



Ethnoscience-Based Digital Learning Media in Science Learning for Junior High School Students: A Systematic Review of the Literature

Dewi Khoirun Nisa¹, Fikri Natadiwijaya², Asri Widowati³

^{1,2,3} Universitas Negeri Yogyakarta, Indonesia

Corresponding Author:  dewikhoirun.2025@student.uny.ac.id

ABSTRACT

Ethnoscience-based digital learning media in science learning is an innovation that integrates science with local culture. This study aims to identify what digital media are used to integrate ethnoscience, relevant science topics, impact on aspects of learning outcomes, and challenges in implementing ethnoscience-based digital media through a systematic literature review using the PRISMA guide. Of the 271 articles identified, 13 articles were selected based on inclusion and exclusion criteria. The results of the study show that ethnoscience-based digital media is effective in improving concept understanding, science literacy, science process skills, motivation, environmental literacy and cultural literacy. The integration of local culture in digital media helps students connect science concepts with everyday life, thus creating more relevant and meaningful learning. However, challenges such as limited technological infrastructure, teacher readiness, and student adaptation to digital learning are still major obstacles. Collaboration between educators, educational institutions, and governments is needed to overcome these constraints, by providing adequate training and resources.

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INTRODUCTION

21st century education demands continuous innovation and adaptation of learning strategies to equip students with essential skills such as critical thinking, creativity, collaboration, communication, science literacy, and digital literacy (Hughes et al., 2022). Teachers act as facilitators who not only deliver material, but also create an active learning atmosphere and support student engagement through various learning models and media (Masrurroh et al., 2022). The implementation of contextual and interactive learning is urgently needed to address the dynamics of student needs in the junior high school environment. Digital learning media, such as e-modules, interactive videos, mobile learning, augmented reality and web-based applications, are important

means to increase students' motivation, engagement, and understanding of scientific concepts. Through its interactive and adaptive characteristics, digital media is able to facilitate a more contextual and engaging learning experience compared to conventional media. However, the use of digital media in general nature often does not pay attention to cultural aspects and local contexts that are close to students' lives (Dewi et al., 2022).

The integration of ethnoscience in science learning becomes relevant and strategic. Ethnoscience is local knowledge that is rooted in the values, practices, and wisdom of the community in understanding nature and the surrounding environment. The integration of ethnoscience in science learning not only functions as an effort to preserve culture, but also as a pedagogical approach that is able to relate the concept of modern science with the real experience of students. Through the ethnoscience approach, students are invited to interpret science as part of their daily lives that are in harmony with the cultural values and traditions of their society.

Along with technological advancements, various innovations in ethnoscience-based digital learning media have emerged. This media incorporates elements of local culture into digital content, both in the form of visuals, narratives, traditional experiments, and scientific simulations based on local contexts. It is important to emphasize that the integration of ethnoscience in science learning is not just for cultural preservation efforts, but also for effective pedagogical strategies to increase the relevance and motivation of students' learning. Ethnoscience-based digital learning media has been proven to strengthen students' connection with local cultural practices and explore the concept of science contextually and applicatively (Alannawa & Hidayati, 2021; Aprina et al., 2024). Recent research notes that science learning with an ethnoscience approach has a positive impact on understanding concepts, scientific attitudes, and fostering a sense of pride and concern for local culture among students.

Although research on ethnoscience-based digital media has developed, there has not been a comprehensive synthesis that maps the connection between science topics, the impact of achievements, and implementation challenges in junior high schools. Therefore, a Systematic Literature Review (SLR) is needed to identify and synthesize existing research findings, so that it can provide a comprehensive picture of the direction of the development of ethnoscience-based digital media in science education. Systematic mapping is urgently needed to strengthen the direction of development, validation and utilization of digital media relevant to ethnoscience in science learning in junior high school. The results of this SLR are expected to contribute theoretically to

the development of science education, as well as become a practical reference for educators in designing learning media that are contextual, cultural-based, and relevant to the learning needs of the 21st century.

RESEARCH METHOD

The method used in this study is Systematic Literature Review using PRISMA (Preferred Reporting Items For Systematic Literature Reviews) guidelines and Meta Analysis (N. Dewi & Dasari, 2023). This research method is carried out by: reviewing and identifying journals or articles systematically by following various steps that have been set. This study applies four stages, namely search strategy (identification), selection criteria (screening), quality assessment (feasibility), and data extraction (inclusion)(Alannawa & Hidayati, 2021)). The first stage is to choose the theme/title to be researched, the second stage is to formulate the problem in the form of questions or so-called research questions. The research questions and Research Questions (RQ) of this study are: RQ1: What are the types of ethnoscience-based digital learning media developed in science learning in junior high school? What biology topics are covered in ethnoscience-based e-modules? RQ2: What science topics are integrated in ethnoscience-based digital learning media for junior high school students? RQ3: What is the impact of the implementation of digital learning media on aspects of student learning outcomes? RQ4: What are the challenges faced in implementing ethnoscience-based digital media in science learning? The next stage is to create inclusions and exclusions. The inclusion criteria or criteria specifically used in this study are:

Table 1.

Inclusion and Exclusion Criteria

Categories	Inclusion Criteria	Exclusion Criteria
Year of publication	Year 2020-2025	Less than 2020
Research subjects	Junior high schools relevant to ethnoscience-based digital learning media	Basic and upper middle skewing Irrelevant journals or articles
Types of publications	Articles published in journals	Articles published in conference proceedings, books, websites, blogs,

The next stage is the creation of databases and keywords. The databases used in the process of searching for journals or reference articles are Scopus and crossref. Keywords used in the scopus search engine and crossref using boolean

search "(ethnoscience OR "local wisdom" OR "indigenous knowledge") AND ("learning media" OR "multimedia" OR "web-based media") AND ("Junior high school" OR "secondary education") AND ("Science Learning" OR "Science education") on scopus, while crossref uses boolean search ("ethnoscience" OR "ethnoscience") AND ("digital learning media" OR "media learnig"). After going through these stages, the results of the data search will be depicted in the PRISMA diagram and then the data will be analyzed with the stages of identification, screening, eligibility, and included. The results of the analysis that met the inclusion criteria and the quality assessment of descriptive research were used to provide an overview of the problems in the research question. The PRISMA steps can be seen in figure 1.

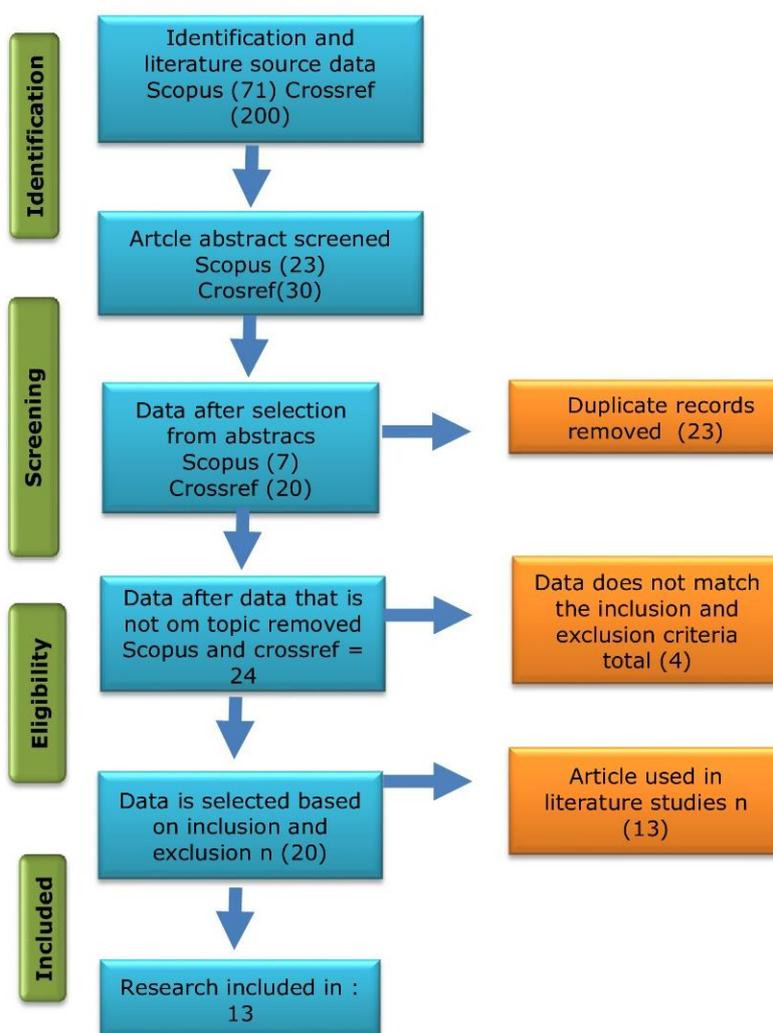


Figure 1.
 Diagram PRISMA

RESULT AND DISCUSSION

Based on the research method using PRISMA, 71 articles from Scopus and 200 articles from Crossref that refer to keywords were obtained and by selecting articles, 13 articles were obtained to review 13 journals. Later, the author's name, title, ethnoscience topics and science materials, and objectives will be listed in table 2.

Table 2.
Analysis of Journal Articles

Ye s	Author & Year	Title	Types of Digital Media	Ethnoscie nce Context	Science Topics	Purpose
1	(Anggrae ni et al., 2022)	Developm ent and Validation of e-Books during the Post- Pandemic to Improve Attitude towards Environme ntal Care in Case of Indonesia	Google Sites	The Myth of the Squirrel	Interaction of living things with the environme nt and environme ntal conservati on	Understan ding of the concept and attitude of caring for the environme nt
2	(Hayandi et al., 2025)	Developm ent of Interactive Learning Media Based on Lang Tapai Ethnoscien ce in Science Material as an Effort to Increase Students' Sustainabil ity Awareness	MPI	Simply Cut It	Biotechnol ogy	<i>Sustainabili ty Awareness.</i>

"						
3	(N. Dewi & Dasari, 2023)	Developm ent of Ethnoscien ce-Oriented Multimed i a Learning Process of Salt Making on Conductiv ity Materials on the Response of Junior High School Students	MPI virtual Lab	traditiona l knowledge of the salt making communi ty in Bangkala n	Change exists	Understan ding concepts and motivation s
4	(Zelviana et al., 2023)	Science Teachers Perception Toward e-LKPD Discovery Learning Based on Ethnoscien ce Lampung Traditiona l Food to Improve Students Science Process Skills on Digestive System Materials in Junior High School	e-LKPD	Tradition al food of Lampung	Digestive system	Students Science Process Skills

5	(Heliawat i et al., 2022)	Adobe Flash Learning Media Using Indigenou s Knowledg e To Improve Students' Scientific Literacy	MPI virtual Laborator y	Tradition al knowledg e of local medicines and natural ingredien ts as a chemical context	Classificat ion of living things	Science literacy and learning motivation
6	(Kurniant o et al., 2024)	Effect of Augmente d Reality Integrated Traditional Games Nglarak Blarak to Improve Critical Thinking and Graphical Representa tion Skills	AR Augmente d Reality Smashing Blarak	Javanese toy "Nglarak Blarak" as a context of style- energy.	Style and energy	Critical thinking and graphical representa tion;
7	(Elvianast i et al., 2023)	Ethnoscien ce Integrated Flipbook Learning Media on Living Things Classificati on	Ethnosain s Integrated Media Learning Flipbook	Medicinal plants of the Betawi tribe	Classificat ion of living things	Results of cognitive aspects and cultural literacy
8	(Rahmat et al., 2023)	Effect of Mobile Learning Integrated Traditional Games	Mobile learning "MOLERA VA"	traditiona l toys of Egrang.	Motion and style	Understan ding concepts and Multiple representa

		Egrang to Improve Multiple Representation Skills				tion
9	(Hasanah & Kusumawati, 2022)	Development of Ethnoscience-Based Digital Teaching Materials in Authentic Jember Patrol Music in Sound Sub Materials for Students in Junior High School	Digital Flippbook	Authentic Jember Patrol Music	Sound concept	Understanding of concepts and cultural literacy
10	(Subali et al., 2023)	RE-STEM Android app improve students' scientific literacy skills	RE-STEM Android-Based Learning Media	Squirrels, Squirrels, Squirrels,	Sound	Science literacy
11	(Syaifulah & Dilirosta, 2023)	Development of E-Module Based on Ethnoscience Approaches on Additive and Addictive Substance	e-Module articulate storyline	IPA module	E-Additives and addictive substances	Student independence and motivation to learn

		for Junior High School				
12	(Bahari et al., 2024)	Development of Interactive Learning Media Based on Android Integrated with Ethnoscience Towards the Development of Students' Soft Skills and Science Literacy Abilities in Science Learning at Junior High School	Multimedia Interactive Learning	Sustainability awareness of local culture students of Sengeti, Muaro Jamb Regency	Simple aircraft	Develop <i>students' soft skills</i> and science literacy skills.
13	(Nurmasitoh et al., 2025)	Development of Problem-Based Learning (PBL) Ethnoscience E-Module on the Biodiversity of Herbal Plants to Enhance	E-Module	Traditional herbal plants	Classification of Living Beings	Critical thinking and environmental literacy

Junior
High
School
Students
Critical
Thinking
and
Environm
ental
Literacy

RQ 1. What are the types of ethnosience-based digital learning media developed in science learning in junior high school?

A total of 271 articles were found related to ethnosience-based digital learning media topics, only 13 articles met the inclusion criteria. The results of the analysis show that the application of ethnosience-based learning media in junior high school science learning has a good impact, namely being able to improve student learning outcomes, and 21st century skills which include critical thinking, science process skills, science literacy; and attitude aspects including learning motivation, environmental literacy and cultural literacy. In the bar chart below.

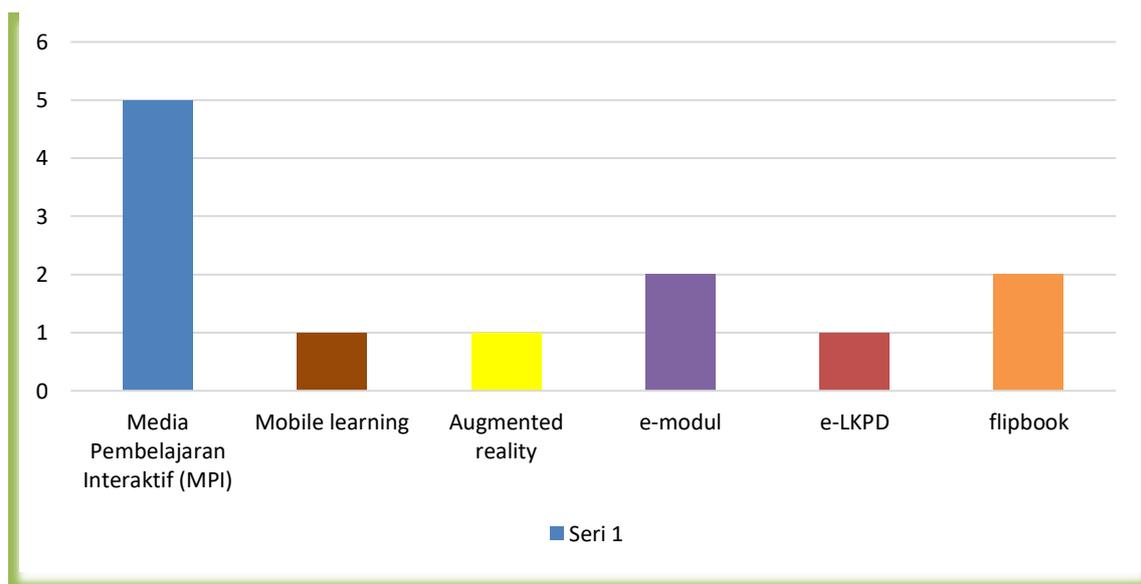


Figure 2.

The Most Widely used Digital Learning Media

Based on the graph of ethnosience-based digital media categories for junior high school science learning, it can be concluded that the most use of digital learning media is in android-based interactive learning media, and e-

modules which each occupy the largest proportion among the studies reviewed. Other types of media such as digital flipbooks, e-LKPD, mobile learning and AR were also found, but with fewer studies.

Several studies have shown that ethnoscience-based digital e-modules are often chosen because they are flexible, accessible, and can be integrated with various science topics as well as elements of local culture. While Android apps are growing rapidly, the availability of devices among students allows for interactive learning based on traditional educational games and simulations. Interactive multimedia and digital video are often used to reinforce conceptual visualizations and relate science materials to cultural practices such as typical foods, local traditions, or traditional games.

These findings show that ethnoscience digital media innovations have accommodated the diverse needs of science learning in junior high schools. The dominance of e-modules and Android applications confirms the importance of adapting media to student characteristics and technological advancements, while the diversity of media types facilitates contextual and participatory approaches according to local wisdom. Thus, the use of various ethnoscience digital media can enrich learning experiences, increase science literacy, and foster appreciation for local culture in the junior high school environment.

RQ2. What science topics are integrated in ethnoscience-based digital learning media for junior high school students?

The development of ethnoscience-based digital learning media in junior high schools actively integrates various science topics so that learning becomes more contextual and meaningful. Various science topics have been integrated into ethnoscience-based digital media in junior high schools to provide contextual and meaningful learning. Each of these topics is raised through association with local cultural elements, such as herbal plants, food-making traditions, traditional musical instruments, folk games, regional specialties, and natural processes in the community.

The integration of this topic aims to strengthen science competence while instilling an appreciation for the culture of making science not only formal knowledge, but also closely related to daily life and the heritage of the surrounding community.

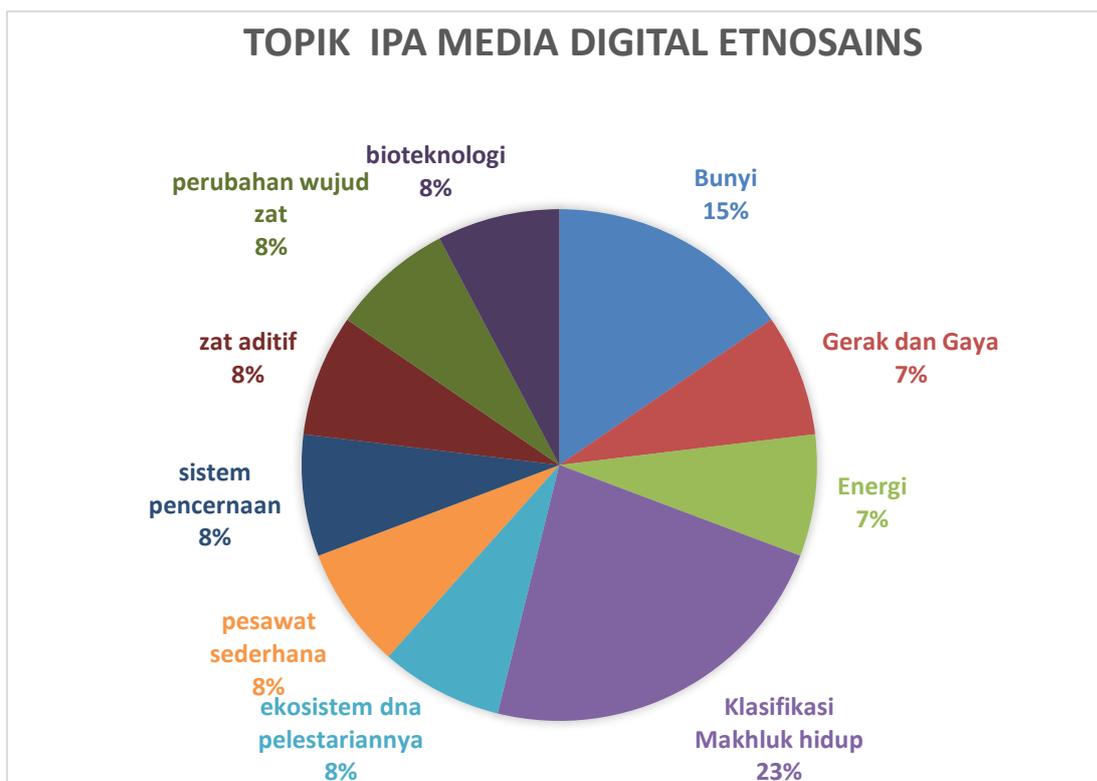


Figure 3.

Pie Chart of Science Topics in Ethnoscience-Based Digital Media

The findings show that the classification of living things is the most dominant topic integrated, followed by sound, motion and force, and energy. Meanwhile, biotechnology, digestive system, substance change, simple planes, and additives are also raised to contrast the concept of modern science with traditional practices or knowledge. This integration aims to strengthen science and cultural literacy while fostering students' appreciation of local wisdom.

RQ3. What is the impact of the application of digital learning media on aspects of student learning achievement?

Ethnoscience digital media significantly contributes to improving students' science literacy and understanding of science concepts. RE-STEM Android App Subali et al. (2023) and MPI virtual laboratory Heliawati et al. (2022) has a significant impact on science literacy, expanding students' insight into natural phenomena through the local cultural context. Mobile learning MOLERAVA Rahmat et al. (2023) and the AR application Nglarak Blarak Kurnianto et al. (2024) Improve students' multiple representation, critical thinking, and graphical representation skills with visual stimulation based on local traditions.

The implementation of ethnoscience-based e-modules, e-LKPD, and interactive multimedia not only strengthens the understanding of science concepts (e.g. on the theme of classification of living things, digestive system,

and additives), but also builds students' learning motivation, independence, and soft skills. Google Sites-based e-books Anggraeni et al. (2022) and environmental project media instilling an attitude of caring for the environment and local cultural literacy. Innovations such as PBL herbal e-modules Nurmasitoh et al. (2025) and multimedia Lang Tapai Hayandi et al. (2025) proven to foster critical thinking skills, environmental literacy, and sustainability awareness.

Another impact identified is the increase in science process skills Zelviana et al. (2023), cognitive outcomes and cultural literacy Elvianasti et al. (2023) and Hasanah & Kusumawati (2022), as well as student learning motivation and independence Dewi & Dasari (2023), and Syaifullah & Dilirosta (2023). The use of ethnoscience-based digital media is able to make learning more contextual and authentic, relevant to students' lives, and supports the achievement of 21st century competencies.

In general, ethnoscience digital media provides reinforcement to science literacy, concept understanding, process skills, cultural literacy, environmental attitudes, and 21st century character of junior high school students.

RQ4. What are the challenges faced in implementing ethnoscience-based digital media in science learning?

The implementation of ethnoscience-based digital media in junior high school science learning brings innovative potential, but in the field there are various challenges that need to be overcome. These obstacles arise at the level of teachers, students, and the education system. Several studies highlight teachers' lack of understanding of ethnoscience principles, the lack of digital media that is truly contextual and culturally adaptive, and the limitations of technological infrastructure. In addition, the adaptation of ethnoscience content from one region to another also faces obstacles of local relevance. The challenge of integrating digital technology and local wisdom requires collaboration from various parties, continuous training, and media development based on research and practice validation. The following challenges are presented in Table 3.

Table 3. Challenges in the Development and Research of Ethnoscience Digital Media

No	Author & Year	Challenge
1	(Anggraeni et al., 2022)	how to combine information technology (e-book based on Google Sites), local culture as local wisdom, and environment-based science learning models effectively so that it can build the character of environmental concern, and digital learning carried out online has challenges in maintaining student concentration, interaction, and motivation. Media must be packaged in

No	Author & Year	Challenge
		an interactive and innovative way in order to generate enthusiasm for learning
2	(Hayandi et al., 2025)	The lack of integration of science learning with local culture in the daily learning process causes students to not know and appreciate the local wisdom in their environment
3	(N. Dewi & Dasari, 2023)	Lack of depth of chemistry learning, traditional methods are boring, need for interactive ethnosience-based multimedia, media limitations, need for web-based technology, validation and positive student response
4	(Zelviana et al., 2023)	Teachers experience limitations in the use of technology in learning, so that no one uses e-LKPD during the learning process, and students also do not know ethnosience and have not used ethnosience-based e-LKPD-based learning media, so it is necessary to develop interesting and easy-to-use media to train science process skills
5	(Heliawati et al., 2022)	Local knowledge-based materials (such as the use of Gwang plants in East Nusa Tenggara) are less well known in other areas so the introduction and understanding of the local context and not all students have high-specification devices to use these.
6	(Kurnianto et al., 2024)	AR as a new technology for students needs adaptation and habituation, teachers need special competencies in the integration of technology and ethnosciences, and access and availability of technology are obstacles to implementation
7	(Elvianasti et al., 2023)	The lack of teachers' understanding of ethnosience concepts means that it is still rare to use learning media that integrates ethnosience in learning
8	(Rahmat et al., 2023)	Mobile learning and the use of mobile phone applications as learning media are new for teachers and students in schools, so it requires adaptation and training so that the use of media is effective and runs smoothly and students experience difficulties in representing physics concepts in verbal form from mathematical equations, which shows that there are obstacles in connecting mathematical symbols with everyday language

No	Author & Year	Challenge
9	(Hasanah & Kusumawati, 2022)	Science learning, especially physics material (sound waves) so far, has tended to use conventional methods that are less interesting and difficult for students to understand, especially in abstract concepts.
10	(Subali et al., 2023)	Teachers who are not familiar with the use of MPI may have difficulty explaining. In addition, not all teachers are familiar with using MPI or other digital platforms to teach.
11	(Syaifullah & Dilirosta, 2023)	Students' scientific literacy skills are still low, so that the association of science with local culture is difficult for students to understand, Access and use of applications in rural areas so that they do not support students' independent learning
12	(Bahari et al., 2024)	Limited teachers' understanding in optimizing Android-based learning media that integrates ethnosience as a contextual learning approach, The lack of linkage between science learning and ethnosience that develops in society, so that students do not know the indigenous culture of their region
13	(Nurmasitoh et al., 2025)	compile materials that combine science concepts with local wisdom in an interactive manner and facilitate students in solving real problems related to the surrounding environment independently

Discussion

From the results of the analysis of the 13 latest articles, the implementation of ethnosience-based digital media in science learning faces various challenges both in technical, pedagogical, and cultural aspects. One of the main challenges is how to integrate technology, local culture, and learning models that are in accordance with the actual needs of students and the demands of today's curriculum. Digital learning media must be packaged in an interactive and innovative manner in order to arouse enthusiasm for learning, maintain concentration and interaction, and encourage student motivation in the context of online and offline learning (Anggraeni et al., 2022).

The lack of integration of science with local culture causes students to lack knowledge and appreciation of local wisdom in their environment (Hayandi et al., 2025). In addition, the dominance of boring traditional learning methods and the lack of depth of science learning, especially chemistry and physics, are obstacles that cause a decrease in student engagement and a decrease in the quality of concept understanding. Media innovations such as web-based multimedia, interactive flipbooks, ethnosience videos, as well as validation

and systematic testing are needed for the media developed to be effective and to obtain positive student responses (N. Dewi & Dasari, 2023; Hasanah & Kusumawati, 2022).

From the educator side, the limited knowledge and competence of teachers in the use and development of digital media and ethnoscience integration are still limiting factors. Most teachers still need training in the use of new technologies such as digital e-LKPD, Android applications, or mobile learning so that the goal of improving students' science process skills and scientific literacy can be achieved (Bahari et al., 2024; Zelviana et al., 2023). In fact, some teachers are not familiar with using professional digital platforms, so the learning process is not optimal.

Another obstacle that is also dominant is the problem of access and infrastructure, both hardware, internet networks, and applications that are different between urban and rural areas (Syaifullah & Dilirosta, 2023). Not all students and teachers have devices with high specifications, so the development and use of technology-based media needs to be adjusted to real conditions in the field (Heliawati et al., 2022). On the student side, there is a variety of academic abilities and digital literacy that require the creation of media that is truly adaptive and supports independent learning across skill levels.

Thus, to bring effective innovations in ethnoscience-based science learning, cross-stakeholder collaboration, continuous training for teachers, adaptive technological innovation, and learning strategies that are truly contextual and relevant to the needs and characteristics of students in various regions in Indonesia are needed.

CONCLUSION

As a result of a systematic review of 271 identified articles, thirteen articles were selected based on inclusion and exclusion criteria. The results show that ethnoscience-based digital learning media that has been developed in junior high schools are very diverse, including e-modules, Android applications, interactive multimedia, contextual videos, digital flipbooks, mobile learning, and augmented reality that are integrated with cultural elements and local wisdom from various regions of Indonesia. Biology topics and other science topics raised in this media include the classification of living things, digestive system, ecosystems, additives and addictive substances, simple planes, sounds, motion and styles, changes in form, energy, and biotechnology, where the association with traditions, games, food, traditional practices, and natural products is very helpful in making learning closer to the

environment and the lives of students. The application of ethnoscience digital media has been proven to have a positive impact on learning outcomes, such as increasing science literacy, concept understanding, science process skills, learning motivation, creativity, independence, environmental care, and appreciation for students' local culture. However, this media integration still faces technical, pedagogical, and cultural challenges, such as limited teacher competence, technological adaptation, limited access to devices and networks in certain areas, lack of contextual media resources, and the need for content management to suit local characters and the needs of students from various backgrounds.

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