Tadris: Jurnal Keguruan dan Ilmu Tarbiyah 6 (2): 229-241 (2021)
DOI: 10.24042/tadris.v6i2.9509

TADRIS: JURNAL KEGURUAN DAN ILMU TARBIYAH
(Tadris: Journal of Education and Teacher Training)
P-ISSN: 2301-7562 | E-ISSN: 2579-7964
ejournal.radenintan.ac.id/index.php/tadris/index

A Thematic Review on Exploring Ethnoscience in Science Education: A Case in Indonesia

Yohanes Freadyanus Kasi[1]*, Achmad Samsudin[2], Ari Widodo[3], Riandi[4]
[1]Master Program of Science Education, Universitas Pendidikan Indonesia, Indonesia
[2]Department of Physics Education, Universitas Pendidikan Indonesia, Indonesia
[3]Department of Science Education, Universitas Pendidikan Indonesia, Indonesia
[4]Department of Biology Education, Universitas Pendidikan Indonesia, Indonesia

Article History:
Received: July 18th, 2021
Revised: September 10th, 2021
Accepted: December 6th, 2021
Published: December 31st, 2021

Keywords:
Ethnoscience,
Indonesia,
Science education,
Thematic review

***Correspondence Address:**
yohaneskasi@upi.edu

Abstract: This study aims to review the ethnoscience studies in science education in Indonesia thematically. From 2010 to 2020, the databases contained 71 relevant articles of ethnoscience studies. These studies belonged to the content analysis theme parameters of method/design, sample, data collection, data analysis, topic, result, recommendation, and location. The results indicated that most of the ethnoscience studies explored the effect of integrating ethnoscience with the lessons to investigate students' achievement and attitudes towards science. Correspondingly, the investigated studies mostly used Research and Development (R & D) and experimental research design. The preferred data collecting techniques were tests (multiple-choice/description), questionnaires, and observation. Moreover, seventh and eighth graders of junior high school commonly employed the argumentation activities in physics, chemistry, biology, and basic concept of science topics. This study suggests the teachers employ different methods (e.g., ethnoscience) to improve concept understanding, problem-solving skills, critical thinking skills, and motivation in learning science from the primary school level. Furthermore, resources from cultural activities in Indonesia are beneficial for integrating ethnoscience in learning.

INTRODUCTION

Teachers or pre-service teachers should understand their role as the learning resources for the students (Azizah, Hasibuan & Paristiowati, 2021; Kapofu, 2019; Treagust, D. F., Won, M., Petersen, J., & Wynne, 2015). The competency-based approach implies essential modifications in the curriculum and teaching, especially in expressing how teachers interpret learning. The traditional emphasis has been on reproducing understanding rather than its transmission to real-world situations (Aydin, 2012). These approaches rely on the teachers' competence. It is necessary to focus not only on the knowledge but also on the skills (Wallace & Priestley, 2016). One approach to teaching science is the ethnoscience approach, which teaches through students' personal and cultural strengths, knowledge capabilities, and prior achievements (Abonyi O.S, 2004). Ethnoscience was selected as it investigates original knowledge of the societies and changes it into a scientific one (Davison, D. M. & Miller, 1998; Jegede, O. J. & Okebukola, 1991; Vlaardingerbroek, 1990).

The application of the ethnoscientific teaching approach is hence based on the references to the Science for All Movement. The movement emphasizes that a) the content, language, symbols, designs, and purpose of the curriculum should be linked to day-to-day experiences and goals, b) theory should be linked to practice, human purpose, the quality of life, and in-school experience to out-of-school experience; and, c) teaching and learning should begin from the beliefs, interests, and learning skills that students bring to the classroom and should help them develop and extend their ability and understanding (e.g. (Fasasi, 2017; Hiwatig, 2008).

Indonesia is now implementing the curriculum 2013 to foster students' critical thinking and actively looking for information, explaining a phenomenon, and giving explanations to a problem (Kementerian Pendidikan dan Kebudayaan, 2014). The curriculum 2013 supports and involves the culture and local wisdom in science. It means that science teachers must be approachable to the development of culture and local wisdom (Sudarmin et al., 2019) by utilizing technology to be linked in learning (Bitner & Bitner, 2002). Also, to build interest and the ability to improve their learning process.

In current years, several ethnoscience studies have become the focus of investigation (Sturtevant, 2017). The studies concentrate on students' confidence (Price, C. A. & Chiu, 2018; Ardianti, S. D., Wanabuliandari, S., Saptono, S. & Alimah, 2019) and motivation to learn science (Nurdiana, U. & Widodo, 2019; Hiwatig, 2008). Regarding contribution in learning, the studies increased students' cognitive, affective, psychomotor, critical thinking skills (Risdianto et al., 2020), concept understanding (Glackin, 2016), components of scientific literacy (Dewi et al., 2019), scientific literacy (Nurcahyani et al., 2021), problem-solving skills (Bang et al., 2007), and teachers' self-efficacy (Gaikhorst et al., 2015). Similarly, integrating ethnoscience in science education seems to be an effective and sustainable technique to comprehend the purposes of several science curriculums (Acharya, K. P., Rajbhandary, R. & Acharya, 2019; Aydin, 2013; Meier, 2012; Hewson & Ogunniyi, 2011; Onwu, O. M. O. & Krle Jr, 2011). The ethnoscience in science instruction offers teachers an occasion to develop students' knowledge and skills.

The variables mentioned above are the targets of the science curriculum. The ethnoscience design related to science education research has constantly been preferred. Analyzing the ethnoscience in science learning and presenting the past progress of ethnoscience is important to understand its general outcome. Therefore, the purposes, methods, sample, data collection, data analysis, topics, results, recommendations, and location might provide a rounded interpretation to ethnoscience. (Bağ & Çalik, 2017) concluded the argumentation studies (between 2006 until 2016) to categorize the effectiveness of the argumentation studies according to purpose, method, sample, conclusion, and recommendation. Similarly, this analysis would deliver understandings of the outcomes of ethnoscience studies. Furthermore, a thematic review of ethnoscience would also enlighten potential studies.

Indonesia is an archipelagic country that has a variety of cultural riches. These cultural activity resources are also related to science concepts, so that several research focuses have examined culture-based science learning (e.g. Sturtevant, 2017; Price, C. A. & Chiu, 2018; Ardianti, S. D., Wanabuliandari, S., Saptono, S. & Alimah, 2019; Hiwatig, 2008). However, no research has analyzed the extent of scientific research in Indonesia and its distribution. This study is expected to thematically review the ethnoscience studies from 2010 to 2020

with the following research questions: (1) What are the purposes of ethnoscience exploration?; (2) What are the research methods?; (3) Which sampling technique was employed by the research?; (4) What are the data collection techniques?; (5) What are the analysis methods?; (6) What are the topics?; (7) What are the results?; (8) What recommendations were produced?; (9) Where is the research conducted?

Categorizing ethnoscience studies is ascetically vital for the related literature. This thematic analysis can guide the researchers to devise ethnoscience research efficiently. Assumed the previous topics, the current research is beneficial to cover the related literature. Henceforth, this research recommends the researchers, teachers, and curriculum developers trace the predispositions of ethnoscience studies by decreasing their capacities.

METHOD

This research engaged the thematic review (e.g., science and social education) through creating topics and models (Bağ & Çalik, 2017). The thematic review offers an unlikely cause for researchers (Ültay & Çalık, 2012) since this research is directed to review the ethnoscience studies in Indonesia.

This research explored famous ethnoscience studies in Indonesia. The data sources were Taylor & Francis, Web of Science, DOAJ, Microsoft Academic Search, BASE (Bielefeld Academic Search Engine), Copernicus International, Google Scholar, IOP Publishing, ERIC, and Elsevier to collect associated research with a total of 71 research.

The parameters were the purpose, method/design, sample, data collection, data analysis, subject, general knowledge claim, recommendation, and location. An example of the data analysis is displayed in Table 1.

Table 1. An Example Data Analysis of These Constraints

Parameter	Description
Purpose	Intended to develop scientific literacy through ethnoscience pedagogic in chemistry learning
Method-Design	Qualitative-Generic Qualitative Design
Sample	Middle school
Data collection	Interview, audio-video record, test
Data analysis	Qualitative content analysis
Subject	Global warming
General knowledge claim	Effectively improve students' understanding of concepts and creative thinking skills.
Recommendation	Produced some recommendations for educators and curriculum developers in East Java

The research had been categorized and coded distinctly (see Table 1). Therefore, an overall of 80 codes was produced. The reviewed research was carefully inspected to avoid any missing data. The coding technique was carried out based on the parameters. All codes for each study were completely performed to minimalize any error. This process took about a month involving a group of experts (researchers and two post-graduate students, who enrolled in 'Meta-synthesis applications in primary teacher education). They independently coded two studies randomly selected from the coding.

RESULT AND DISCUSSION

Frequencies of the ethnoscience purposes and correlated codes are presented in Table 2.

Table 2. Frequencies of the Purpose

Subject	Codes		f
Purpose	Identification of scientific concepts in local culture and their usefulness in learning science		14
	Design-based ethnoscience (material, evaluation tool, etc.)	Booklet	20
		Students' worksheet	5
		Based on technology	4
	The effect of different teaching strategies in ethnoscience.		22
	The relationship between different variable(s) (concept understanding, scientific literacy, critical and creative thinking, teachers' pedagogical content knowledge, etc.) on ethnoscience		50
Total			**115**

Table 2 displays the purposes contained in four different codes. These codes identify scientific concepts in local culture and their usefulness in learning science. The design-based ethnoscience comprises creating any teaching material and evaluation tool using ethnoscience and analyzing its efficiency. Additionally, the relationship between different variables on ethnoscience holds the connections between some variables.

Table 2 informs that 14 ethnoscience studies focused on identifying scientific concepts in local culture and their usefulness in learning science. On the other hand, the design-based ethnoscience consisted of 29 studies (20 booklet, 5 students worksheet, and 4 technology-based media). Furthermore, the effect of different teaching tools using ethnoscience and the relationship between different variables (s) on ethnoscience consisted of 22 and 50 studies.

Table 3. Frequencies of the Method or Design

Subject	Codes		f
Method/ Design	Quantitative	Experimental	15
		Descriptive	4
		R & D	29
		Action research	1
	Qualitative	Case study	1
		Ethnographic research	8
		Other (Qualitative but the design is not detailed)	13
	Mixed-method		0
Total			**71**

Table 3 reveals that four ethnoscience studies were conceded through descriptive quantitative, while one was conducted with a case study. Fifteen ethnoscience studies were considered under experimental research methodology, while 29 were conducted with Research and Development (R & D). The ethnoscience studies under the 'other' category (qualitative, but the design is not detailed), ethnographic research, action research, mixed-method were 13, 8, 1, and 0, respectively. Frequencies of the sample in the ethnoscience studies are shown in Table 4.

Table 4. Frequencies of the Sample

Subject	Codes		f
Sample	Teachers		11
	People		13
	College student		4
	Students	12^{th} grade	1
		11^{th} grade	6
		10^{th} grade	6
		9^{th} grade	2
		8^{th} grade	12
		7^{th} grade	16
		6^{th} grade	0
		5^{th} grade	6
		4^{th} grade	1
		3rd grade	1
Total			**79**

As can be seen in Table 4, frequencies of the sample in the ethnoscience studies were 11 for teachers, 13 for people, 4 for college students, 1 for K-12, 6 for K-11, 6 for K-10, 2 for K-9, 12 for K-8, 16 for K-7, 0 for K-6, 6 for K-5, 1 for K-4, and 1 for K-3.

Frequencies of the data collection tools in the ethnoscience studies are available in Table 5.

Table 5. Frequencies of the Data Collection Tools

Subject	Codes	f
Data Collection Tool	Open-ended questions	12
	Interview	25
	Observation	29
	Audio-video record	1
	Test (Multiple-choice/essay)	39
	Document	23
	Questionnaire	30
Total		**159**

Table 5 reveals that 12 ethnoscience studies used open-ended questions, while 25 used the interview. One of them employed audio-video records, while 29 of them preferred observation. Frequencies of the ethnoscience studies that employed the test, document, and questionnaire were 39, 23, and 30.

Frequencies of the data analysis in the ethnoscience studies are shown in Table 6.

Table 6. Frequencies of the Data Analysis

Subject	Codes		f
Data analysis	Quantitative	T-test	14
		N-gain	14
		Descriptive analysis	5
		Effect Size	1
		Wilcoxon	1
		ANCOVA	0
		Mann Whitney U	0
		Correlation	0
		ANOVA	1
		MANOVA	1
		Regression	0
		Kolmogorov-Smirnov	1
	Qualitative	Descriptive analysis	32
		Content analysis	0
		T-test	19
Total			**92**

Table 6 shows that five ethnoscience studies used descriptive quantitative analysis, while 32 employed descriptive qualitative analysis. Frequencies of the ethnoscience studies that used the t-test, N-gain, effect size, Wilcoxon, ANCOVA, and Mann Whitney U were 14, 14, 1, 0, and 0, respectively. Similarly, 22 of these studies arranged alternative scoring keys. Further, frequencies of the ethnoscience studies employed correlation (0), ANOVA (1), MANOVA (1), and regression (0).

Frequencies of the topic in the ethnoscience studies are displayed in Table 7.

Table 7. Frequencies of the Topic

Subject	Codes	f
Topics	Physics (Newton's Law, Heat, Transfer of Heat, Work and Energy, vibrations, waves, sounds, forces, earth and moon, torque principles, energy and their changes, global warming)	19
	Chemistry (salt hydrolysis, characteristics of substances, addictive substances, stoichiometry, elements, compounds, ionic bonds, separation of mixtures, heat transfer, crystallization, Solubility and Ksp, properties of elements and compounds, measurement of concentrations, saturated and unsaturated solutions, nucleations, polymers, colloids, acid bases, macromolecules, chemical bonds, hydrocarbons, colligative properties of solutions, chemical bonds, redox, electrolyte, and non-electrolyte solutions)	17
	Biology (biodiversity, conservation, human excretion system, ecosystems, reproductive systems, biotechnology, environmental pollution, food and health, breeding in plants, energy in life)	16
	The basic concept of science	12
	Others	7
	Total	**71**

As seen in Table 7, 19 of the ethnoscience studies focused on physics topics while 17 focused on chemistry.

Furthermore, 16 studies focused on biology, 12 focused on the basic concept of a science topic, and 7 focused on ethnoscience.

Table 8. Frequencies of the Ethnoscience Types

Subject	Codes		f
Types of ethnoscience	The development of variable(s) with different teaching tools through ethnoscience	Ethnoscience with technology activities	5
		Ethnoscience with learning strategies	16
		Ethnoscience with integrated teaching material	21
	Ethnoscience-oriented curriculum		5
	Local science learning resources		8
	Not applicable		2
	Total		**71**

As seen in Table 8, the frequency of the ethnoscience-oriented curriculum was five. Similarly, frequencies of the ethnoscience studies with technology activities, learning strategies, integrated teaching material, local science learning resources, and not applicable were 5, 16, 21, 8, and 2, respectively.

Table 9. Frequencies of the General Knowledge

Subject	Codes		f
General knowledge claim	Effectiveness of the teaching intervention	Positive effect	47
		Neutral effect	1
		Negative effect	1
	Factors influencing ethnoscience (understanding students' concepts, scientific literacy, critical and creative thinking, teachers' pedagogical content knowledge, etc.)		54
	Effectiveness of technology integrated Ethnoscience		5
	View of ethnoscience		14
	Total		**122**

As seen in Table 9, 49 of the ethnoscience studies mentioned the effectiveness of the teaching intervention. Furthermore, 47 out of 49 ethnoscience studies had a positive effect, while one portrayed a neutral result. Also, one study described a negative effect. There are 54 ethnoscience studies focused on factors influences. Frequencies of the view of ethnoscience and effectiveness of technology integrated ethnoscience were 14 and 5.

Table 10. Frequencies of the Recommendation

Subject	Codes	f
Recommen-dation	Suggestions for classroom practice	27
	Suggestions for future research	15
	Suggestions for design-based studies	28
	Not applicable	12
	Total	**82**

Table 11. Frequencies of the Location

Subject	Codes		F
Location of the research	Sumatera Island	North Sumatera	1
		West Sumatera	3
		South Sumatera	1
	Java Island	West Java	4
		Central Java	31
		East Java	18
	Kaliman-tan Island	North Kalimantan	0
		West Kalimantan	2
		East Kalimantan	0
		Central Kalimantan	0
		South Kalimantan	0
	Sulawesi Island	North Sulawesi	0
		West Sulawesi	0
		Central Sulawesi	0
		Southeast Sulawesi	0
		South Sulawesi	0
	Bali Island		2
	West Nusa Tenggara Island		3
	East Nusa Tenggara Island		1
	Maluku Island	Maluku	0
		North Maluku	0
	Papua Island	Papua	5
		West Papua	0
	Total		**71**

As seen in Table 10, 27 of the ethnoscience studies recommended classroom practices, while 15 suggested the implications for future research. Also, 28 of them recommended design-based studies.

As seen in Table 11, 53 of the ethnoscience studies were located on Java island (31 in Central Java, 18 in East Java, and 4 in West Java). The ethnoscience studies' frequency in Sumatera, Kalimantan, Bali Island, West Nusa Tenggara, and Papua were 5, 2, 2, 3, and 5, respectively. Further, frequencies of the ethnoscience studies located in East Nusa Tenggara, Sulawesi, and Maluku were 1, 0, and 0.

Figure 1. The Distribution of Ethnoscience Studies in Indonesia

Assumed the results of the ethnoscience studies, a high number of the code 'Identification scientific concepts in local culture and their usefulness in learning science' (see Table 2) might be identified as a teaching resource (Pauka et al., 2005). A number of the ethnoscience studies under the code 'Design-based ethnoscience' may result from developing teaching material, evaluation tools, and others based on the ethnoscience. Integrating ethnoscience in science education seems to be a functioning technique to comprehend the purposes of many science curriculum improvements (Roth, W. M., Lee, Y. J. & Hsu, 2009; Davison, D. M. & Miller, 1998). Furthermore, teachers give a positive perception about using the teaching materials based on technology to increase student motivation (Wood et al., 2005). An uncountable ethnoscience study under the code 'The effect of different teaching strategies using ethnoscience' was appropriate for integrating teaching strategy (Fasasi, 2017; Erbas, 2018). This result might consequence the learning model multifaceted of integrating teaching strategy using ethnoscience. Besides, high frequencies of the ethnoscience studies under the code 'The relationship between different variable(s) on ethnoscience' reveal a good point from this integration. It may have originated from a straightforward base of relationships as associated with ethnoscience studies.

The fact that ethnoscience studies frequently used Research and Development (R&D) (see Table 3) may be derived from the nature of some variables based on ethnoscience. Research and Development (R&D) may be observed as more appropriate to explore some aspects. Subsequently, there are no frequencies of ethnoscience studies with mixed-method (quantitative and qualitative). Some ethnoscience studies used the experimental research methodology, quantitative, and qualitative

methods originated from a comprehensive examination and data triangulation requirement. Furthermore, few studies employed action research, case study, and ethnographic research may be caused by various requirements and assignments (present shared interpretation(s) of quantitative methodologies, a lack of knowledge of these methodologies, data collection, analysis, sample, etc.).

The common part of the ethnoscience studies was focused on teachers' level (see Table 4) that might originate from the assumption that teachers' knowledge is an important key in the learning process. Teachers' engagements in learning facilitate their students' learning (Sgouros, G. & Stavrou, 2019; McNeal, P., Petcovic, H. & Reeves, 2017; Amin & Vithal, 2015). Furthermore, the minority of the ethnoscience studies were carried out on K-7 until K-10 level because the students were in their critical age stages. Also, the ethnoscience studies were carried out to K-3 until the K-6 level. Henceforth, how students progress ethnoscience should be discovered. However, the unfinished number of ethnoscience studies in the lower levels may originate from the science topics' difficulties.

The ethnoscience studies were mostly dominated by tests (multiple-choice/description) and questionnaires (see Table 5). A higher frequency of open-ended questions in the quantitative research procedures might originate from choosing the Research and Development (R&D) and experimental research methodology. Nonetheless, these tests were frequently used to examine the consequence(s) of ethnoscience on other independent variables (e.g., problem-solving skills, critical skills, and scientific literacy). The time efficiency appears to have fortified researchers to choose these tests (Günay & Aydin, 2015).

Related to the other data collection tools, the frequencies of the ethnoscience studies employing audio-video records were lower than tests, questionnaires, and interviews. It might be caused by ethnoscience studies that are resolute from the apprehensions of misplaced data. Audio-video records are generally only used to recurrent viewing essential data collection. The benefits of the test, questionnaire, and interview appear to be more appropriate for ethnoscience studies because they strengthen the data that has been obtained.

The frequencies of the ethnoscience studies using quantitative and qualitative data analysis were practically identical (see Table 6). The ethnoscience studies seem to have comprehensive results with quantitative data analysis completed by qualitative data analysis. The frequency of qualitative descriptive analysis and alternative scoring keys was somewhat higher than that of content analysis may stem from the impression descriptive analysis is more suitable and time-efficient to answer research questions in investigating tests, questionnaires, and interviews. A high frequency of t-test and N-gain might have originated from the experimental research methodology with pre-and post-test design. Correspondingly, the effect size in the quantitative analysis is important in studies exploring the effects of ethnoscience. In other opinions, this might originate from the studies considering the impact (s) of data collection tools. Moreover, the incomplete correlation and regression analysis frequency may be accredited to rare studies concentrating on the relations between aspects based on ethnoscience.

The frequency of the ethnoscience studies on physics, chemistry, biology, and basic concept of science (see Table 7) was similar. Many cultural activities in Indonesia have different explanations in science. The topics such as global warming, heat transfer, sounds, salt hydrolysis, addictive substances, colloids, ecosystems, and environmental pollution

are discussed since medium level (K-7, K-8, etc.).

A high frequency of the ethnoscience studies under ethnoscience with integrated teaching material (see Table 8) might be caused by simplicity in integrating ethnoscience in the learning process (Prins et al., 2019). Moreover, ethnoscience studies seem to have compensated more consideration for developing some aspects. The low frequency of the ethnoscience-oriented curriculum and technology activities was difficult to integrate one concept into another concept in the culture activity (Barak & Hussein-Farraj, 2012). New science education programs failed to realize the importance of culture and the process of technology design and transfer (Nweke et al., 2014).

Most of the ethnoscience studies generated positive effects (see Table 9). This significance might have originated from existing teaching strategies. The neutral outcome in the ethnoscience studies may be originated from the chosen interference proposed by the science curriculum. Correspondingly, an adverse effect may be caused by the inappropriate use of ethnoscience. The frequencies of the factors influencing ethnoscience might come from many studies that reveal the impact of culture-related instruction in science learning. Nevertheless, few studies examined the effectiveness of technology integrated ethnoscience may curtail from a precedence awareness.

The ethnoscience studies recommended several suggestions for design-based studies (Abonyi O.S, 2004). Besides, the ethnoscience studies recommended several suggestions for classroom practice and future types of research that examine the relationships between some variables. Such a piece of knowledge for future research might result from identifying varied factors.

The frequency of research location in ethnoscience is dominated in the Java island because many cultural activities in Javanese can be explained scientifically. Besides, many researchers in Java consider the importance of culture in the classroom. Otherwise, the East Nusa Tenggara area, which has a lot of cultural activities, gets a low research frequency.

The traditional house of Nagekeo district, East Nusa Tenggara 'Soa Waja Ji Vao,' has a stage with a red cover as a roof. As the concept of science, the purpose of making a house on stilts is for air ventilation process under the floor of the board (stage) to reduce room humidity. Furthermore, the use of Imperata as a roof aims to isolate heat radiation from the sun because Imperata is a porous or hollow material.

Figure 2. Traditional House from Nagekeo (Source: Google)

Other cultural activities (social context) that are contrary to the scientific context are the activity of burning wilderness/forest before the start of the hunting event. This burning aims to make it easier for people to see the animals. This activity is contrary to the scientific context of biological diversity. The argument is that biological diversity underpins the functioning of ecosystems and the provision of services essential to human well-being, further contributing to economic development (Gonçalves et al., 2019). Additionally, the ritual of “Ngoa Ngii "or cutting teeth for girls in parts of Nagekeo is a sign of self-maturity. This ritual is contrary to the concept of science

since the tooth enamel will decrease, thereby accelerating damage to the teeth. Indigenous science knowledge should be part of the school curriculum in cultural activities. Curriculum developers and educators need to collaborate with community elders to negotiate indigenous ways of living when teaching science (Glasson et al., 2010).

Figure 3. The Ngoa Ngii Ritual

CONCLUSION

Based on the analysis, the purposes of ethnoscience were dominated by the effect of teaching strategy using ethnoscience, while the frequency of design-based ethnoscience using technology was lower. The frequencies of the method/design were dominated by R & D, while the frequencies of action research and case study were lower. The research sample was dominated by the seventh and eighth graders of junior high school. Furthermore, data collection tools were dominated by tests (Multiple-choice/essay) and questionnaires. The descriptive analysis and physics topics dominated the studies. The types of ethnoscience were dominated by ethnoscience with integrated teaching material and general knowledge. Mostly, his ethnoscience studies yielded positive effects. The design-based studies got the most frequency. The ethnoscience studies were mostly done in the Central Java area.

The ethnoscience research in the Nagekeo district is very useful since it identifies scientific concepts in cultural activities. The science concepts in culture can be brought into science education as a method, model, and learning media to improve students' concept understanding, creative and critical thinking, scientific literacy, and problem-solving skills. If the teacher implements science education well, the students can possess a sense of unity (Rachmadtullah et al., 2020). Ethnoscience research can improve the teachers' abilities (Rahmawati, Y., Ridwan, A., Cahyana, U. & Wuryaningsih, 2020; Haidar, 2002) to master the concepts of science (content) and learning management (pedagogy).

ACKNOWLEDGMENT

The researcher sincerely thank Lembaga Pengelola Dana Pendidikan (LPDP) and Departemen Keuangan Indonesia for the financial support during the researcher's study at Indonesia University of Education.

REFERENCES

Abonyi O.S. (2004). Effects of an Ethnoscience-based instructional package on students' conception of scientific phenomena. *Journal of the University of the Gambia*, *1*(1), 172.

Acharya, K. P., Rajbhandary, R., & Acharya, M. (2019). Possibility of learning science through livelihood activities at community schools in Nepal. *Asian Social Science*, *15*(6), 88.

Amin, N., & Vithal, R. (2015). Teacher knowing or not knowing about students. *South African Journal of Education*, *35*(3), 1–9.

Ardianti, S. D., Wanabuliandari, S., Saptono, S., & Alimah, S. (2019). A needs assessment of edutainment module with ethnoscience approach oriented to the love of the country. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 153–161.

Aydin, H. (2012). Multicultural education curriculum development in Turkey.

Mediterranean Journal of Social Sciences, *3*(3), 277–286. https://doi.org/10.5901/mjss.2012.v3n3p277

Aydin, H. (2013). A literature-based approaches on multicultural education. *Anthropologist*, *16*(1–2), 31–44. https://doi.org/10.1080/09720073.2013.11891333

Azizah, N., Hasibuan, P., & Paristiowati, M. (2021). Sustainability development-based agroindustry in chemistry learning to improve the preservice chemistry teachers' competence. *Jurnal Keguruan Dan Ilmu Tarbiyah*, *6*(1), 125–138. https://doi.org/10.24042/tadris.v6i1.8346

Bağ, H., & Çalik, M. (2017). A thematic review of argumentation studies at the K-8 level. *Egitim ve Bilim*, *42*(190), 281–303. https://doi.org/10.15390/EB.2017.6845

Bang, M., Medin, D. L., & Atran, S. (2007). Cultural mosaics and mental models of nature. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(35), 13868–13874.

Barak, M., & Hussein-Farraj, R. (2012). Integrating model-based learning and animations for enhancing students' understanding of proteins structure and function. *Research in Science Education*, *43*(2), 619–636.

Bitner, N., & Bitner, J. (2002). Integrating technology into the classroom: Eight keys to succes. *Journal of Technology and Teacher Education*, *10*(1), 95–100.

Davison, D. M., & Miller, K. W. (1998). An ethnoscience approach to curriculum issues for American Indian students. *School Science and Mathematics*, *98*(5), 260–265.

Dewi, C. A., Khery, Y., & Erna, M. (2019). An ethnoscience study in chemistry learning to develop scientific literacy. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 279–287.

Erbas, Y. H. (2018). The pros, cons and necessity of multicultural education. *Australian Journal of Dermatology*, *2*(1), 40.

Fasasi, R. A. (2017). The impact of ethnoscience instruction on cognitive achievement in science. *International Journal of Education and Learning*, *6*(2), 33–42.

Gaikhorst, L., Beishuizen, J. J., Zijlstra, B. J. H., & Volman, M. L. L. (2015). Contribution of a professional development programme to the quality and retention of teachers in an urban environment. *European Journal of Teacher Education*, *38*(1), 41–57.

Glackin, M. (2016). 'Risky fun' or 'Authentic science'? How teachers' beliefs influence their practice during a professional development programme on outdoor learning. *International Journal of Science Education*, *38*(3), 409–433.

Glasson, G. E., Mhango, N., Phiri, A., & Lanier, M. (2010). Sustainability science education in Africa: Negotiating indigenous ways of living with nature in the third space. *International Journal of Science Education*, *32*(1), 125–141. https://doi.org/10.1080/09500690902981269

Gonçalves, F., Carlos, C., Crespi, A., Villemant, C., Trivellone, V., Goula, M., Canovai, R., Zina, V., Crespo, L., Pinheiro, L., Lucchi, A., Bagnoli, B., Oliveira, I., Pinto, R., & Torres, L. (2019). The functional agrobiodiversity in the Douro demarcated region viticulture: Utopia or reality? Arthropods as a case-study – A review. *Ciência e Técnica Vitivinícola*, *34*(2), 102–114.

Günay, R., & Aydin, H. (2015). Inclinations in studies into multicultural education in Turkey: A content analysis study. *Egitim ve*

Bilim, *40*(178), 1–22. https://doi.org/10.15390/EB.2015.3294

Haidar, A. H. (2002). Emirates secondary school science teachers' perspectives on the nexus between modern science and arab culture. *International Journal of Science Education*, *24*(6), 611–626.

Hewson, M. G., & Ogunniyi, M. B. (2011). Argumentation-teaching as a method to introduce indigenous knowledge into science classrooms: Opportunities and challenges. *Cultural Studies of Science Education*, *6*(3), 679–692. https://doi.org/10.1007/s11422-010-9303-5

Hiwatig, A. D. F. (2008). Ethno-scientific teaching approach, student proficiency, and attitude toward science and ethnic culture. *Education Quarterly*, *66*(1), 2–20.

Jegede, O. J., & Okebukola, P. A. O. (1991). The effect of instruction on socio-cultural beliefs hindering the learning of science. *Journal of Research in Science Teaching*, *28*(3), 275–285.

Kapofu, L. K. (2019). Teacher culture and emergent context in two desegregated science classrooms in South Africa: A focused ethnography. *South African Journal of Education*, *39*(2), 1–8.

Kementerian Pendidikan dan Kebudayaan. (2014). Materi pelatihan implementasi kurikulum 2013 Tahun 2014. In *Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendidikan*.

McNeal, P., Petcovic, H., & Reeves, P. (2017). What is motivating middle-school science teachers to teach climate change? *International Journal of Science Education*, *39*(8), 1069–1088.

Meier, L. T. (2012). The effect of school culture on science education at an ideologically innovative elementary magnet school: An ethnographic case study. *Journal of Science Teacher Education*, *23*(7), 805–822. https://doi.org/10.1007/s10972-011-9252-1

Nurcahyani, D., Yuberti, Irwandani, Rahmayanti, H., Ichsan, I. Z., & Rahman, M. (2021). Ethnoscience learning on science literacy of physics material to support environment: A meta-analysis research. *Journal of Physics: Conference Series*, *1796*(1). https://doi.org/10.1088/1742-6596/1796/1/012094

Nurdiana, U., & Widodo, W. (2019). The effectiveness of congklak traditional game to improve student S ' learning motivation in. *Jurnal Penelitian Pendidikan IPA*, *4*(1), 8–13.

Nweke, C. O., Abonyi, O. S., A, O. C., Ijok, M., & Njoku, A. (2014). Effects of experiential teaching method on pupils' achievement in Basic Science and Technology. *International Journal of Scientific & Engineering Research*, *5*(5), 875–881.

Onwu, O. M. O., & Krle Jr, W. C. (2011). Increasing the socio-cultural relevance of science education for sustainable development. *African Journal of Research in Mathematics, Science and Technology Education*, *15*(3), 5–26.

Pauka, S., Treagust, D. F., & Waldrip, B. (2005). Village elders' and secondary school students' explanations of natural phenomena in Papua New Guinea. *International Journal of Science and Mathematics Education*, *3*(2), 213–238.

Price, C. A., & Chiu, A. (2018). An experimental study of a museum-based, science PD programme's impact on teachers and their students. *International Journal of Science Education*, *40*(9), 941–960.

Prins, C., Joubert, I., Ferreira-Prevost, J.,

& Moen, M. (2019). Disciplinary practices in the early grades: Creating culturally responsive learning environments in South Africa. *South African Journal of Education*, *39*(3), 1–7.

Rachmadtullah, R., Syofyan, H., & Rasmitadila. (2020). The role of civic education teachers in implementing multicultural education in elementary school students. *Universal Journal of Educational Research*, *8*(2), 540–546.

Rahmawati, Y., Ridwan, A., Cahyana, U., & Wuryaningsih, T. (2020). The integration of ethnopedagogy in science learning to improve student engagement and cultural awareness. *Universal Journal of Educational Research*, *8*(2), 662–671.

Risdianto, E., Dinissjah, M. J., Nirwana, & Kristiawan, M. (2020). The effect of Ethno science-based direct instruction learning model in physics learning on students' critical thinking skill. *Universal Journal of Educational Research*, *8*(2), 611–615. https://doi.org/10.13189/ujer.2020.080233

Roth, W. M., Lee, Y. J., & Hsu, P. L. (2009). A tool for changing the world: Possibilities of cultural-historical activity theory to reinvigorate science education. *Studies in Science Education*, *45*(2), 131–167.

Sgouros, G., & Stavrou, D. (2019). Teachers' professional development in Nanoscience and nanotechnology in the context of a Community of Learners. *International Journal of Science Education*, *41*(15), 2070–2093.

Sturtevant, W. C. (2017). Studies in ethnoscience. *American Anthropologist*, *66*(3), 475–500.

Sudarmin, S., Zahro, L., Pujiastuti, S. E., Asyhar, R., Zaenuri, Z., & Rosita, A. (2019). The development of PBL-based worksheets integrated with green chemistry and ethnoscience to improve students' thinking skills. *Jurnal Pendidikan IPA Indonesia*, *8*(4), 492–499.

Treagust, D. F., Won, M., Petersen, J., & Wynne, G. (2015). Science teacher education in Australia: Initiatives and challenges to improve the quality of teaching. *Journal of Science Teacher Education*, *26*(1), 81–98. https://doi.org/10.1007/s10972-014-9410-3

Ültay, N., & Çalık, M. (2012). A thematic review of studies into the effectiveness of context-based chemistry curricula. *Journal of Science Education and Technology*, *21*(6), 686–701. https://doi.org/10.1007/s10956-011-9357-5

Vlaardingerbroek, B. (1990). Ethnoscience and science teacher training in Papua New Guinea. *Journal of Education for Teaching*, *16*(3), 217–224. https://doi.org/10.1080/0260747900160302

Wallace, C. S., & Priestley, M. R. (2016). Secondary science teachers as curriculum makers: Mapping and designing Scotland's new Curriculum for Excellence. *Journal of Research in Science Teaching*, *54*(3), 324–349.

Wood, E., Mueller, J., Willoughby, T., Specht, J., & Deyoung, T. (2005). Teachers' perceptions: barriers and supports to using technology in the classroom. *Education, Communication & Information*, *5*(2), 183–206.