



Ethnoscience in Learning Science: A Systematic Literature Review

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abstract

This study aims to determine the trend of ethnoscience development research in science learning in Indonesia. As classified as the qualitative research, this study used a content analysis approach. A systematic literature review technique was done to analyze the ethnoscience approach in science learning, used 73 reviewed articles, from 2017 to March 2022. The results shows: (a) Integrated research topics is the most dominant ethnoscience approach used to develop learning Modules with 4D research designs, (b) Learning outcomes are integrated with ethnoscience, especially for scientific literacy, critical thinking skill, creative thinking skill and problem-solving. (c) The ethnoscience-integrated learning model is dominated by project-based learning and discovery learning models at the high school level with biology subjects. The ethnoscience approach in science learning preservice the local culture as the attempt to develop the students' scientific literacy beside reintroducing the culture.

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1. Introduction

In responding the 21st century education, the adult learning are emphasised on ability to solve problems in creative way (long life learning) regarding the existing conditions and challenges (Indrasari & Rahmat, 2022; Muhali, 2019; Dewi, 2019). The education in the 21st century focuses on the on the students ability in developing knowledge, skills, attitudes and values superior (Asrizal et al., 2018). Creativity is a great alternative to help students in developing the problem solution competency and being skillful in executing their idea (Winarto et al., 2022).

Using the real-world context is also regarded as the key principles in implementing and coloring the learning activities. The 21st century education focused on appropriate resources, strategies and context with related with the students' daily life, more collaborative orientation, communication development as well as critical thinking enhancement and academic achievement (Zakiyah & Sudarmin, 2022; Wati et al., 2021; Nofiana & Julianto, 2018). In this setting, the education is carried out and facilitated by teachers, at this time when this the environment has potential for presenting participant to their favorite activities (Kusumah et al., 2022).

Science learning contains natural lesson materials and the its combination with daily and realife materials as the object of the study (Kusumah et al., 2022). Related enhancement quality education has been integrated with real world solving problem context, one of them is study development (Sartika, 2019). Science learning examines natural phenomena that based on scientific methods that train students' problem-solving and critical thinking skills. The scope of science learning does not only discuss facts, concepts and principles but also conducting experiments/projects to obtain discoveries (Asrizal et al., 2018). Inappropriate use of science learning models and methods by teachers who use the "lecture method" do not help the students to build their problem solving skills (Desmalinda & Festiyed, 2018). The development of research produces the outcome to improve the learning system and resources produced through education (Azizah & Astuti, 2020). The Indonesian education quality is supported by internal factors such as the diversity that Indonesia has. This including social culture, ethnicity, tradition, food and historical artifacts.

Ethnoscience based learning take the advantages of various potencies beside characters and local contents (Hadi et al., 2019; Mayasari, 2017; Walid et al., 2020). Other research also mentions ethnoscience refers to information, original from language and culture certain related with attitudes, traditions, skills, and ideas underlying local cycle growth past and present socio economic that effort for build environment combined learning with culture as part from learning science that 's called with approach ethnoscience(Kasi et al., 2020).

A number of studies show that integrated science learning approach with ethnoscience has more effect on the cognitive aspects enhancement such as self-increase, and both self and cultural awareness (Kasi et al., 2020). Other research also mentions right approach used in learning is ethnoscience due to the a strategy for in creating plans and environment learning that integrates ethnoscience in the science activity, in understanding the scientific knowledge that used by the schools, which is then transferred into scientific knowledge in a learning process (Jufrida et al., 2018; Suryanti et al., 2021; Walid et al., 2022).

Empirical evidence that prove the use the implementation of the ethnoscience approach can be used in the learning process, increase the students' learning and critical outcomes, thinking skills and scientific thinking skills of students in local culture (Fadilah et al., 2019; Hidayatullaah et al., 2021), can help students care about and preserve local wisdom(Lestari & Fitriani, 2016). Culture has a positive role in learning science in Indonesia (Syazali & Umar, 2022).

Inlight, this study this aimed at tracing the trend of ethnoscience in Indonesia. This study become valuable for the relevant researchers, educators, and interested parties in improving the education quality related with applying the ethnoscience in science learning. Furthermore , the advantages and disadvantages from the approach will be taken into account teaching the natural sciences subject at School.

The following questions were answered by this study: (1) What topics are mostly used in the ethnoscience study? (2) what is the most learning outcome? Does it becomes achievements in research ethnoscience? (3) what model are mostly used in ethnoscience science learning ? (4) what type ethnoscience science learning are mostly related ? (5) what research development model are related to ethnoscience study? (6) what level of education are mostly studied in ethnoscience?

2. Method

This study is classified as a qualitative study as it use a content analysis approach with a systematic literature review technique to find out trends in ethnoscience in learning natural sciences. The article was analyzed is a type of development research related to ethnoscience in

science learning. Since the articles from literature reviews, literature from theses or theses and experimental articles are not included in the analysis. A Systematic Review of References is a secondary study that combines findings from various primary studies to answer study questions (Newman & Gough, 2020). This study adopted the review process according to (Pahlevan-Sharif et al., 2019), namely: (1) formulating research questions; (2) determine the criteria for article review (Table 1); (3) searching for articles in various databases (Google Scholar, DOAJ) by typing the keywords "ethnoscience and" learning "science"; (4) article coding using Paper Classification Form (PCF); (5) identify the patterns over all articles; (6) synthesize these patterns to answer research questions. The coding instrument of the PCF adaptation was developed by (Kızılaslan et al., 2012). The instrument has met the requirements of validity and reliability. The collected data were analyzed by using percentage calculations.

Table 1. Criteria integrated review articles ethnoscience

Category	Criteria
Type Publication	Ethnoscience study, learning model, research model development (R&D)
Year Publication	2017- March 2022
Aspect	Science, Physics, Chemistry, Biology
Subject Study	Participant Educators and educators in all level education
Type study	empirical and theoretical

The implementation of ethnoscience approach is tend to be annually more recognizable as the last year, number measured in 2020 for 29 articles and 2021 for 27 articles.

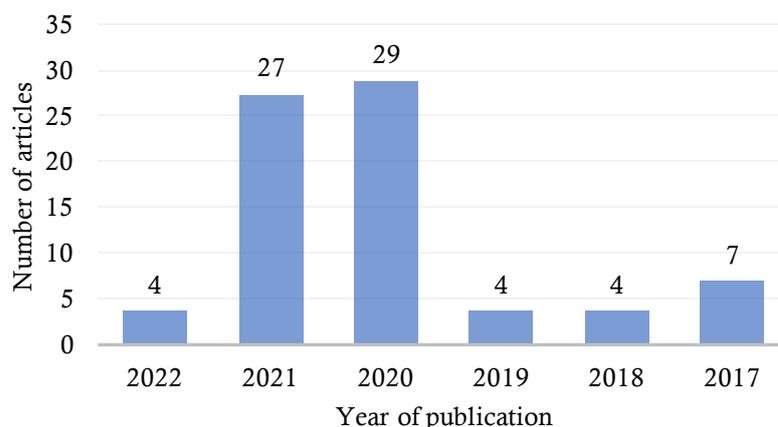


Figure 1. The Distribution of Ethnoscience articles in learning science

3. Result and Discussion

The results and discussion are written in one unit; the author is not justified based on the results and prior discussion in the form of a new chapter. How to write in the results and discussion is done directly by reviewing directly one by one, the research results obtained with relevant references and prioritizing from primary sources. The results of the study can be equipped with tables, pictures, and graphics to clarify the presentation of the research results verbally.

Topics study integrated ethnoscience

The number of the studies related to the ethnoscience study is yearly increased in Indonesia and they use various topics. This proves that ethnoscience contribute the education is related with the learners' local culture exploration . Learning ethnoscience increases scientific

literacy (Syazali & Umar, 2022; Perwitasari et al., 2016; Nadhifatuzzahro, 2019), learning ethnoscience also push participants to develop their potency, in terms of critical thinking development that is by integrating them into teaching materials (Syazali & Umar, 2022). Figure 1 shows the search results for the topics related to ethnoscience, module topics (37%) dominated ethnoscience research, then LKPD (Worksheet) topics (23%), teaching materials (11%), books (9%), and other topics such as learning tools, multimedia learning and comic media.

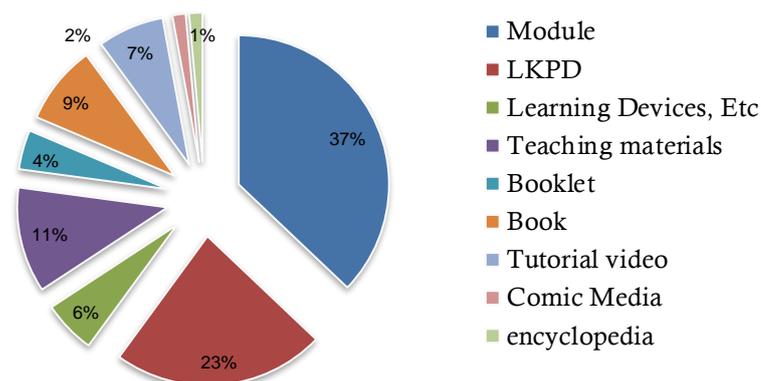


Figure 2. Research topics related to ethnoscience

Figure 2 shows that most ethnoscience researches are dominated by module topics. This finding refers to the results of research which says that to overcome learning problems, learning innovation is required by developing modules systematically ((Sella, 2022; Yunansah et al., 2022)). Learning by using appropriate teaching materials, and considering the times and conditions of the students can create a more enjoyable learning process and make students more interested in learning. The teaching materials can be in the form of modules (Kurniawan & Syafriani, 2021). The module itself is very suitable and linked with ethnoscience, it can be connected with environment and local culture (Sari et al., 2021). Through the module, students can measure their own abilities and can learn according to their respective learning abilities (Yerimadesi et al., 2017).

Integrated learning outcomes ethnoscience

The ethnoscience approach is associated with learning achievement. This is illustrated by the results obtained from the review of integrated ethnoscience learning outcomes from the development research (R&D) reviewed. Figure 3 shows that scientific literacy has 36%, critical thinking skills has 13%, creative thinking skills has 9% and problem solving has 9% .

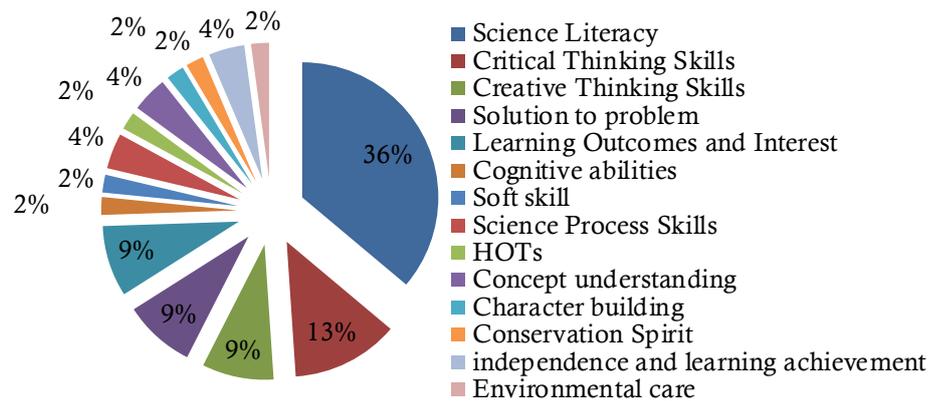


Figure 3. Learning outcomes of ethnoscience research

Figure 3 shows that scientific literacy dominates ethnoscience research. Science is related to natural phenomena in which knowledge must be explored. The literacy strategies can increase the cognitive value of students (Warlinda & Yerimadesi, 2020). Scientific literacy is used to translate natural phenomena that occur in everyday life, ethnoscience has the potential to shape the ability of students to behave well in daily life by considering surroundings or environmental conditions (Zakiyah & Sudarmin, 2022; Sriyati et al., 2022; Sahil et al., 2022). Regarding the literature review, there are still limited research reveals learning outcomes related to environmental care, conservation spirit, character education due to the limitations of educators in exploring the student potency.

Integrated ethnoscience learning model

Study development are done by learning model for support science learning, including study ethnoscience. Figure 4 shows results processing to study ethnoscience that utilizes science learning model assistance implimentation .

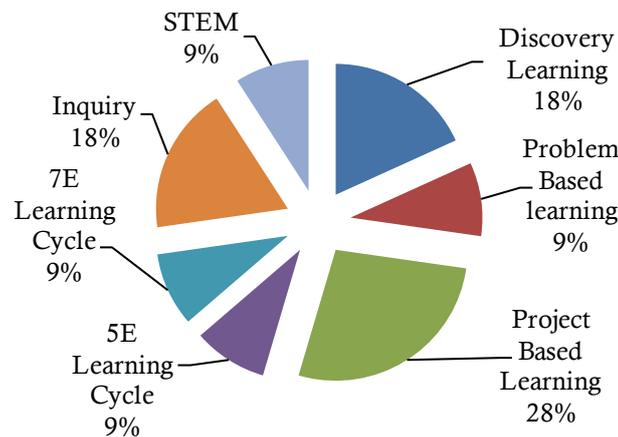


Figure 4. Model learning related ethnoscience

Figure 4 shows big part of ethnoscience study held with integrate into more advanced science learning models dominated by the project based learning model and discovery learning . Ethnoscience could be developed by to do learning that refers to a culture that can practice the education literacy. Project Based Learning (PjBL) is a learning model that uses a project in the learning process, and student-centered. The model of PjBL gives opportunities to plan their learning activities, carry out projects with a collaborative way, and produce a work product that

can be presented to others. Project Based Learning (PjBL) is an innovative learning that can encourage students to do inquiry work collaboratively within research and create a project that implements their knowledge of finding the new things, proficient in using technology and able to solve a problem (Suranti et al., 2016).

The Project Based Learning (PjBL) learning model refers to constructivist. The students build their own knowledge with the help of groups. The model contains local excellence that link science concepts to real-world contexts. As a result, it can arouse the students' enthusiasm, actively involved in learning activities. This can be useful for the development of student competence. The model was developed based on constructivist learning that requires students to construct their own knowledge (Yaron, 2003).

Type integrated science learning ethnoscience

Table 2 show results that learning biology (31%) dominate type the most science learning researched .

Table 2. Integrated science learning ethnoscience Type

No	Type Science Learning	Percentage
1	Physics	20%
2	Biology	31%
3	Chemical	16%
4	Science	29%

Ethnoscience study as part of preservation of local culture used more the field of biology. Mostly suitable field for linked with local wisdom because it studies about nature and the surroundings. The biology topics have more changes to practice science literacy, such as one of them membrane transport material and vice versa. Ethnoscience have close relationship with study on biology knowledge, biology knowledge called as living knowledge (Resmiyanto, nd).

Local wisdom has the potential to be used as an innovative biology learning resource in schools to develop students who are literate, with character, and as agents of conservation (Alimah, 2019). Biology learning integrate with local wisdom could explore the thinking potency, train and familiarize it to carry out problem solving activities that originate from local wisdom. The biology learning with problem-solving activities based on local wisdom activate students' cognitive structures to critically analyze the problems that occur in their surroundings and find solutions with a creative way which based on the values contained in local wisdom used as learning resources. The ability to think critically and creatively can be accustomed through learning biology with problem solving activities based on local wisdom.

Development research model integrated ethnoscience

Based on the developments in the world of research, research development has been adopted from various models proposed by experts. Many apply the 4D model (30%), the ADDIE model (26%), and the model according to Borg and Gall is 19%.

Table 3. Research model design development integrated ethnoscience

Development model	Percentage (%)
4D	30
ADDIE	26
Borg & Gall	19
Plomp	5
Dick and Carrey	5
Tessmer	5
Other	10%

The trend of researcher using a significant 4D development model this influenced by assumptions or perception of the researchers responding the the 4D model as the simplest model 4D model development is a more concise development but includes a complete development process. The define stage has equality with analysis. The develop stage includes validation, revision, implementation and evaluation activities. 4D ends the activity by implementing dissemination activities (Mulyatiningsih, 2016).

Integrated education level ethnosience

Destination study is to uncover development ethnosience study in Science learning in Indonesian Education for all level of education. Review results proves that 73 articles show high school level more (40%), followed by junior high school (36%), elementary school (17%), college (4%), and vocational school (3%).

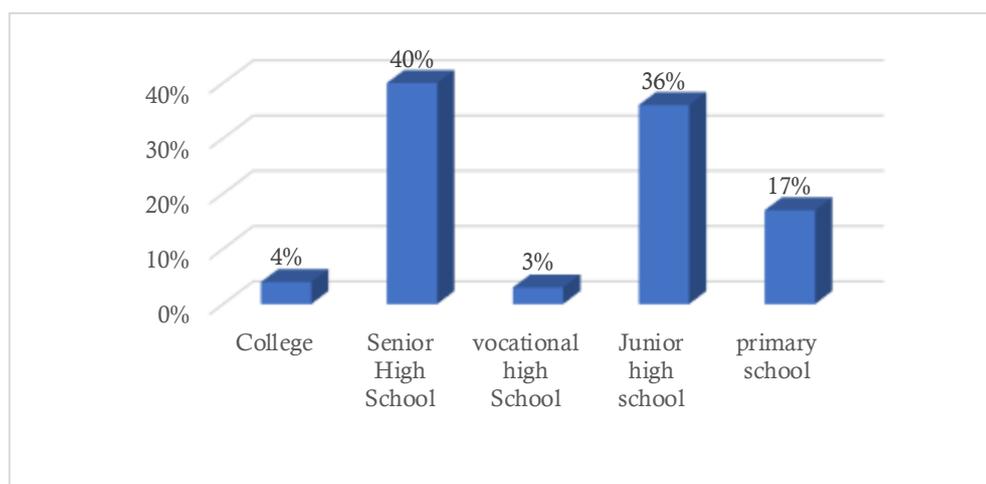


Figure 5. Educational levels related to ethnosience research

Figure 5 shows the high school level dominations. This results is in accordance with theories in Senior High School class XI temperature and heat based on ethnophysics that could add outlook participant educate related integrated material with local wisdom, making the learning Becomes more interesting and the learner more close with environment (Sari et al., 2021; Endang, 2022; Dwi, 2022). Multicultural education based on local wisdom must be taught to students through overall learning in each subject at school (Banks & Banks, 2019)

4. Conclusion

The ethnosience approach in science learning contributes very well to preserving local culture so that students can develop scientific literacy and reintroduce the culture. Nowadays learning is no longer emphasizes understanding, but on critical, creative thinking and problem solving skills by using various learning models such as project based learning and discovery learning models in the field of science learning starting at elementary, junior high school, senior high school or college levels.

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