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How is The Effectiveness of Ethnoscience-Based Modules in Science Learning in Indonesia?: A Systematic Literature Review

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abstract

This research aims to determine the effectiveness of ethnoscience-based science modules in Indonesia for junior high school students. The research method used is a systematic literature review using digital libraries, namely Google Scholar, Scopus, Eric, and Garuda. In this research, several stages were carried out, such as literature search strategies, selection procedures, data extraction, and data analysis. So that the selected literature is relevant, the search uses the keywords "module, ethnoscience, science". Next, a screening was conducted to obtain scientific article publications from 2020 to 2024. Based on keywords, 1990 articles were selected based on exclusion and inclusion criteria, resulting in 21 relevant articles. The results of this research are that the development of ethnoscience-based modules mostly uses ADDIE and 4D models, and materials that are widely used in developing ethnoscience-based science modules are additive and additive materials. It can be seen that ethnoscience-based science modules are effective in improving 21st-century skills. That is it, the results of this research open up good opportunities for new researchers to study this topic further and serve as a reference for researchers and teachers.

1. Introduction

Indonesia is a pluralistic country of various tribes, races, languages, religions and cultures. It has much diversity, including culture (Lintang & Najicha, 2022). Cultural diversity is a wealth and beauty for Indonesia (Fuziani et al., 2021). Indonesia is known for its many ethnic groups, which have given birth to different cultural patterns and become group identities (Nurfalah et al., 2023). Indonesia has a vibrant cultural heritage due to its diverse ethnic population and rich culture (Anista et al., 2023). Thus, it can be understood that diversity in Indonesia covers various aspects such as viewpoints, customs, cultural values, ethics and belief systems, but many differences shape the identity of each community group. Practical education cannot be separated from cultural values. Culture is part of education. The two are closely related because they complement and support each other (Widyastuti, 2021).

Education is a conscious effort to realize cultural heritage from one generation to another (Hidayah et al., 2023). Education is realized in a learning atmosphere and learning process so that students actively develop their potential for religious, spiritual strength, self-control,

personality, intelligence, noble morals, and the skills needed by themselves and society (Rahman et al., 2022). Learning is a process of interaction between students and educators in a learning environment (Syafrin et al., 2023; Ubabuddin, 2019). So, learning is a process to help students learn well. In the entire educational process, learning is the most important activity (Bararah, 2020; Miasari et al., 2022). This means that a person's success in achieving educational goals really depends on how learning can take place effectively (Zohriah et al., 2023). Learning is assistance provided by educators so that the process of acquiring knowledge and insight, mastering skills and habits, and forming attitudes occurs (Putra et al., 2024). Learning is the process of managing and organizing the environment around students so that it grows and encourages students to carry out the learning process (Firmansyah & Triwahyuni, 2022). So, learning can be called the process of providing guidance and assistance to students in the learning process. Teachers act as mentors for a small number of students who have problems (Firman & Anhusadar, 2022). There are many differences in learning, such as in digesting lesson material, there are students who have difficulty digesting lesson material. Given these differences, teachers must be able to adapt according to student needs (Gunawan et al., 2020).

Natural Sciences is a field of learning consisting of physics, chemistry, and biology. By studying science, students can get to know the surrounding environment and all its contents through various activities carried out by students in learning activities (Lusidawaty et al., 2020). Science learning is a way of finding out about the natural environment systematically, so that science is not just mastery of skills, knowledge in the form of facts, concepts, or principles, but is also a process of discovery through experimentation in the learning process (Muliadi et al., 2022).

Science learning is learning that allows students to gain direct experience so that it can increase students' strength in accepting, retaining, and applying the concepts they have learned. Science is built based on scientific products, processes, and attitudes (Orni et al., 2023). However, science learning is often difficult to understand (Hidayah et al., 2023; Imanuel, 2020; Sudewiputri, 2019; Yunarti, 2021). This can also be seen from the unsatisfactory learning outcomes of students (Ramadhanti et al., 2020; Zannah & Zulfadewina, 2022). In several educational units, students appear less enthusiastic about participating in learning (Adnyani et al., 2020; Afriana & Prastowo, 2022; Suryani, 2023). So to support learning activities, teachers must be able to design learning media (Susilo, 2020). The existence of learning media can help teachers explain abstract material more concretely, besides that, the existence of learning media can make students understand the learning material more quickly (Magdalena et al., 2021; Nurfadhillah et al., 2021; Shoimah, 2020; Wulandari et al., 2023). Therefore, teachers must use learning media in every activity (Mulyawati et al., 2022; Putro et al., 2020).

One of the learning media that teachers can use in contextual science learning activities is ethnoscience-based modules. Ethnoscience-based modules are teaching materials designed by integrating local knowledge and culture (ethnoscience) into the learning process (Nelmi & Amini, 2023). This module combines modern scientific concepts with the local community culture's values, practices, and knowledge. The goal is to make learning more relevant and contextual for students so that they can understand science better through examples and experiences close to their daily lives.

Although ethnoscience-based modules can support the independent learning process, they will guide students to conduct research independently regarding problems in the form of the surrounding culture (Wulandari et al., 2023). However, teachers in learning activities rarely apply local wisdom-based modules in learning activities, and apply ethnoscience learning. Science learning using an ethnoscience approach is rarely applied because it is less than optimal in exploring and integrating science material into scientific science (Suryani et al., 2023). Apart from that, there is a lack of teacher understanding regarding ethnoscience

learning (Rikizaputra et al., 2021). So it is necessary to conduct a study regarding the effectiveness of this ethnoscience-based module to provide new knowledge for teachers regarding the many benefits of using ethnoscience-based modules.

From the description of the problem above, researchers are interested in conducting a systematic review of journals, theses, and dissertations regarding the effectiveness of ethnoscience-based modules in science learning. Systematic reviews are used to synthesize various relevant research results to improve previous research evidence, as well as represent information from various problems contained in research. A systematic review is necessary to provide a clear picture of trends, key findings, and assessments in previous research. The novelty of this research lies in exploring the extent of research regarding the effectiveness of ethnoscience-based modules in junior high school science learning that has been carried out in Indonesia. Science subjects are fundamental, because they contain material related to methods of finding out about nature systematically. It is hoped that the results of this systematic review will be able to provide a common perspective on the overall results.

2. Method

This research is a literature review research (Snyder, 2019), using the PRISMA method or what is known as Preferred Reporting Items for Systematic Reviews and Meta-analyses (Page & Moher, 2017). The literature stage is based on Research Questions so that the discussion is more focused and makes it easier for researchers to find related data. The Research Questions (RQ) in this study are presented in Table 1.

Tabel 1. Research Question

Number	Question	Analysis is sought
1	How many ethnoscientist-based modules have been developed by researchers in the last five years?	At this stage, researchers analyzed the number of ethnoscience-based modules that researchers had developed in approximately the last five years
2	What is the effectiveness of ethnoscience-based modules in the learning process at junior high school level?	At this stage the researcher analyzed the effectiveness of ethnoscience-based modules in the learning process at junior high school level through previous articles
3	What are the development research models that are widely used in developing ethnoscience-based modules?	At this stage the researcher analyzes the development research model used in the research
4	What materials were applied by previous research regarding the use of ethnoscience-based modules in the learning process at junior high school level?	At this stage the researcher carried out an article analysis regarding what material was applied to interactive multimedia media in the learning process at the junior high school level

Search Strategy

Search for articles through digital libraries, namely scopus, google scholar, eric, and garuda. The selection of these four databases was due to several reasons. First, Scopus is one of the largest databases that includes high-quality journals in various scientific fields. With broad coverage and strict evaluation, Scopus is the main choice for searching for trusted and internationally indexed scientific references. Second, Google Scholar provides easy access to various scientific publications around the world. With easy searches and broad coverage, Google Scholar is suitable for finding references from various sources, including journal articles, books,

research reports, and others. Third, ERIC (Education Resources Information Center) is a special resource for the education sector that provides access to journals, research reports and other resources. ERIC is ideal for researchers who focus on education. Fourth, Garuda (Digital Reference Garba) is Indonesia's national repository that provides access to local academic publications. For researchers looking for references from Indonesian scientific works, Garuda is a very relevant source.

Using a combination of these databases allows researchers to obtain references that are credible, diverse, and relevant to the field of study being researched. However, this is also guaranteed by the specific constraints of a defined set of search criteria and procedures. The search was based on articles published between 2020 until 2024. The following keywords were taken: module, ethnoscience, science learning.

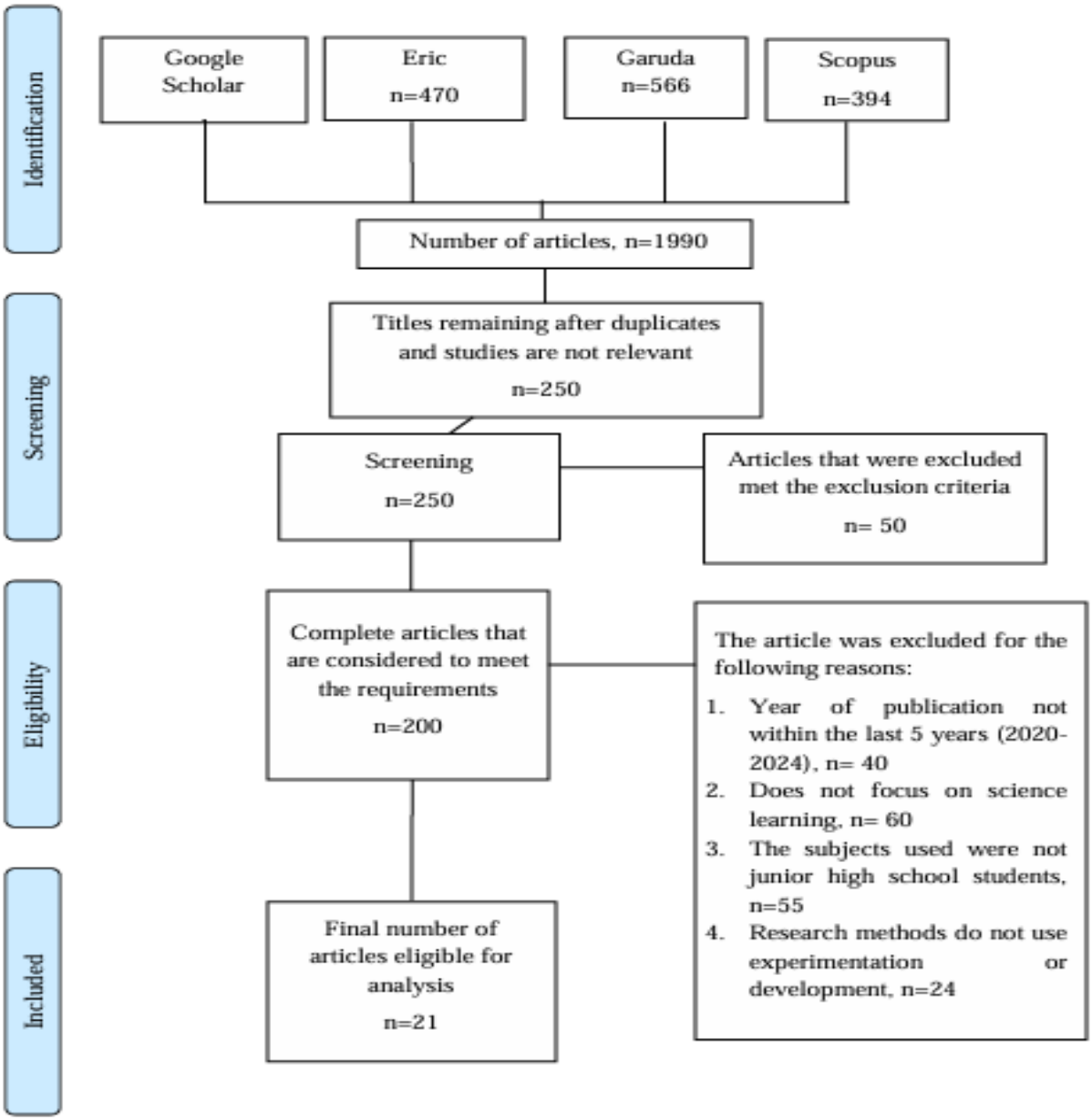

Figure 1. Research procedure

Selection procedure

The selection process considers inclusion and exclusion criteria in the title, abstract and content. The inclusion and exclusion criteria for selecting relevant articles to consider the performance of this research showed in Table 2.

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	1) Research articles published in 2020-2024, 2) Research topics include science learning, 3) Research subjects are limited to junior high school level, 4) The research article method is in the form of experimentation and development. Specifically for development articles, researchers only select articles that carry out research up to the field trial stage.
Exclusion Criteria	1) Publications whose complete text is not available. 2) Studies outside the educational context. 3) Learning that does not involve teachers.

Data extraction

Based on the PRISMA declaration guidelines, a flow diagram has been prepared showing the selection process carried out in this study, according to the measures of identification, screening, eligibility and inclusion (Moher et al., 2009).

Data analysis procedures

In the analysis process the data is entered into a spreadsheet, where the information taken from the paper is identified and arranged in columns based on the following topics: title/author/periodical and year of publication; method; results/conclusions; materials, and their effectiveness.

3. Result and Discussion

Based on the systematic literature review that was carried out, 21 articles were found that were worthy of analysis. The articles used are articles originating from Indonesia because this research is about developing modules based on local wisdom for junior high school students in science learning in Indonesia. The number of developments in ethnoscience-based modules in science learning can be seen in Figure 2.

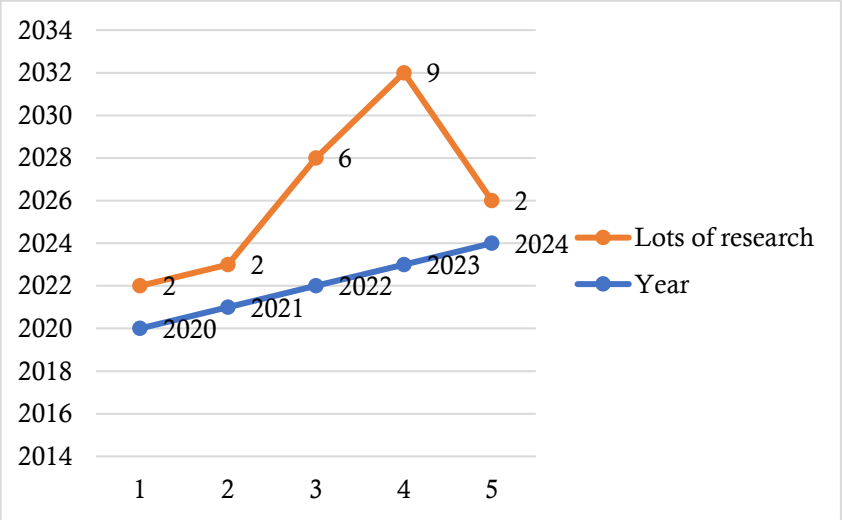

Figure 2. Development of ethnoscience-based modules for 2020-2024

In approximately the last 5 years, research on the development of ethnoscience-based modules that were tested up to the implementation stage in science learning only amounted to 21 articles with details of the most people carrying out module development up to the implementation stage, namely in 2023 there were nine studies and in 2024 there were only two studies. This directly states the need to develop ethnoscience-based modules in science learning and see how effective the modules developed are. As is known, ethnoscience-based modules have many benefits, such as supporting the independent learning process, so that they will guide students to carry out independent research related to problems in the form of the culture around students, so that they can improve students' critical thinking skills (Wulandari et al., 2023). Then, in the last five years of research into developing ethnoscience-based modules in science learning to train 21st-century skills, this can be seen in Table 3. The effectiveness of the learning module in Table 3 can be visualized in Figure 3.

Table 3. Effectiveness of ethnoscience-based modules in science learning

Number	Effectiveness	Reference
1	Scientific literacy	(Juwita et al., 2023; Laila, 2022; Lubis et al., 2021; Mardianti et al., 2020; MUNA, 2023; Nihwan & Widodo, 2020)
2	Science process skills	(Nuryah et al., 2022; Nur Ni'mah et al.,, 2023)
3	Character	(Putri et al., 2023)
4	Critical thinking	(Farida, 2023; Ihsan & Pahmi, 2022; Kristiyaningsih & Febrianti, 2024; Nabil et al., 2021; Riska et al., 2024; S. I. Wulandari et al., 2023)
5	Learning outcomes	(Nabila et al., 2023; Aprila et al., 2023; R. U. Dewi, 2022; SIDDIQ, 2022)
6	Understanding of concepts and entrepreneurship	(Agustia, 2023)
7	Scientific Creativity	(Aninnas et al., 2023)

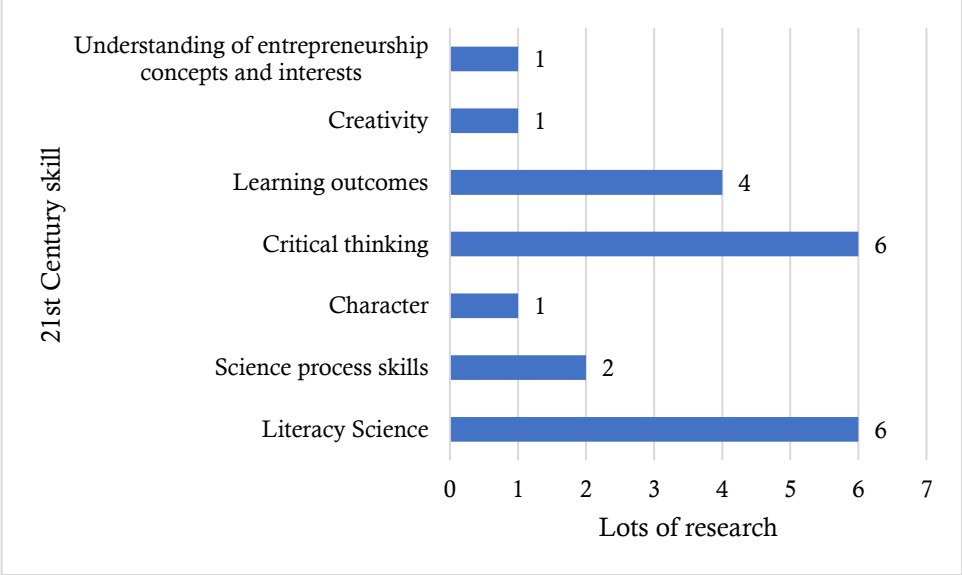

Figure 3. Module Effectiveness

In Table 3 and Figure 3, it can be seen that so far, researchers who have developed ethnoscience-based modules in science learning have only tested effectiveness in the form of scientific literacy, science process skills, character, critical thinking, scientific creativity, learning outcomes, and understanding of concepts and entrepreneurship. It can be seen that most of the

modules developed test students' scientific literacy abilities and critical thinking skills at school. There is much research that trains critical thinking skills because critical thinking skills are important to train so that students can solve problems in everyday life (Setiadi & Elmawati, 2019; Suryanti et al., 2018)**.** Then, many studies train scientific literacy through ethnoscience-based modules due to several reasons, namely the decline in Indonesia's PISA scores (Wijaya et al., 2024), contextual ethnoscience learning is considered capable of increasing scientific literacy (Dewi et al., 2019; Lasmana, 2024), scientific literacy can foster critical thinking and skills in solving problems creatively (Popova & Jones, 2021), and encourage curiosity and creativity (Adnan et al., 2022). Although many studies measure scientific literacy and critical thinking skills in developing ethnoscience-based modules in science learning, several studies measure other skills in module development. The development of ethnoscience-based modules uses various research methods, as shown in Figure 4.

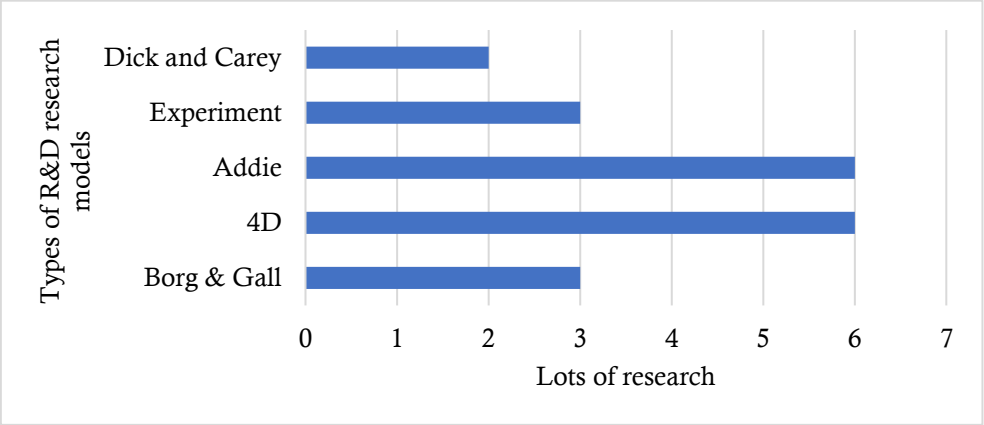

Figure 4. Ethnoscience-based module development method

Figure 4 shows that the types of development research that are often used in research or frequently used in research are the 4D and ADDIE models. The 4D and ADDIE models are often used because they have straightforward and structured stages, from planning to evaluation. This makes it easier for researchers to follow the steps that have been set. The choice of the Four-D model was due to its advantage that it does not take a long time because the stages are relatively not too complicated (Johan et al., 2023). Then the Addie model has advantages such as having a straightforward, structured development procedure and having a logical sequence of stages (Rachma et al., 2023). The materials often used in developing ethnoscience-based modules in science learning are listed in Table 4.

Table 4. Material in developing ethnoscience-based modules in science learning

Number	Material	Reference
1	Environmental pollution	(Ihsan & Pahmi, 2022; Mardianti et al., 2020)
2	Additives and addictive substances	(Aninnas et al., 2023; Dewi, 2022; Farida, 2023; Kristiyaningsih & Febrianti, 2024; Laila, 2022; Nuryah et al., 2022; Siddiq, 2022)
3	Wave and sound vibrations	(Putri et al., 2023; Riska et al., 2024)
4	Heat and its transfer	(Nabil et al., 2021)
5	Global warming	(Lubis et al., 2021)
6	Substances and their changes	(S. I. Wulandari et al., 2023)
7	Temperature and heat	(MUNA, 2023)

Number	Material	Reference
8	Land and the survival of life	(Nihwan & Widodo, 2020)
9	Biotechnology	(Nabila et al., 2023; Aprila et al., 2023; Juwita et al., 2023)
10	Material and its changes	(Agustia, 2023; Ni'mah & Noor, 2023)

The choice of material in developing ethnoscience-based modules or teaching materials is important. It is necessary to carry out a curriculum or material analysis to determine whether the material used follows the local wisdom used in the module. The following is a visualization image of Table 4 in graphic form.

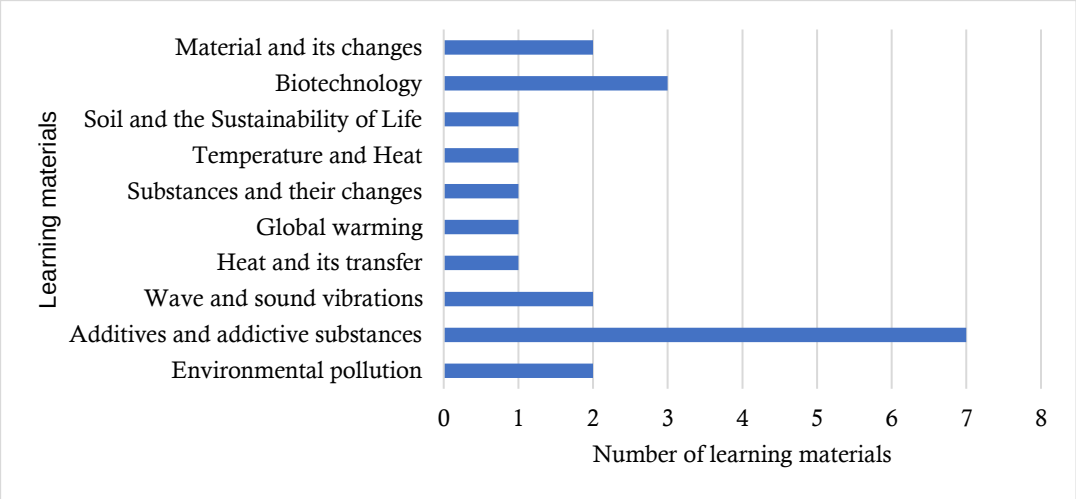

Figure 5. Learning Materials

From Figure 5, it can be analyzed that many researchers have developed ethnoscience-based modules using additives and addictive substances. The selection of this material is, of course, carried out by analysis in development research to find material based on local wisdom. Apart from that, additive material is a material that is difficult to study (Kiki et al., 2021; Ratnawati, 2021). Ethnoscience-based modules can actively involve students in learning (Idul & Fajardo, 2023; Mardianti et al., 2020; Syahmani et al., 2022). The module consists of learning activities to help students achieve formulated goals. With the studies on the development of ethnoscience-based modules, it is hoped that future researchers will innovate in developing modules or e-modules from previous research.

4. Conclusion

This research concludes that ethnoscience-based modules effectively support Natural Sciences (IPA) learning at the junior high school level. Research conducted through a systematic literature review of 21 scientific articles shows that ethnoscience-based modules can improve 21st-century skills such as scientific literacy, critical thinking skills, conceptual understanding, scientific creativity, and student learning outcomes. Ethnoscience-based modules often use the ADDIE and 4D development models because of the clarity of the stages and logical structure. Materials often used in ethnoscience-based development modules are additives and those relevant to the local cultural context. Integrating local cultural values into learning makes students understand scientific concepts better and fosters a sense of connection with their own environment and culture. The results of this research highlight the importance of developing ethnoscience-based teaching materials and encourage researchers and teachers to continue to explore the use of this

module more widely, including its application in various local contexts in Indonesia. This is expected to improve science learning holistically.

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