application, processing the data through the Vos Viewer application to obtain a visualization of existing keywords. 4. processing data via the Tableau application aimed at alternative visualizations of the information obtained. 5. processing Data through the Bibliometric application designed to visualize the data. 6. Selection of journal articles to be analyzed (9 pieces) based on the application process data.

Once the data is obtained, the data in article form is transferred or inserted into the specified application, and then the results in image form are analyzed descriptively. In general, the criteria used to capture articles for analysis are shown in Table 1.

Table 1. Reference criteria for data collecting

No	Criteria	Condition
1	Language	English
2	Publication year	2014-2023
3	Source	Scopus
4	Keywords	"Ethnochemistry"

RESULT AND DISCUSSION

Bibliometric analysis is part of reference management analysis to see how a research scope develops (Dwikoranto & Widiasih, 2023). Apart from that, the distribution of research topics can be known through this analysis as a reference in determining research topics.

One of the popular methods is Co-Word Analysis, which, in principle, looks at the relationship between two or more experts in a research field based on the keywords used. The more often a keyword appears, the more closely related it is. In bibliometric analysis, several components can be described. Based on this data, the analysis can be divided into several parts, namely Keyword Analysis, Year of Publication Analysis, and Quarterly Theme Analysis. The most relevant journal and author information is also presented as a complement.

Keyword Analysis

Year	Title	Result
	school location, and parental educational status on learners' attitude towards science	urban schools, and students from low-educated parents perform better than those from highly-educated parents. Ethnoscience instruction promotes students' attitudes toward science. Therefore, its use in educational teaching, especially among traditional science students, should be explored (Fasasi, 2017).
2018	The role of women in food security (case study of rice farmers in Blang Pala village, Banda Baro District, Aceh Utara regency)	The study was carried out using in-depth interviews with an ethnoscience approach. The results show that women significantly contribute to their family's food security and food provision efforts at the household level (Shamadiyah & Nasution, 2018).
2019	An ethnoscience study in chemistry learning to develop scientific literacy	The research results show that there is a need for (1) a curriculum that emphasizes the development of chemical literacy for students; 2) chemistry lecturers' skills in designing learning programs by utilizing local potential in their respective regions; (3) initial discussion of basic chemical concept material coverage; and (4) emphasis not only on chemical content but also on context, process, and attitudes (Dewi et al., 2019).
2020	A Multi-Perspective Reflection on How Indigenous Knowledge and Related Ideas Can Improve Science Education for Sustainability	This research suggests a Didactic model and framework for outlining and designing science education for sustainability that considers indigenous knowledge and non-Western ideas and related alternatives (Zidny et al., 2020).
-	Effect of Contextual Collaborative Learning Based Ethnoscience to Increase Student's Scientific Literacy Ability	The research results show that students' overall achievement of science content, processes, and attitudes has increased in the moderate category. This means the influence of ethnoscience-based contextual, collaborative learning on the scientific literacy capacity of students' content, processes, and attitudes (Dewi et al., 2021).
2022	Developing a Problem-Solving Essay Test Instrument (PSETI) in the Instruction of Basic Science Concepts in Ethnoscience Context	The results of the development of the PSETI instrument show that 19 items meet the validity and reliability of the 21 items/composed. PSETI is an essay test with scoring that uses a partial credit model based on three categories of polytomous data. The instrument's reliability is 0.77, and it is concluded that it is suitable for measuring the problem-solving abilities of prospective teachers in science learning in an ethnoscience context (Winarto et al., 2022).
2023	Implementation the Ethnoscience-Based Smart Module To Improve Students' Patriotism	Based on the research results, it can be concluded that applying ethnoscience-based intelligence modules can increase students' spirit of patriotism in elementary schools (Ardianti et al., 2023).

Based on the results of research on ethnoscience from 2014 - 2023, the development of ethnoscience research is not only from a cultural perspective but is used as a new approach to improving learning. Ethnoscience (especially ethnobiology and

ethnoecology) in building a new approach to nature conservation in the Tropics called ethnoconservation (Diegues, 2014). Ethnoscience provides information about the methods used by people from various parts of the world to benefit from nature

curriculum that emphasizes the development of chemical literacy for students; 2) chemistry lecturers' skills in designing learning programs by utilizing local potential in their respective regions; (3) initial discussion of basic chemical concept material coverage; and (4) emphasis not only on chemical content but also on context, process, and attitude. Thus, it can be concluded that the development of scientific literacy needs to be carried out by focusing on preparing scientific literacy for the next generation with curriculum content that pays attention to culture and daily life so that it is more contextual (Dewi et al., 2019).

Views on curriculum policy, science ethnoscience, and ethnoscience are developed based on theoretical and empirical literature on these issues. The discussion is divided into five parts: curriculum policy and policy borrowing, Indonesian ethnoscience philosophy, culture-based learning, ethnoscience and ethnoscience of science, and policy borrowing versus local wisdom. The significance of the results provides insight into the government, academics, policymakers, and the education community (Suprpto et al., 2021). The research results show that students' overall achievement of science content, processes, and attitudes has increased in the moderate category. This is due to the influence of ethnoscience-based contextual, collaborative learning on the scientific literacy capacity of students' content, processes, and attitudes (Dewi et al., 2021).

Bibliometric methods with various modifications have been carried out. Specifically for the ethnoscience theme, there are articles discussing this, one of which is indexed by Scopus. *Ethnoscience Research Trends Through Bibliometric Analysis (2011-2020) and Indonesia's Contributions* (Suprpto et al., 2021).

CONCLUSION

This article is based on bibliometric data from the VOS viewer application.

After interpreting the output from the application image (data), research themes related to ethnoscience can still be carried out with various innovations. The development of ethnoscience, identifying the primary sources where research journals are published, the countries and institutions where research is conducted, the top individual active researchers, the most cited authors in the field, and the main topics of interest in ethnoscience are the focus of research.

The author points out several essential points related to ethnoscience research from 2014 to 2023. The number of ethnoscience documents increased yearly, dominated by journal articles. Until 2023, there were 51 Scopus-indexed journal documents. Indonesia and the United States contributed the most documents on ethnoscience. Then, visualization of ethnoscience research trends produces three significant clusters and one minor cluster:

1. Ethnoscience in the world of education is related to the realm of academics, anthropology, history, and other social sciences
2. Ethnoscience about approaches in the process of collecting research data
3. Ethnoscience in the world of health is related to psychology and humans

The findings can help relevant researchers recognize trends in ethnoscience research globally and recommend directions for further research. The limitation of this article is that the scope of the analysis could be more specific in the field of education. This is because the search engine, in this case, the Scopus database, does not differentiate ethnoscience in education from ethnoscience in other fields. Future researchers should use more specific keywords to obtain an appropriate article database. In this work, the author uses bibliometric methods to study the state of research in certain areas of knowledge. The results show that research related to ethnoscience-based scientific literacy modules in chemistry learning is still very possible, considering the many limitations

in several schools. However, it should be noted that ethnoscience-based scientific literacy cannot replace global scientific literacy because global literacy skills are needed in everyday life.

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