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Ethnoscience in Indonesia and It's Implication to Environmental Education: A Systematic Literature Review

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Abstract: Cultural diversity and knowledge are valuable resources for expanding the concept of ethnoscience. Indonesia, with thousands of islands, is the wisdom of local communities in agriculture, the environment, traditional medicine, food, clothing, entertainment, human contact with nature, and other fields. This publication includes descriptive data from ethnoscience research in science learning in Indonesia and its significance using the SLR method. In Indonesia, ethnoscience research trends in learning are dominated primarily by research and development with research groups in the form of: integration of local knowledge in the curriculum, use of technology in ethnoscience learning, ethnoscience-based environmental education, and development of ethnoscience-based contextual learning materials.

Keywords: Environmental education; Ethnoscience; SLR

Introduction

Indonesia, a country that has cultural diversity and local knowledge, is an important source for the development of the concept of ethnoscience. Ethnoscience is an approach that integrates indigenous knowledge that has been practiced by the community for a long time and has been passed down from generation to generation with modern science. Ethnoscience recognizes the existence of local values and wisdom while utilizing scientific methods and approaches to validate, test and develop this knowledge.

Indonesia's wealth, which has thousands of islands, is local community wisdom related to agriculture, the environment, traditional medicine, food, clothing, entertainment, those related to human interaction with nature, and others. However, currently the local knowledge of the community has decreased in value and is affected by globalization and modernization. Therefore it is important to preserve and respect traditional knowledge in Indonesia while utilizing it in the context of learning modern science

Ethnoscience research in Indonesia is important to understand in depth the integration of traditional knowledge with modern science and to implement it in learning. Several examples of ethno-science research in Indonesia have been carried out to improve learning outcomes, higher-order thinking skills, scientific literacy, skills, motivation, and interest in entrepreneurship (Agustin et al., 2018; Damayanti et al., 2017; Hadi et al., 2020; Kurniawan & Syafriani, 2021; Masfufah et al., 2020; Rahayu & Sudarmin, 2015; Walidah et al., 2023).

Systematic literature studies related to ethnoscience have been carried out for the last 5 years of research in the journals Scopus and SINTA (Primadianningsih et al., 2023; Sari et al., 2023). However, no study has been discovered that outlines the usage of ethnoscience for learning in Indonesia over the previous ten years (2013-2023) and its relationship to environmental education. This article presents descriptive data related to ethnoscience research in science learning in Indonesia. This research is expected to provide insight into the

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potential and challenges of implementing ethnoscience in education in Indonesia.

Method

This study is an SLR that uses identification, screening, and in-depth analysis techniques from relevant scientific articles to answer research questions on the theme "ethnoscience" (Xiao & Watson, 2019). SLR research with a systematic and transparent method helps summarize the latest knowledge on a particular theme (Husamah et al., 2022).

Research Questions

Research questions are used to develop a research focus and provide a clear research scope. The research questions that have been developed in this research are: What are the trends in the publication of ethnoscience in learning in Indonesia in SINTA-accredited journals? and What are the implications of ethnoscience research in existing learning?

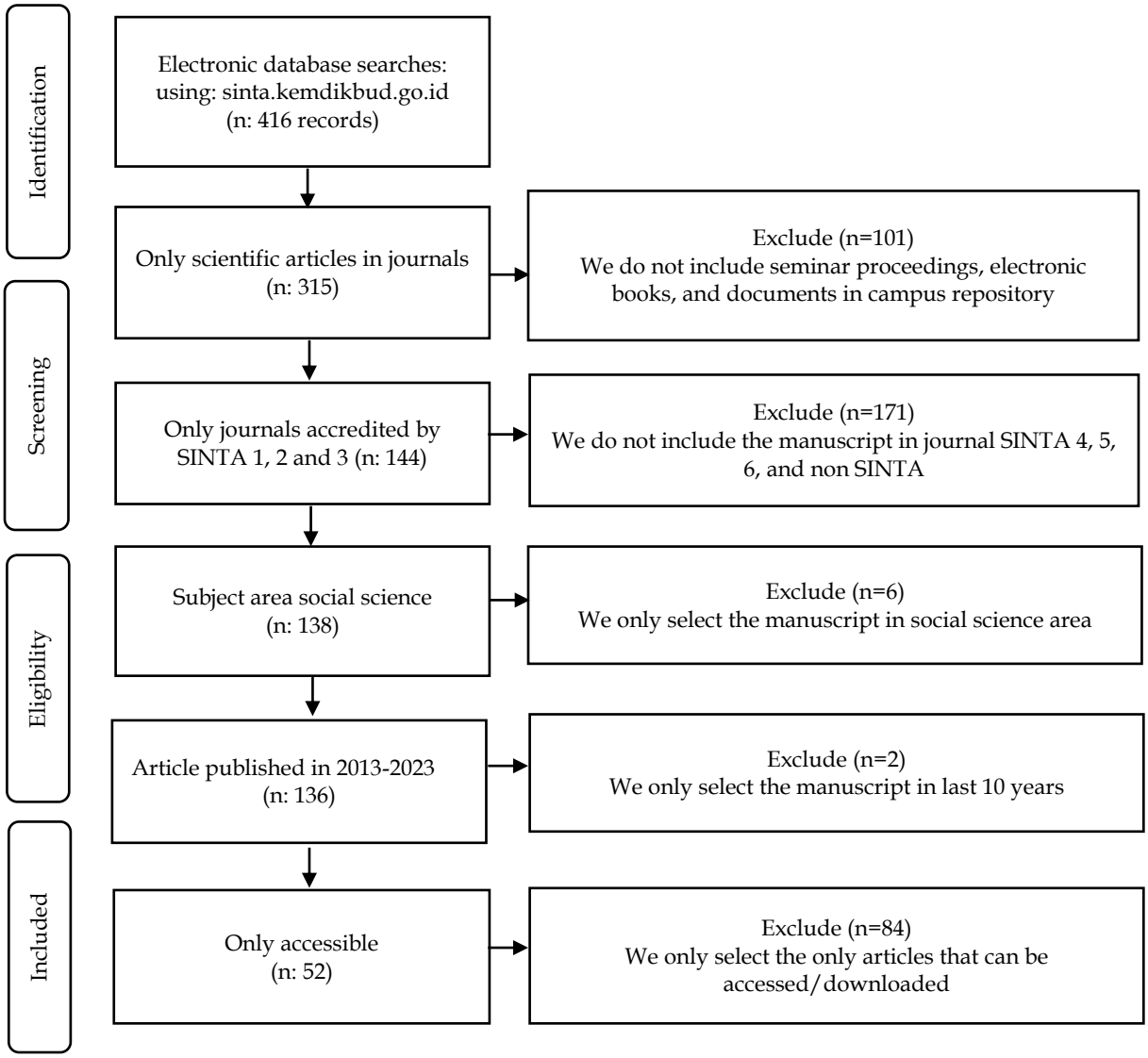

Figure 1. Research Flowchart

Finding Articles and Inclusion Criteria

The keyword "ethnoscience" was entered into the SINTA database search menu by the researchers. We collected 416 papers, of which 101 were released because they were seminar proceedings, publications, or documents in institutional archives. To maintain the quality of the papers analyzed, the 315 scientific publications received were filtered back into 144 articles using the criterion of only articles published in SINTA 1,

2, and 3 recognized journals. Furthermore, we reduced the number of papers from 136 to 8 because they did not meet the criteria for a social science subject area and were published between 2013 and 2023. At the end, we had 52 (84 excluded) papers with eligibility criteria that could be accessed or downloaded in their entirety.

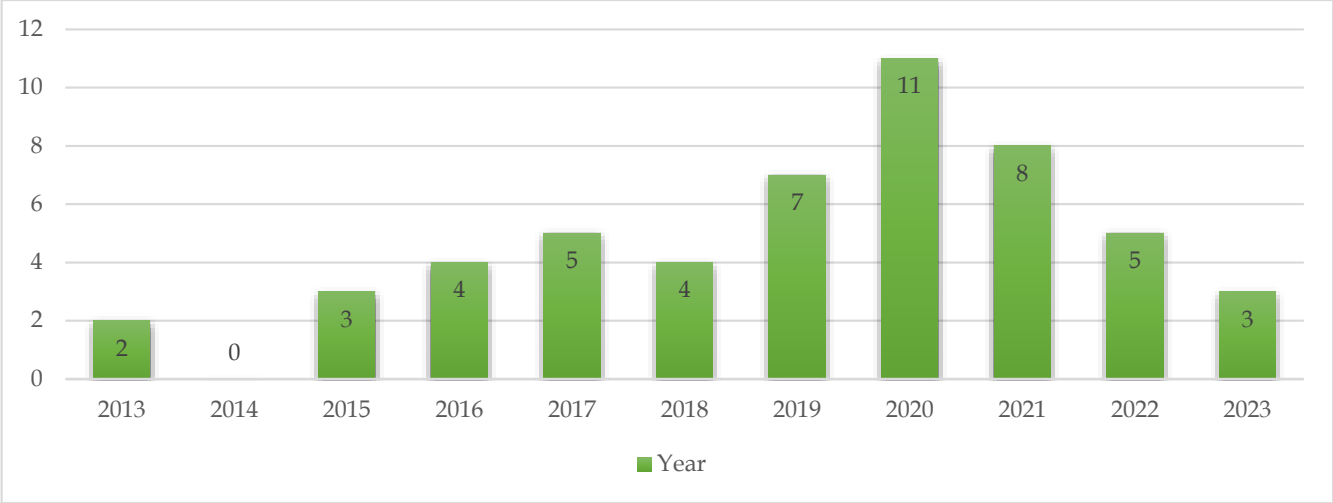

Figure 2. Distribution article of the year

Research on the theme of ethnoscience in learning is trending or most published in the 2019-2021 range. Nevertheless, ethnoscience is still an interesting research to date. This data has limitations in articles published outside the SINTA 1, 2, and 3 journals, which we did not include in the analysis. Ethnoscience research trends in learning over the last 10 years show recognition and respect for traditional knowledge of society in the context of modern education. Several major themes of ethnoscience research trends in education include: 1) integration of local knowledge in the curriculum, 2) use of technology in ethnoscience learning, 3) ethnoscience-based environmental education, and 4) development of ethnoscience-based contextual learning materials (Gruenewald, 2003; McGregor, 2004).

Result and Discussion

The results of SLR research on the theme of ethnoscience in learning are divided into several parts, namely: research methods used, names of researchers who appear most often and their collaborations, research funding, and important information in research related to environmental education

Table 1. Types of research on ethnoscience

Type of research	Amount	References
Research and development	24	(Agustin et al., 2018; Ariningtyas et al., 2017; Damayanti et al., 2017; Eko Atmojo & Lukitoaji, 2020; Fiteriani et al., 2021; Haspen et al., 2021; Kurnia & Nugrahani, 2022; Kurniawan & Syafriani, 2021; Pratiwi et al., 2021; Rahayu & Sudarmin, 2015; Septiaahmad et al., 2020; Sulistri et al., 2020; Sumarni & Supanti, 2021)
Qualitative	12	(Azizah et al., 2021; Hadi et al., 2019; Hadi & Ahied, 2017; Ilhami et al., 2021; Puspasari et al., 2019; Supriyadi & Nurvitasari, 2019; Wicaksono, 2013)
Experiment	11	(Dinissjah et al., 2019; Hadi* et al., 2020; Masfufah et al., 2020; Masfufah & Ellianawati, 2020; Rahma & Safarati, 2019; Subekti & Fibonacci, 2014; Supriyadi et al., 2016; Temuningsih et al., 2017; Walidah* et al., 2023; Wibowo & Ariyatun, 2020)
Case study	2	(Sumarni, 2020; Imansari et al., 2018)
Literature study	1	(Khoiri & Sunarno, 2018)
Action research	1	(Masfufah et al., 2020)

The trend of ethnoscience research in learning in Indonesia is mostly dominated by research and development. Each of these studies generally produces products in the form of learning modules, media, textbooks, learning tools, and evaluation instruments for ethnoscience learning. Other types of research found were qualitative, experimental, case studies, literature studies, and classroom action research. Some qualitative research was found using in-depth interview methods, field observations, and filling out questionnaires by respondents. While experimental research is mostly found with quasi-experimental designs.

Author and Collaboration

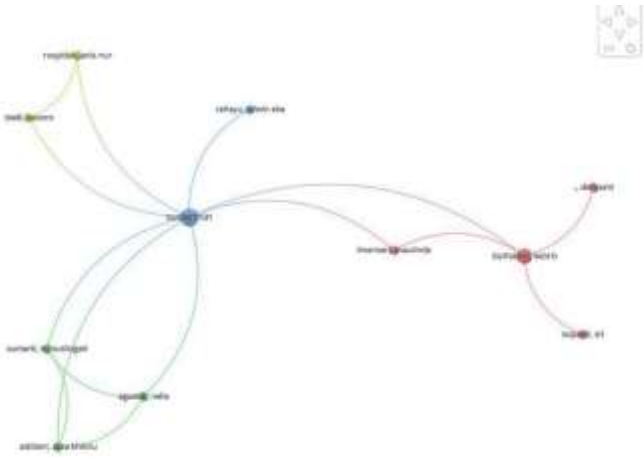

Figure 2. Dominant authors and the relationship between authors in the theme of Ethnoscience (Source: Authors' own elaboration using VOSviewer software)

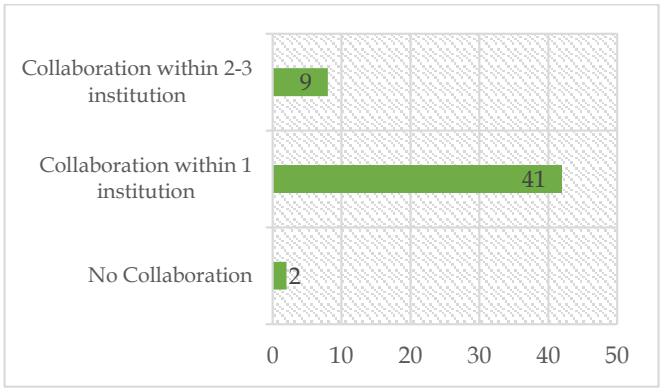

Figure 3. Author collaboration in writing articles

The names of researchers who were found quite a lot in the articles analyzed were Professor Sudarmin (Agustin et al., 2018; Imansari et al., 2018; Masfufah et al., 2020; Nisa, A., Sudarmin, 2015; Rahayu & Sudarmin, 2015; Ria Febu Khoerunnisa, N. Murbangun, 2012; Rosyidah et al., 2013). The researcher also has high connectivity or collaboration with other researchers both in the same institution and in different institutions. Professor Sudarmin is a researcher in the field of ethnoscience, apart from being published in national level (SINTA 1, 2, and 3) he has also published many articles on ethnoscience in reputable international journals. Most research on ethnoscience in learning is carried out collaboratively in one institution/university as shown in Figure 3. While the number of author collaborations in one article is mostly carried out by 3 authors (Figure 4).

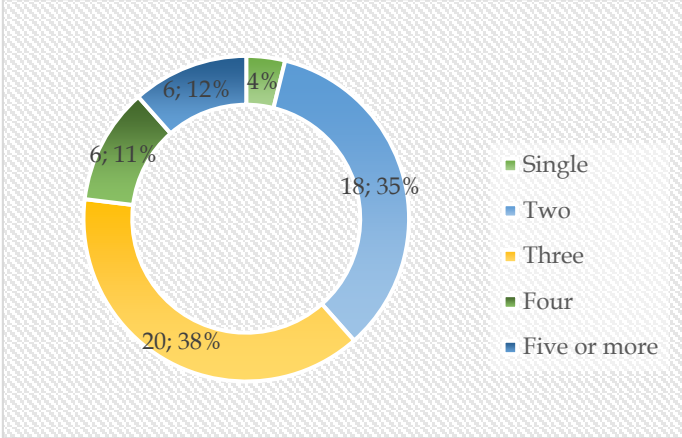

Figure 4. Collaborative distribution of researcher

Table 3. Funding sponsor ethnoscience theme

Funding sponsor	Amount
DRPM (Directorate of Research and community service)	2
Institute for Research and Community Service (LPPM) Universitas PGRI Yogyakarta	1
LP2M UIN Walisongo	1
DIPA, Directorate of Research and Community Service, Ministry of Research, Technology and Higher Education	1
No information/ funds by own researcher	47

Research on ethnoscience education is relatively in demand at the moment and receives funding both from the government, in this case the Ministry of Education, and from internal funding on campuses. However, independent funding from researchers constitutes the majority of funding sources for ethnoscience research. Carrying out research with independent funding and/or the funding source is not stated is assumed to be carried out by researchers, namely students, lecturers or teachers (practitioners).

Table 4. Important information for each article

Type contribution	Important information
Ethnoscience diversity in Indonesia	Ethnoscience is very diverse, depending on the surrounding environment. The application of ethnoscience in class is necessary to understand the local knowledge of each region. Through the process of scientific analysis, knowledge obtained from generation to generation becomes scientific concepts that can be accommodated as references for learning resources. Culture in Indonesia which is a source of student learning materials, namely:

Type contribution	Important information
	• Batik activities related to the concepts of temperature and heat from physics lessons, the concepts of electrolyte and non-electrolyte solutions in chemistry lessons, • The ethnoscience of "berkarang" and "menyodong" has a value content related to modern biological sciences • The activity of "manongkah kerang" has an indigenous science which includes the concept of natural science, in the process of manongkah and alat tongkah. • Ethnoscience in Singkawang City (Chinese New Year lantern parade, Belalle', Sedau dragon furnace industry, Ngabayotn/ Naik dango ceremony) for science learning process, especially heat material and its transfer. • The culture of using saliva in healing minor wounds can be reconstructed scientifically because saliva contains histatins and enzymes • Traditional medicine by Dongke regarding the understanding of the concepts of health, illness, and disease related to the socio-cultural conditions of the community • Ethnoscience of traditional Javanese cakes in the material of carbohydrates, fats, proteins (food chemistry), and the material of entrepreneurial attitudes • Ethnoscience Lerak fruit as a substitute for detergent • The use of "bleng" salt in making "gendar" on salt hydrolysis materials • "Dol's" music game ethnoscience • Ethnoscience of traditional Barodak wedding procession • The process of making Tempe in the community for learning materials on fermentation biology and food chemistry. • Salt production process in traditional ponds • Use of uyah (krosok salt) as a mixture of iodized salt • The culture of using young coconut water • Community knowledge about Smong (Tsunami) in Geography learning with the theme of earthquakes and disaster mitigation • The ethnoscience of bird pest repellents in rice fields, the ethnoscience of "kentongan" and "bedug" application of loudspeakers in mosques in physics subject on vibration and sound. • Traditions in Setu Babakan village (Betawi batik, egg crust, Betawi pickles, crocodile bread, firecrackers) • The culture of circumcision, the culture of smoking, the traditional treatment of dysmenorrhea and morning sickness on the reproductive system • Ethnoscience of South Sumatra (cuko on empek-empek, making pindang fish, MSG for soil fertility, making kletek prawns, bekasam on fish, and dyeing jumputan cloth) • Ethnoscience of making salted eggs on diffusion and osmosis materials. • Ethnoscience of the Malind tribe (kahwanuk activities (measurement), sasi (prohibition), nangge (carving), making sago sep, wet (interaction of living things with the environment), clan (surnames based on animal names, use of bia shells (shells), wani (intoxicating drink), tifa music instrument, prohibition to marry with a certain clan). • Ethnoscience sipak rago (West Sumatra) • Ethnoscience of the Surakarta community in making tape, pancakes and ice in science lesson.
Integration ethnoscience concept	Researchers integrate ethnoscience in several ways to achieve learning objectives, including through: • ethnoscience-laden inquiry learning • STEM-based ethnoscience learning • Ethnoscience-based PBL learning • discovery learning with an ethnoscience approach • PBL model assisted by worksheet containing ethnoscience • Ethnoscience-based Direct Instruction model • observation, discussion, presentation and practice activities • an ethnoscientific CTL approach • ethnoscientific approach • guided inquiry-based learning module integrated with ethnoscience • textbooks integrated with ethnoscience

Type contribution	Important information
	• poster media containing ethnoscience • integrated science module integrated with ethnoscience • ethnographic science booklet • Ethnoscience-based LKPD • ethnoscience-based food safety project tools • science-based flipbook media • story media based on ethnoscience • Ethnoscience teaching materials through the 5E cycle model • Guided Inquiry-based e-module integrated with ethnoscience
The purpose of integrating ethnoscience into learning	Ethnoscience learning processes and evaluation instruments can be used to measure and improve: • higher order thinking skills • problem solving skills • cognitive learning outcomes and entrepreneurial interest • cognitive, affective and psychomotor evaluations • students' scientific literacy skills • cultural literacy and citizenship of students • creative thinking skills • understanding of the concept, and increasing interest in learning it • inspire enthusiasm and curiosity • learning outcomes and creative thinking skills • critical thinking skills • increase the spirit of conservation • awareness and responsibility to preserve culture
General comprehension	• many educators do not know the concept of ethnoscience, • many teachers never implement ethnoscience because of a lack of understanding • Ethnoscience integration into learning will be more effective if it is included in the subject matter • Ethnoscience integration makes the learning process more meaningful and contextual.

Based on the findings of 52 manuscripts that have been analyzed by researchers, there are several ethnoscience studies that promote the Environmental Education (Ilhami et al., 2021; Irawan & Muhartati, 2019; Mahendrani & Artikel, 2015; Rahayu & Sudarmin, 2015; Supriyadi & Nurvitasari, 2019). In the discussion section of articles resulting from ethnoscience research, efforts have been found to bridge the wisdom of local communities with scientific knowledge on various subjects. These efforts provide students with a more holistic perspective on the surrounding environment by integrating traditional knowledge with modern knowledge (Kaya & Seleti, 2013). In addition, the ethnoscience learning process strengthens relationships with local places and communities. This learning will foster a sense of ownership, thus inspiring students to be more responsible for the surrounding environment. Learning that raises the intelligence of local communities introduces students to sustainable solutions that have been tested for generations and can be implemented in modern problems (Riggs, 2005). Ethnoscience learning practices acknowledge the dependence between cultural diversity and modern scientific practices. These activities value traditional skills (practices), knowledge, and language that can achieve conservation goals that protect human-made ecologies and systems (Bohensky et al., 2013; Grey et al., 2020; Limpo et al., 2022). Students who experience learning have the ability to approach problems from various perspectives to produce innovative solutions. In the end, ethnoscience learning helps students appreciate diversity in the environment and have a sense of mutual respect and collaboration on environmental issues.

Conclusion

In Indonesia, research and development has largely dominated ethnoscience research in learning. Over the last ten years, ethnoscience research in learning has revealed a recognition and respect for traditional societal knowledge in the setting of modern education. Ethnoscience research in education is classified into four categories; integration of local knowledge into the curriculum, use of technology in ethnoscience learning, ethnoscience-based environmental education, and production of ethnoscience-based contextual learning materials.

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Author Contribution
Susanti Murwitaningsih; conceptualization and critical revision, Maesaroh; analysis and drafting manuscript.

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Conflicts of Interests
The authors declare no conflict of interest.

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