Analysis of the Feasibility and Effectiveness of Ethnoscience-Based Science Learning Tools for Improving Students' Science Literacy: A Review

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Abstract: In the 21st century, cultural values among students began to fade due to the development of increasingly sophisticated technology, so that efforts are needed to reintegrate these cultural values through learning or known as ethnoscience-based learning. This study aims to analysis of the feasibility and effectiveness of ethnoscience-based science learning tools for improving students' science literacy. This research is a literature study or literature review of the research results of various articles on science literacy skills in ethnoscience-based science learning. The articles reviewed are articles obtained from various journals both national and international journals. This study reviewed as many as 25 articles however, in this article reducing back. So that 16 articles will be discussed, 16 articles are articles published in the last 5 years. Based on the results of the literature review that has been done that ethnoscience-based science learning is categorized as feasible and effective in science learning.

Keywords: Ethnoscience; Effectiveness and Feasibility; Science Literacy; Science Learning.

Introduction

Science is a collection of knowledge, ways of thinking, and investigation. Science is seen as a process as well as a product, so that in learning teachers must consider effective and efficient learning strategies and methods (Sari, 2020; Lubis et al., 2021). According to Sumarni (2018) that science learning will be better if students can utilize their experiences through the application of learning tools.

The tools prepared by teachers to support the learning process well are learning tools consisting of syllabus, lesson plans, students worksheet, media, and test instruments (Sahidu, 2019; Kriswanti et al., 2020). The development of physics learning tools is expected to be in accordance with current learning demands that are oriented towards cultural values.

According to Sudarmin (2018) culture-oriented learning or called ethnoscience is the knowledge of local people about certain cultures and traditions as a form of local wisdom that can be tested scientifically. Ethnoscience learning is a learning approach that links learning materials with the culture that exists in the surrounding environment as an object of science learning. However, ethnoscience-based learning is still rarely implemented by teachers which causes low science literacy of students (Hadi., 2019; Hikmawati, 2021).

Based on the results of the PISA survey (2018), Indonesia is in the sixth position from the bottom or 74th from other countries. The low science literacy experienced by students is due to: lack of maximum mastery of learning so that students' competencies are not achieved, the lack of seriousness of students in learning, facilities that do not support the learning process both in the classroom and outside the classroom, unorganized science learning process (Adnan et al., 2021). In addition, another factor in low science literacy is that teachers do not develop learning tools that suit the needs of students, so learning is less effective (Dewi

et al., 2019: Nuroso et al., 2018). Therefore, the author tries to analyze the effectiveness of ethnoscience-based learning tools on improving students' science literacy skills.

Method

This research is a literature study or literature review of the research results of various articles on science literacy skills in ethnoscience-based science learning. The articles reviewed are articles obtained from various journals both national and international journals. This study reviewed as many as 25 articles however, in this article reducing back. So that 16 articles

will be discussed, 16 articles are articles published in the last 5 years.

Result and Discussion

This study is a qualitative research that examines the feasibility and effectiveness of ethnoscience-based science learning tools on students' science literacy skills. This article was reviewed as many as 25 articles, but reduced back to 16 related articles. The articles reviewed are national and international standard articles. Therefore, the results of the review of articles on the feasibility and effectiveness of ethnoscience-based science learning tools on students' science literacy can be seen in Table 1.

Table 1. Results of Review Articles on the Feasibility and Effectiveness of Ethnoscience-Based Science Learning Tools for Improving Students' Science Literacy Skills.

Author	Year	Article Title	Feasibility Score %	Effectiveness Score %
Hastuti, et al.	2022	Scientific Literacy Assessment Instrument on Addictive Substances Topic in Ethnoscience Integrated Inquiry Based-Learning	96 Very Valid 75 Reliable	_
Dewi, et al.	2020	The Development of Ethnoscience Based Acid-Base Modules to Improve Students' Scientific Literacy Ability	80 Valid 87 Reliable	0.40 (Medium)
Atmojo, et al.	2019	Science Learning Integrated Ethnoscience to Increase Scientific Literacy and Scientific Character	_	0.81 (High)
Permataningsih, et al.	2020	Pengembangan Bahan Ajar IPA Smp Topik Klasifikasi Materi Dan Perubahannya Untuk Menunjang Literasi Sains	80 Valid	_
Ain & Mitarlis	2020	Pengembangan LKPD Berorientasi Inkuiri Terbimbing Untuk Meningkatkan Literasi Sains Pada Materi Faktor- Faktor Yang Mempengaruhi Laju Reaksi	89.63 Very Valid	0.75 (High)
Dewi	2019	Improving creativity of prospective chemistry teacher through chemoentrepreneurship oriented inquiry module on colloid topics	_	0.50 (Medium)
Melyasari, et al.	2018	Scientific Literacy Skill of Junior High School Student Using Ethnoscience Based Learning	_	0.56 (Medium)
Oktaviana, et al.	2018	Pengembangan Modul Fisika Berintegrasi Kearifan Lokal Membuat Minyak Lala Untuk Melatih Karakter Sanggam	79.41 and 78.20 Moderately Valid	0.89 (High)
Perkasa	2018	Bahan Ajar Berorientasi Environmental Sustainability Education Berintegrasi Kearifan Lokal Untuk Meningkatkan Literasi Sains Mahasiswa	_	0.78 (High)

| Author	Year	Article Title	Feasibility Score %	Effectiveness Score %
Setiawan, et al.	2018	The Development Of Local Wisdom-Based Natural Science Module To Improve Science Literation Of Students	87.5 - 91.7 Very Feasible	0.40 (Medium)
Sudarmin, et al.	2018	The influence of inquiry learning model on additives theme with ethnoscience content to cultural awareness of students	_	0.81 (High)
Nabila, et al.	2021	Pengembangan Modul IPA Berbasis Etnosains Pengolahan Kopi Untuk Meningkatkan	82 Valid	0.40 (Medium)
Dwi, et al.	2018	Kelayakan Buku Ajar Berbasis Etnosains Pada Materi Pencemaran Lingkungan Untuk Melatihkan Berpikir Kritis Siswa Smp	91.25 Very Valid	_
Adnan., et al.	2021	Scientific Literacy Skills of Students: Problem of Biology Teaching in Junior High School in South Sulawesi, Indonesia	_	0.81 (High)
Lubis, et al.	2021	Pengembangan Modul Pembelajaran Ipa Berbasis Etnosains Materi Pemanasan Global Untuk Melatih Kemampuan Literasi Sains Siswa SMP	Material 72 (Feasible), Media 96.25 (Very Feasible), and Language 93 (Very Feasible).	_
Latifah, et al.	2018	Pengembangan Lembar Kegiatan Siswa (LKS) Berorientasi Literasi Sains Pada Materi Pembelajaran Termokimia Kelas Xi Sma	Content 91.67 (Very Valid), Construct 93.34 (Very Valid) Presentation 90 (Very Valid) and Language 91.42 (Very Valid).	_
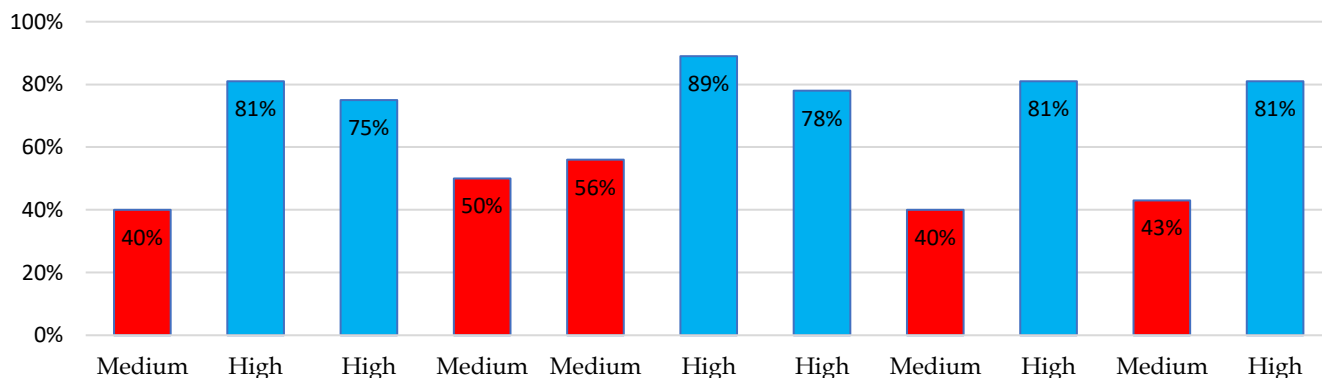
Figure 1. The effectiveness of ethnoscience-based learning tools on science literacy skills.

Based on Table 1, discussing the feasibility and effectiveness of ethnoscience-based science learning tools on students' science literacy skills. The feasibility value is based on the validity test value and reliability test. The validity test obtained the highest score of 96% with a very valid category and a medium score of 74.91% quite valid category. For the Reliability value obtained with the highest score of 87% and a score of 75%. Therefore, based on the validity and reliability scores obtained that ethnoscience-based learning tools are feasible to use in learning, especially science learning.

The effectiveness value of ethnoscience-based science learning tools can be seen in Figure 1. It is found that ethnoscience-based science learning is effective with

the highest value of 89% and a medium value of 40%. This shows that ethnoscience-based science learning can improve students' science literacy. This is in accordance with the opinion of Najib (2018) that community knowledge of local wisdom in their area can be used and applied to learning.

In addition to analyzing the feasibility and effectiveness of this article will discuss what is meant by science literacy and the relationship between science learning and ethnoscience.

Science Literacy

Science literacy is an activity to read, analyze, assess, and review existing information. Science literacy also means something that can increase students' awareness of themselves and the environment around them (Bagasta, 2018; Ahmad, et al., 2020). Meanwhile, according to the PISA framework (2018), it is scientific knowledge to be able to identify questions, obtain new knowledge, explain scientific phenomena, and draw conclusions based on facts, and understand the characteristics of science.

Based on the framework according to PISA (OECD, 2018) that science literacy has characteristics that must be mastered by educators, namely: *Context* is an activity that must be understood by students regarding the natural conditions around them. The purpose of this activity is so that students can apply or apply science learning that can solve real problems. An example of a problem is global warming. So that PISA divides 3 parts in the context of science, namely life and health, earth and environment, and technology. *Science competency* is an activity that provides encouragement for active learners in learning. Because in this activity learners explain scientific phenomena, evaluate and design scientific investigations, and interpret scientific data and evidence. *Science knowledge* is a very diverse concept or problem. Therefore, it is expected that learners can connect existing problems with science. In science knowledge forms content knowledge, procedural knowledge, and epistemic knowledge. Content knowledge is scientific knowledge that discusses knowledge about the natural world. Procedural knowledge is an activity that discusses steps such as the concept of variables, and the concept of measurement. and epistemic knowledge is knowledge about defining an important role in the process of building scientific knowledge based on hypotheses, theories, and observations. *Attitudinal knowledge* is an activity that evaluates students' attitudes to science in three areas, namely science interest, assessing science approaches and environmental awareness.

Linkage of Ethnoscience-Based Science Learning

Ethnoscience is natural knowledge, namely forms of language, customs, culture, morals and also technology created by certain people or people who have natural knowledge. The ethnoscience approach is the reconstruction of the original science that exists in society to become natural science (Sudarmin, 2018; Hastuti et al., 2022). Ethnoscience is part of the activities that combine or transform between indigenous science and scientific science. Indigenous science knowledge is all knowledge about the facts of community life. This knowledge comes from the beliefs or perceptions of the community that have existed from generation to generation that are not structured and systematic towards a certain natural phenomenon.

Nuralita (2020) said that Ethnoscience is a learning approach that links learning materials with the culture that exists in the surrounding environment as an object of science learning. Ethnoscience-based learning that does not separate cultural science and local wisdom from society can also be used as a learning approach to increase students' reading interest, motivation and creative thinking skills towards science.

An example of the implementation of ethnoscience in science learning is research conducted by Nabila et al., (2021) related to ethnoscience in coffee processing which is constructed from community knowledge (indigenous science) into scientific science concepts. One of the ways or steps of coffee processing is drying, in the knowledge of the community this drying is done using braids. Scientifically, using braids can reduce the evaporation of water heat from the ground so that evaporation does not directly hit the coffee.

Therefore, based on examples of the implementation of ethnoscience in science learning, the way to realize it is by determining themes related to cultural knowledge (ethnoscience), determining materials based on the cultural themes raised, and determining basic competencies.

Conclusion

Based on the results of data analysis carried out as many as 25 articles, only 16 articles were used. The 16 articles discuss the acquisition of the feasibility and effectiveness of ethnoscience-based science learning tools with a value of 96.00% very valid and 74.91% quite valid category, while the reliability is 87% and 75%. For the effectiveness value of 89.00% and 40.00%. From the acquisition of feasibility and effectiveness values, it can be concluded that ethnoscience-based learning can improve the science literacy of students. The way to implement ethnoscience-based learning is by determining the theme, determining the material based on the theme, and determining the basic competencies.

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