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RESEARCH TRENDS FOR THE DEVELOPMENT OF LKPD WITH AN ETHNOSCIENCE APPROACH IN LEARNING TO IMPROVE 21th CENTURY SKILL: SYTEMATIC LITERATURE REVIEW

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ABSTRACT

The development of Student Worksheets (LKPD) with an ethnoscience approach is one of the important strategies to realize contextual science learning, rooted in local wisdom, as well as relevant to the demands of 21st century skills. This study uses the Systematic Literature Review (SLR) method with PRISMA guidance to identify, select, and analyze publications on the development of ethnoscience LKPD in the 2015–2025 period that are indexed in the Scopus database and other supporting sources. From the initial 210 documents, the gradual selection process produced 12 articles that met the inclusion criteria related to research design, openness of access, and relevance of themes to the development of ethnoscience LKPD. The results of the study show that the research is dominated by research and development (R&D) design with the ADDIE model or similar, focusing on testing the validity, practicality, and effectiveness of LKPD in improving learning outcomes, science literacy, motivation, and students' appreciation of local culture. Overall, the development of LKPD with an ethnoscience approach is proving to be a relevant and prospective topic to be researched, with opportunities for further development on a variety of contexts, educational levels, and integration with innovative approaches such as STEM, project-based learning, and the use of digital technology.

Keywords: *Ethnoscience;* LKPD; 21st century skills; science learning

INTRODUCTION

21st century education is designed to prepare a generation that is technologically literate, adaptive, and highly competitive in meeting the demands of modern society. Every aspect of education—from standards, assessments, curriculum, teacher professionalism, to learning methods—needs to be aligned so that students have 21st century competencies, namely critical thinking, creativity, collaboration, communication, and science literacy skills (Haryanti & Fatisa, 2021). Thus, education not only focuses on improving cognitive abilities, but also shapes the character, culture, and scientific attitude of students to become agents of change in facing future challenges (Handayani *et al*., 2022). According to Mardiyah *et al* (2021) Motivation alone is not enough in realizing ideals, there must be concrete evidence or forms and hard efforts for the Indonesian government and even all of us in welcoming the digitalization era. Kuche *et al* (2024) added that the most important role of educators is that educators must be able to maintain the delivery of knowledge and skills to students, but with this delivery, these students will lose the role of technological developments and changes in learning methods. In such conditions, educators must explore and create learning that is not boring and can keep up with existing developments, not only continue to

be given past methods until they forget about developments that continue to change and change. Not only teaching knowledge but also with skills is a requirement for the success of learning in the 21st century.

However, conditions in the field show that science learning in schools still tends to be teacher-centered and emphasizes purely conceptual aspects. The results of an unstructured interview with a science teacher at SMP Negeri 2 Rembang (September 2025) revealed that students still have difficulty associating the concept of science with a real context. Their 21st-century skills—particularly critical thinking, communicating, collaborating, and creating—have not been optimally developed. Therefore, innovative teaching materials are needed that can foster learning motivation and activate students in the learning process (Suryaningsih & Nurlita, 2021)

One alternative solution is the use of Student Worksheets (LKPD). LKPD plays an important role in helping students understand concepts through structured, exploratory, and contextual activities. Previous research Rahayu (2020) in Novanda *et al* (2024) shows that LKPD is able to improve 21st century skills because it encourages learners to discover, investigate, and reflect on their own knowledge. Lestari *et al* (2023) added that the development of LKPD needs to pay attention to elements such as instructions for use, learning indicators, and activities that lead students to think and act scientifically.

More than that, the success of learning does not only depend on technology or teaching strategies, but also on the ability to relate the material to the local potential around the students (Abshor, 2023). The concept of ethnoscience provides a framework to bridge modern science with local wisdom. The integration of ethnoscience in science learning can help students understand scientific concepts through the practices and culture of their regions, so that science feels more meaningful and contextual (Sanova et al., 2021). Adellistia *et al* (2021) also said that this approach also strengthens a sense of identity and concern for the local environment, as well as honing 21st century skills through culture-based inquiry activities. However, in reality, in today's era, there are many students who do not understand the local potential of their area. This phenomenon poses problems for the world of education in Indonesia, it proves that the lack of integration in the learning process with the surrounding environment causes students to tend to not recognize the potential that exists in their area (Siti *et al.*, 2020). This condition shows the need to develop LKPD with an ethnoscience approach as a means of learning that not only trains 21st century competencies, but also instills local wisdom values.

Various ethnoscience-based LKPD and e-LKPD development studies consistently report a high level of validity and effectiveness in improving students' critical thinking skills and science literacy, so that this kind of product has the potential to be adopted more widely in teacher training and teaching tool development policies. Various ethnoscience-based LKPD development studies during 2015–2025 generally focus on validity, practicality, and effectiveness tests in specific local contexts with similar R&D designs, so comprehensive mapping is not available on: (1) how ethnoscience LKPD is designed and measured in relation to specific 21st-century competencies; (2) methodological variations and limitations

of the research design used; and (3) the distribution of geographical contexts, levels, and pedagogical integration models that support replication and adoption across regions.

Based on these problems, this literature study was conducted to analyze the trends and relevance of research related to the development of LKPD with an ethnoscience approach by answering three main questions:

RQ1: Is the development of LKPD with an ethnoscience approach still a relevant topic for future academic research?

RQ2: How is the distribution of research on the development of LKPD with an ethnoscience approach?

RQ3: What are the practical implications of research on the development of LKPD with an ethnoscience approach for future research?

METHODS

This study uses the Systematic Literature Review (SLR), which aims to collect and analyze various studies relevant to the topic of development of LKPD with an Ethnoscience approach. SLR is a systematic approach with the aim of identifying, assessing, and interpreting existing research results related to a specific topic (Nurhidayah *et al.*, 2025). The literature search strategy is focused on the Scopus database with the range of 2015–2025 using the TITLE-ABS-KEY STRING ("students worksheet" OR "LKPD") AND ("ethnoscience"OR "ethnoscientists"). The selection of Scopus as the only database was based on the consideration of strict journal selection standards as well as the availability of bibliometric data that supported the analysis using VOSviewer and Biblioshiny. Thus, the findings of this SLR reflect the trend of research on the development of LKPD with an ethnoscience approach to internationally indexed publications. This study uses the PRISMA method with several stages. According to Abelha *et al* (2020) there are four stages in conducting a review, namely the search (Identification), selection criteria (Screening), Quality Assessment (Eligibility), and data extraction (Included).



Figure 1. Systematic *Literature Review* (SLR) Stages

The first step is to determine the theme. The title of the research you want to research. After that, make a problem formulation and create a database and search key using the bollean code. Each article that passed the inclusion criteria was assessed using a quality assessment sheet developed from the criteria of developmental studies, quasi-experiments, and PTK in science education. The aspects assessed included design clarity, sample and context reporting, intervention quality (ethnoscience-based LKPD/e-LKPD), instrument quality (validity, reliability, practicality, effectiveness), and potential internal bias (absence of control groups, small sample size, cycle limitations, etc.). The scores of each aspect are outlined in an appraisal table, then averaged to be categorized into high, medium, or low quality. The following table is 1 of the search strings used for the systematic review process

Table 1. Search strings used for the systematic review process

Basis Data	Display String
Scopus	TITLE-ABS-KEY “(Students Worksheet OR LKPD) AND (Ethnosains OR Ethnoscience)”

After that, create the inclusion and exclusion criteria in the form of a table as shown in table 2 below.

Table 2. Inclusion and Exclusion Criteria

Criteria	Eligibility	Exlusion
Literature	Journal Articles	Skripsi, Book, Sitation
Language	Indonesian, English	Non-Indonesian and English
Time	2015-2025	<2015
Open Access	Full Text	Abstract Only
Research Design	RnD	Non-RnD

After determining the inclusion and exclusion criteria, the next step is to select the article to be reviewed. The following is the flow of article selection in the form of a flowchart.

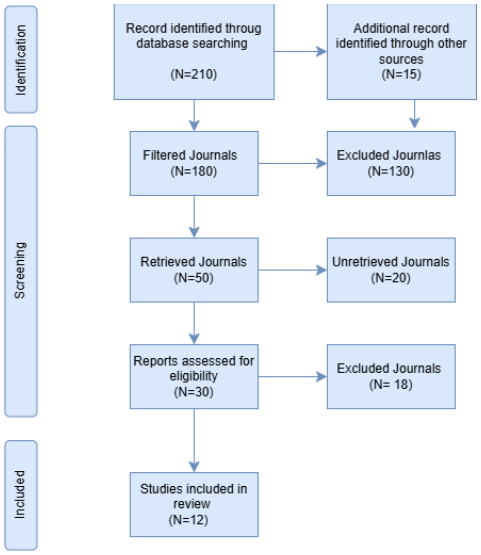


Figure 2. PRISMA Flowchart

The data were analyzed using narrative synthesis with a thematic approach. The findings of each study were coded and grouped based on research design, level of education, and type of outcome (science/chemistry literacy, numeracy literacy, critical thinking skills, science process skills, and character). Quantitative data such as N-gain values, completion percentages, and validity and practicality scores were summarized descriptively to illustrate the level of effectiveness of the intervention. Quantitative meta-analyses were not performed due to the heterogeneity of research design, instruments, and data reporting among the studies reviewed

The results of the quality assessment are used to give weight to the synthesis of findings; studies with the high-quality category are the main basis for drawing conclusions related to the effectiveness and practicality of LKPD with an ethnoscience approach, while medium and low-quality studies are treated more carefully and are mainly used as a support or context illustration. Thus, the risk of bias due to weak research design can be minimized in the interpretation of these SLR results

RESULTS AND DISCUSSION

Search through publish or perish with the application of a number of keywords has produced publication data related to the development of LKPD with Ethnosains content in 2015-2025. A total of 200 related studies are spread across various universities throughout Indonesia in the form of articles in national journals. Of the 210 articles obtained from the scopus database but not all of them met the criteria mentioned above, as many as 15 documents were deleted due to duplication. 180 documents were screened but there were still many that did not meet the criteria, so as many as 130 documents were deleted and 50 documents remained. 50 documents were analyzed to meet the criteria as mentioned above and 30 were produced that met the eligibility criteria. 30 documents were analyzed again to be re-filtered so that the documents produced were really feasible according to the criteria and 12 final documents were produced. Figure 2 below shows the number of studies related to the development of LKPD with

Ethnosains content based on scopus (GS) data-based from 2010-2025.

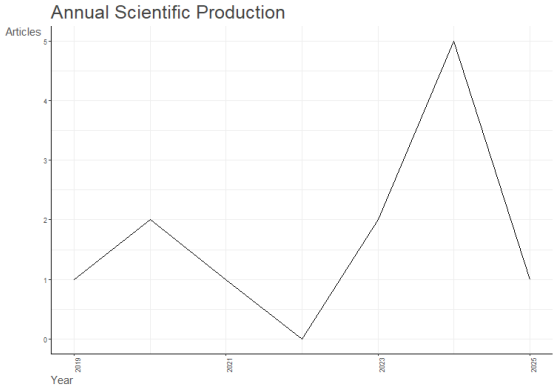


Figure 3. Research Trends for the Development of LKPD With Ethnoscience

During 2015-2025, 12 documents were published and made available to the public related to the development of a loaded LKPD Ethnosains Found through search Scopus. According to the database, which was analyzed through Biblioshiny The X axis shows the year the article was published while the Y axis shows the number of documents. The data generated that the number of copies of LKPD development articles is loaded Ethnosains experienced ups and downs throughout 2015-2025. It can be seen that starting in 2019, many related research were developed until the peak was in 2024. Although the study on the development of LKPD is loaded with Ethnosains It has also decreased, but based on the graph, the related studies are still relevant and are a hot trend that many researchers have studied. This is in line with Kasim's opinion et al (2025) that the use of ethnoscience approaches in learning will continue to develop, especially in integrating local cultures. The ethnosian approach can also improve learning outcomes and students' awareness of local wisdom which is very important to support the development of contextual and locally cultured education. In addition, the study on the development of LKPD is loaded with Ethnosains This also shows the development of studies that are more marked by the number of citations in related studies that will be presented in the following table 3.

Table 3. Top five most cited authors based on *the Scopus Database*

No.	Author	Source	Number of Quotes
1	Sudarmin *et al* (2019)	Indonesian Journal of Science Education	98
2	Nisa *et al* (2024)	Journal of Education and Learning	20
3	Rinto *et al* (2020)	Journal of Physics Conference Series	19
4	Andani *et al* (2020)	Journal of Science Education Research	18
5	Januarti & Muliyadi (2024)	International Journal of Science Education and Science	9

Table 3 describes the 5 authors with the highest number of citations by database Scopus i.e. in the first position of the author Sudarmin *et al* (2019) with a total of 98 citations. Author Nisa *et al* (2024) with a total of 20 citations, the third position is Rinto *et al* (2020) with the number of citations of 19, followed by the fourth position, namely Andani *et al* (2020) with a total of 18 citations and in the last position Januarti & Muliyadi (2024) with the least number of citations of 9. This shows that the study of development of loaded LKPD Ethnosains It is still a trend with many still

taking quotes about related. This is in line with Aksnes *et al* (2019) that citations are one of the bibliometric indicators that are often used in assessing the influence and relevance of a research because citations describe the extent to which a work is utilized, referenced, and becomes the basis for further research in the scientific community. However, based on the evidence collected in the ethnoscience study, LKPD still faces some important limitations. Many studies use relatively small samples and very local contexts, so positive findings are potentially under-representative of a broader context. In addition, effectiveness tests are generally only conducted in the short term without tracking retention and long-term impact on learning outcomes and student character .

The following is table 4 which shows the distribution of journals that publish research related to the development of LKPD with *Ethnoscience.*

Table 4. The top five article sources related to the Use of LKPD with *an Ethnoscience* approach in the last ten years (2015-2025) based on *Scopus Data*

No	Journal	Publisher regions	Total
1	Indonesian Journal of Science Education	Central Java (Semarang)	2
2	Journal of Science Education Research	Nusa Tenggara Barat	2
3	Ijcer (International Journal Of Chemistry Education Research)	Yogyakarta	1
4	International Journal Of Science Education And Science	Nusa Tenggara Barat	1
5	Indonesian Journal of Science Education	Aceh	1

Table 4 explains the journals that contribute the most to publications using LKPD with an ethnoscience approach. The Indonesian Science Education Journal is the main source that contains the most articles on the use of LKPD with an Ethnoscience Approach with a total of 2 documents. In second place is from the Journal of Science Education Research with a total of 2 documents, followed by the third position from the journal Ijcer (International Journal Of Chemistry Education Research), the fourth from the International Journal of Science Education And Science, and finally the fifth position from the journal of the Indonesian Science Education Journal with each published document is 1.

In terms of literature review, this composition shows that research on LKPD with an ethnoscience approach is still in the developing stage, not yet massive, but it is sufficiently concentrated in several key journals so that it makes it easier for other researchers to search and synthesize research results. These findings can also be used as a basis for identifying research gaps, for example by expanding publications to other international journals or developing ethnoscience LKPD at the level and context of material that has not been widely studied (Kurniawati, 2025).

The following is a comparison table that will explain the details in each article that can be seen in terms of integrity, ethnoscience, outcame, and quantitative main findings so that it can make it easier to summarize the evidence map in a concise and direct manner. This table also makes the basis for SLR synthesis and conclusions more transparent, while highlighting the variations and limitations of the evidence (e.g. robust studies vs. validation-only studies).

Table 5. Comparison of Ethnoscience-Based LKPD/e-LKPD Study Summary

No.	Author	Journal Name	Types of Development	Integration with Ethnosains	Outcome yan diukur	Key quantitative findings
1	Rosyada *et al* (2025)	Journal of Innovation in Educational and Cultural Research	R&D (4D)	Typical foods of Pati Regency (mangut ndas manyung, milkfish presto, tape gembong, gandul rice) as a context of chemistry and numeracy concepts	Book validity, characteristics, teacher & student responses	High validity in aspects of Ethno-STEM presentation, content, and relevance; books are considered very worthy and interesting; no N-gain.
2	Hidayah *et al* (2025)	Journal of Science Education Research (JPPIPA)	R&D (ADDIE	LKPD integrates the context of Sasak culture, for example the process of making salt in Pejot Village and making kris in Sakra, as real examples of elements, compounds, and mixtures in PBL activities.	Validity (Aiken V), reliability (Borich)	Aiken V averages 0.91 (very valid); reliability between experts 93%; has not been implemented to students.
3	Wiratama *et al* (2025)	PGMI Partner of MI Education Journal	R&D (INSURED)	Sound materials and their properties are associated with local culture such as Banjari music and Javanese gamelan, including sound sources and students' daily practices.	Science literacy (tests, Ngain), experiment–control comparisons, student responses	Ngain averaged 0.79 (high); significant differences in experimental–control science literacy (p=0.001); The student response of 85.21% was very interesting.
4	Kotimah, *et al* (2024)	Journal of Science Education Research (JPPIPA)	R&D (ADDIE)	The content of the LKPD links additive materials with local wisdom of traditional Lampung food and beverages (Lapis Legit, Engkak Ketan, Bebai Maghing, Seghubal, Es Serbat Mango Kweni, Durian civet coffee), packaged in PBL activities based on real problems.	Critical thinking, science literacy, validity (Aiken V), student response	Aiken V material 0.98 and display 0.97 (highly valid); Ngain critical thinking 0.86 and science literacy 0.87 (high category); 99.35% student response is excellent.
5	Suyanto *et al* (2024)	AlBiruni Physics Education Scientific Journal	R&D (ADDIE)	Lampung traditional musical instrument "Gamolan" as a context of sound waves (frequency, vibration, tone) and practicum activities	Product validity, practicality, potential	Average validity ≥3 (highly valid); practicality of students/teachers ≥93% (very practical); there is no KPS Ngain yet.
6	Fikrina, *et al* (2023)	EduChemia (Journal of Chemistry and Education)	R&D (ADDIE)	Integrating Pekalongan batik culture (process, motifs, dyes, conservation) into a chemical project of acid-base quantitative equilibrium with an ethno-STEAM approach.	Numeracy literacy (estimation, fractions, patterns, spatial, measurement, statistics), character	Validity of the material 49.25 and media 58.5 (very feasible category on the researcher scale); Ngain numerals 0.64–0.66 (moderate); The conservation character and

					conservation, validity, practicality	assessment of the project are excellent
7	Muhlis, *et al* (2023)	Unnes Science Education Journal (USEJ)	R&D (4D)	LKPD combines the concept of soil pollution with the Bugis cultural practice of "mangeppi ase" in the maintenance of rice fields (prayer water, local ingredients such as betel leaves and turmeric) as examples of scientifically analyzed phenomena	Validity of format, illustration, language, content	Validity I: 65% (revision needed); validity II: 85% (very valid); There has been no effectiveness test on students.
8	Siami *et al* (2023)	Journal of Science Education Research (JPPIPA)	R&D (4D)	Elevating Semarang batik (Kampung Alam Malon, natural dyes of secang, mahogany, turmeric, Warak Ngendog, etc.) as an acid-base context and natural indicator in the PBL LKPD.	Chemical literacy (content, epistemic, procedural, context, competence), N-gain, KKM, validity	Material validity 92.86% and media 96.67% (very feasible); N-gain 0.81 (high); 91.67% of students completed KKM; The chemical literacy aspect of most categories is very good
9	Wahyuni ngtyas *et al* (2023)	PTK and Education	R&D (4D)	Ponorogo culture and environment (local locality, environmental phenomena) as a context of science problems in LKPD	Critical thinking (essay test), classical completeness	The average critical score is 54 to 70 then 81; completeness of 20% to 60% then 87%; shows a strong increase between cycles.
10	Hanifha *et al* (2023)	Indonesian Journal of Science Education (JPII)	Quasie r Perime n	Local environmental and conservation issues (e.g. environmental issues around schools/regions) as an SSI context for science literacy	Science literacy, environmenta l awareness, effect size	The eworksheet group showed that the increase in science literacy and environmental concern was higher than the control; significant differences (Mann–Whitney); medium–high effect.
11	Zahra & Desstya (2023)	International Summit on Scinece Technology and Humanity	R&D model ADDI E	The process of making red bricks in Sragen (materials, combustion, physical changes) as the context of videos, images, and student exploration activities	Validity of the material & media	Material validity is 90% and media is 87.5% (very valid); there has been no implementation in the classroom and there is no Ngain data.
12	Mahyuny *et al* (2022)	Journal of Science Education Research (JPPIPA)	R&D	LKPD contains ethnoscience discourse and the context of local wisdom in the classification of living things, so that examples of biological objects and categories are connected to the environment and culture around students.	Validity of material, media, and practicality	Validity of the material 95%, media 93%, practitioner 96.3% (all very valid/very practical); no Ngain data or prepost learning outcomes

Table 5 shows that the development of LKPD with ethnoscience content in general integrates diverse local wisdom ontologies, ranging from traditional Pati food, Sasak Culture, Pekalongan and Semarang Batik, Gamolan Lampung to local industrial agricultural practices as a concrete bridge between the concept of science and the reality of students' daily lives. Sihombing *et al* (2025) added that ethnoscience integration not only enriches the content of the material, but also directs learning activities to the form of problem-based learning, projects, and contextual exploration that have the potential to strengthen science literacy, numeracy literacy, critical thinking skills, science process skills, as well as the character of conservation and environmental concern.

Most of them are developed with the RD model (ADDIE or 4D), oriented towards the validity and practicality of the product, with the results of consistent expert and practitioner assessments in the category of very valid and very practical. Studies that have tested effectiveness have reported moderate-high levels as well as significant differences between experimental and control classes in science literacy, numeracy literacy, and critical thinking, although there are still some studies that have only reached the validation stage without pre-post data or effect size so the evidence for long-term impact is not yet fully strong

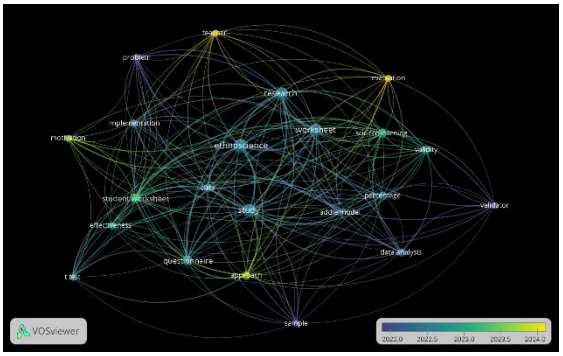


Figure 4. Temporal visualization (*Overlay visualization)* using VOSviewer

The resulting 12 Include documents were analyzed using VOSviewer to produce visualization results. The resulting visualization consists of overlay visualization (figure 4), network visualization (figure 5) and density visualization (figure 6). This visualization describes keywords related to LKPD containing Ethnosains and the relationship between keywords, both temporally and frequency.

The results of this temporal visualization illustrate the trend of keyword development that is the main topic in the study related to LKPD with content Ethnosains. The shift is shown by the change in color in each keyword based on the temporal instruction scale given, where the color brightness level shows the novelty of the keyword application. Figure 4 shows that at the beginning of the high period of development of LKPD with Ethnoscience, the keywords of this research focused a lot on problems that arose marked by the keywords "problem", "sample", "validator", and "data analysis". Furthermore, temporal shifts are shown by the development of integrated research-related keywords and several methods marked with keywords such as "research", "implementation", "data", "questionaire", "study", "ethnos"ience", "worksheet", "percentage", and "ADDIE". The next shift

began to refer to keywords such as "students worksheet", "effectiveness", "science learning", and "validity". Other keywords have also experienced recent shifts, including "approach", "teacher", "evaluation", and "motivation". Currently, studies related to LKPD with Ethnoscience content focus a lot on the keywords "ethnosciense", "worksheet", "research" and "study" which shows that research on the development of LKPD with Ethnoscience content is developed in learning using various methods and innovations that continue to develop. *Sari et al* (2023) explained that research continues to increase and shift from just conceptual studies to the development of concrete teaching materials such as LKPD, interactive e-LKPD and worksheet project-based.

However, in its concrete application, especially by adapting across regions, cultural aspects that need to be considered include the selection of local practices that are truly known to students, the representation of cultural values and symbols that are sensitive and non-stereotypical, as well as the involvement of community leaders or local resource persons to validate the authenticity of ethnoscience content. Developers are also encouraged to explicitly document the sources of local wisdom used (e.g. traditions, crafts, culinary, environmental practices) and relate them to science/curriculum competencies, so that the resulting LKPD/e-LKPD is easier to replicate and adapt by teachers in other regions with different cultural contexts.

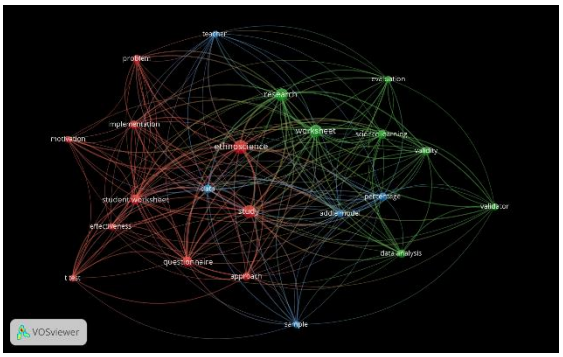


Figure 5. Network *visualization of* keywords using *VOSviewer*

The visualization of the keyword network in figure 5 shows that three keyword clusters are depicted in different colors. This cluster illustrates the relationship between keywords and groups of topics that are widely studied. The red cluster group is generally a keyword about the development of LKPD integrating Ethnoscience. The red cluster consists of the keywords "approach","effectiviness", "ethnoscience", "implementation","motivation", "problem", "quitionnaire","student worksheet", "study", and "t test". The green cluster consists of the keywords "data analysis", "evaluation","research", "science learning", "validity", and "worksheet". While the third cluster is marked in blue consisting of the keywords "ADDIE", "data", "percentage", "sample", and "teacher"

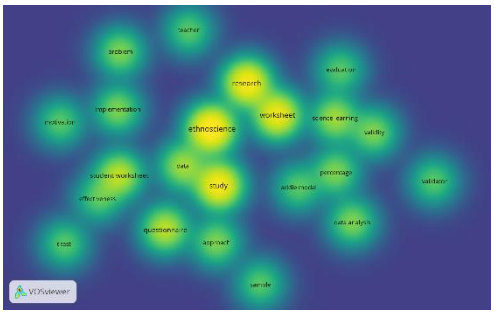


Figure 6. Density *visualization* using *VOSviewer*

In addition to analyzing the relationship between keywords and the trend of keyword development temporally,

a density visualization was also produced by showing the frequency of use of the keyword (figure 6) the color thickness level illustrates the frequency level of the keyword used in studies related to LKPD Loaded with Ethnoscience. Figure 6 shows that the most commonly used keywords consist of "Research", "Ethnoscience", "study", and "worksheet". This means that research related to the development of LKPD integrates a lot with Ethnosains in learning. Kasim *et al* (2025) also added that the learning products that are widely developed by integrating Ethnosains are LKPD or students worksheet, after modules and other learning with a considerable proportion in the corpus of ethnoscience research. LKPD ethnosains also shows several pedagogical benefits such as improving learning outcomes, science literacy, character, and cultural appreciation, thus providing a strong basis for research on the development of new variations of LKPD ethnosains in various materials and levels of education *(Gde et al*., 2023)

The keywords "students workshet", "implementation", "effectiveness", and "motovation" are in clusters that are close to each other, this indicates that ethnoscience-themed research generally focuses on the development of LKPD to improve concept understanding, learning motivation, and effectiveness of the learning process. Meanwhile, terms such as "validity", "validator", "ADDIE model", "data analysis", and "evaluation" are in different clusters which indicates that most studies use a research and development (R&D) approach with the ADDIE model, as well as focusing on the product validation stage and quantitative data analysis. In addition, the emergence of terms such as "questionnaire", "sample", and "t test" shows that the research methods used generally involve questionnaire instruments, statistical tests, and analysis of the effectiveness of the products developed.

The practical implications of the research on the development of LKPD with Ethnosains show that the products developed will be able to increase learning engagement, science literacy, critical thinking skills, and motivation for education through more contextual learning with local culture (Dal *et al.*, 2024). This is in line with the opinion of Mahyuny & Siska (2022) that the development of ethnoscience-related LKPD both in print and electronic form (E-LKPD) is considered very feasible and practical for teachers to use in the classroom, and is able to make a positive contribution to the quality of the learning process and students' appreciation of local wisdom. Teachers and developers of teaching materials can use the ethnoscience LKPD as one of the models for developing learning tools that support the implementation of a curriculum based on local wisdom and 21st century learning at various levels of education *(Suwandi et al*., 2025)

Based on the results of the above analysis, these studies open up opportunities to test the effectiveness of the Ethnoscience LKPD in more diverse contexts such as regional leeches, levels, subjects, and integrate them with various approaches in learning (Andani *et al*., 2020). There is a lot of room to enrich methodological aspects, both through the use of more varied R&D designs and a combination of methods so that the impact of developing LKPD with ethnoscience content on learning outcomes, scientific attitudes, argumentation skills and strengthening cultural identity can be mapped more comprehensively (Nur Aura

Ladistya Novanda et al., 2024). With the demise of practical implications and further research from the development of LKPD with ethnoscience content, it not only contributes to the innovation of teaching materials but also strengthens the direction of science development that is responsive to the socio-cultural context of students.

CONCLUSION

Based on the findings of various studies and literature reviews, the development of LKPD with an ethnoscience approach can be concluded to be a very relevant topic for academic research in the future because it continues to show an increasing trend of publications and a real contribution to improving science literacy, concept understanding, and students' relationship with local culture. In addition, it is necessary to conduct a long-term test to see how the use of ethnoscience LKPD contributes to the formation and strengthening of cultural identity and retention of students' science concepts. The distribution of research on the development of ethnoscience LKPD has so far been dominated by the Indonesian context, especially at the elementary and secondary school levels in science, physics, and chemistry subjects, with strong methodological characteristics on the research and development (R&D) approach using the ADDIE model or similar and focusing on the validity, practicality, and effectiveness of the product. Practically, the results of these studies show that the ethnoscience LKPD is effective in increasing learning motivation, critical thinking, and positive attitudes towards science while strengthening the appreciation of local wisdom, so that it is suitable for teachers to adopt as a contextual learning tool, although the evidence on ethnoscience in the LKPD still has some important limitations, especially because many studies use small samples and very local contexts so that the results are positive less easy to generalize. In addition, effectiveness is generally tested only in the short term without monitoring retention and long-term impact on student learning outcomes and character. Academically, however, it is implied that future research needs to expand the context of cross-regional and cross-level trials, integrate ethnoscience with innovative approaches such as STEM, project-based learning, and digital technologies, and enrich methodological design with a combination of quantitative-qualitative and long-term studies to map the long-term impact on learning outcomes and the formation of students' cultural identity.

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