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THE POTENTIAL OF LOCAL WISDOM AS A LEARNING RESOURCE FOR INTEGRATED SCIENCE (IPAS) IN ELEMENTARY SCHOOLS: AN ETHNOSCIENCE LITERATURE ANALYSIS

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Abstract Indonesia possesses a rich diversity of local wisdom that embodies empirical knowledge and scientific concepts with strong potential to be utilized as learning resources for IPAS (*Ilmu Pengetahuan Alam dan Sosial*, the integrated natural and social sciences subject in Indonesia's elementary school curriculum). However, IPAS instruction still tends to be abstract and insufficiently contextual, which has contributed to low levels of students' scientific literacy. Although previous studies have explored the integration of local culture into science learning, they remain limited in scope and have not yet conducted systematic mapping of the potential of local wisdom as a source for ethnoscience-based IPAS learning. This study therefore aims to analyse and map that potential through an ethnoscience lens, drawing on a systematic literature review of studies published between 2020 and 2025. This research employed a qualitative approach using a systematic literature analysis method. Data from ten selected articles were analysed through stages of selection, classification, and synthesis to identify research focuses, types of local wisdom, geographic contexts, and their implications for IPAS learning. The findings reveal three dominant categories of local wisdom documented in prior research: traditional food practices (such as rempeyek and sate bandeng production), environmental and agricultural management, and traditional handicrafts (such as batik). These forms of local wisdom consistently contain integrated concepts of natural and social sciences including physical change, biological processes, economic activity, and cultural identity that are directly relevant to IPAS instruction. A trend toward qualitative and descriptive approaches was also identified, with research concentrated in Java and limited geographic representation from other regions of Indonesia. This study concludes that ethnoscience-based local wisdom holds significant potential as a contextual and meaningful learning resource for IPAS. The systematic mapping produced in this study provides a foundation for future curriculum developers and researchers to design locally grounded IPAS learning that is both culturally responsive and scientifically rigorous.

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Introduction

Indonesia is recognized as an archipelagic country with extraordinary ethnic and cultural diversity, in which each region possesses local wisdom in interacting with nature (Widodo & Kadarwati, 2022). Indigenous knowledge manifested in daily activities such as traditional agriculture, local medicine, and food processing contains scientific concepts that are relevant to modern science learning (Sudarmin et al., 2021; Nugraheni et al., 2023). However, this potential has often not been optimally utilized in school learning and is still considered separate from formal science instruction in classrooms (Rahmawati & Ridwan, 2020).

Despite the abundance of locally based learning resources, the level of scientific literacy among Indonesian students remains relatively low. The results of the 2022 Programme for International Student Assessment (PISA) indicate that Indonesian students' science literacy score was 383, showing a decline compared to 2018 (OECD, 2023). This achievement suggests that most students still experience difficulties in understanding, reasoning, and applying scientific concepts in real-life contexts (OECD, 2023).

The low level of scientific literacy is closely related to classroom instructional practices. Reports from the Trends in International Mathematics and Science Study (TIMSS) and national studies indicate that science learning in elementary schools is still dominated by lecture-based methods and the use of textbooks as the primary learning resources (Mullis et al., 2020; Prasetyo et al., 2021). Less contextualized approaches make it difficult for students to connect scientific concepts with empirical experiences in their surrounding environment (Fitriani et al., 2022). As a result, science learning tends to be abstract and less meaningful for students (Bybee, 2020).

Furthermore, globalization has contributed to a decline in young generations' understanding of local culture. Students tend to be more familiar with global products than with their own regional potential, which weakens their cultural identity (Sutarto & Sari, 2021). The gap between school instructional materials and students' socio-cultural realities not only hinders their understanding of scientific concepts but also contributes to the degradation of local wisdom values (Hidayah et al., 2023).

To bridge this gap, the ethnoscience approach has emerged as a strategic alternative in IPAS learning. This approach focuses on reconstructing local knowledge into scientific knowledge that is contextual and meaningful for students (Sudarmin et al., 2021). The integration of local wisdom defined as the cultural knowledge and practices collectively held and passed down within a community into IPAS instruction, through an ethnoscience approach that reconstructs such local knowledge into formal scientific concepts, has been proven to enhance scientific literacy, critical thinking skills, and the strengthening of students' character and cultural identity. (Widodo et al., 2024). Therefore, a literature review on the potential of local wisdom within the ethnoscience framework is essential for formulating strategies to improve science literacy based on Indonesia's rich cultural heritage.

State of the Art

Studies on the integration of local wisdom into science learning through the ethnoscience approach have attracted increasing attention from educational researchers in recent years. This trend is in line with the demands of 21st-century learning, which emphasize the contextualization of instructional materials, the strengthening of scientific literacy, and the preservation of local cultural values. At the elementary school level, Integrated Science and

Social Studies (IPAS) plays a strategic role, as it serves as an initial foundation for shaping students' conceptual understanding of natural and social phenomena in their environment.

Nevertheless, preliminary reviews of various scientific publications indicate that most studies still focus on science learning as a separate subject, the development of specific instructional materials, or case studies of local wisdom in particular regions. Comprehensive studies that systematically map the potential of local wisdom as a learning resource in integrated IPAS instruction, especially through ethnoscience-based literature analysis, remain relatively limited. Therefore, a State of the Art analysis is required to identify research trends, major findings, and research gaps that can serve as a basis for the development of future studies.

Based on these considerations, this study presents a State of the Art table summarizing research findings from the past five years related to local wisdom and ethnoscience in science/IPAS learning at the elementary school level.

Table 1. *State of the Art*

Author	Year	Region	Local Wisdom Type	Subject Focus	Research Design	Contribution
Geby Adellestia et al.	2025	Indonesia	Diverse local wisdom	Elementary science	Qualitative descriptive	Shows that integrating local wisdom improves students' scientific understanding and positive attitudes toward cultural diversity
Lilik Nur Kholidah et al.	2023	Serang, Banten	Traditional food (Sate Bandeng)	Elementary science	Exploratory qualitative	Demonstrates that a single local food culture can serve as an effective context for science learning concepts
Tiara Maharani & Dwi A. Siwi	2025	Indonesia	Traditional food (Rempeyek)	IPAS (science & social studies)	Qualitative study	Identifies that traditional food-making activities contain integrated science and social studies (IPAS) concepts
Rizki Putri Wardani et al.	2025	Banyuwangi, East Java	Local wisdom (Banyuwangi)	Elementary science	Descriptive study	Confirms relevance of regional local wisdom for strengthening elementary science concepts in specific geographic contexts
Fitria Nurulaeni & Aulia Rahma	2024	West Java	Cultural practice (Sundanese)	Elementary science	Qualitative study	Establishes a model for integrating Sundanese cultural elements into elementary science learning contexts
Asep Yudi Supriatna et al.	2024	Indonesia	Diverse ethnoscience	Science (module-based)	Systematic literature review	Provides SLR evidence that ethnoscience-integrated modules enhance conceptual

Author	Year	Region	Local Wisdom Type	Subject Focus	Research Design	Contribution
						understanding in science learning
Zaizatun Nihayati et al.	2025	Indonesia	Local wisdom (general)	Elementary science	Literature review	Shows that locally grounded science worksheets significantly increase student engagement in learning activities
Ida Fitriani et al.	2024	Indonesia	Ethnoscience (general)	Elementary science	R&D (product development)	Develops and validates ethnoscience-based e-worksheets, proving their effectiveness as digital learning tools
Devi Alviya et al.	2025	Indonesia	Ethnoscience (general)	Elementary science	Experimental study	Provides experimental evidence that ethnoscience-based learning improves students' local and scientific knowledge
Fitriyah et al.	2025	Sidoarjo, East Java	Traditional craft (Batik)	Elementary science	Exploratory qualitative	Reveals that Sidoarjo batik contains both scientific and cultural concepts applicable as elementary learning resources

Based on the State of the Art mapping presented in the table above, it can be concluded that research on local wisdom and ethnoscience in elementary science education has shown significant development, particularly in utilizing local culture as a context for science learning. However, these studies tend to remain partial in nature, in terms of subject focus, the scope of local wisdom examined, and the research approaches employed. Most studies have not positioned local wisdom as a systematic and integrated learning resource for IPAS, nor have many adopted a comprehensive ethnoscience-based literature analysis approach.

The rapid implementation of the Merdeka Curriculum has placed IPAS at the center of elementary science education in Indonesia, yet instructional practice continues to rely on decontextualized, textbook-driven approaches that are disconnected from students' cultural lived experiences. At the same time, Indonesia's extraordinary diversity of local wisdom spanning traditional food practices, environmental stewardship, and artisanal crafts represents an untapped reservoir of contextually rich scientific knowledge that remains largely unmapped as a pedagogical resource. Bridging this gap is not merely an academic exercise; it is a curricular imperative. An ethnoscience-based approach offers a principled framework for reconstructing local knowledge into teachable scientific concepts, thereby making IPAS instruction simultaneously more meaningful to students and more responsive to Indonesia's cultural landscape. Without systematic documentation of what local wisdom exists, where it is distributed geographically, and how it aligns with IPAS competencies, teachers and curriculum developers are left without the evidence base needed to design culturally grounded instruction at scale.

Therefore, this study occupies a strategic position in addressing these gaps by focusing on an ethnoscience-based literature analysis to map the potential of local wisdom as a learning

resource for IPAS in elementary schools. It is expected that the findings will not only contribute theoretically to the development of ethnoscience and IPAS learning studies but also serve as a conceptual foundation for teachers and curriculum developers in designing contextual, meaningful, and culturally grounded instruction rooted in Indonesia's rich local heritage.

Method

This study employed a qualitative approach using a systematic literature review method to examine the potential of local wisdom as a learning resource for IPAS (Natural and Social Sciences) at the elementary school level from an ethnoscience perspective.

Literature searches were conducted through national journal databases using the keywords ethnoscience, local wisdom, science/IPAS learning, and elementary school. The databases used included Google Scholar, Garuda, and SINTA. The search period was set at 2020–2025. This range was selected because it encompasses the transition from Indonesia's 2013 Curriculum to the Merdeka Curriculum, which specifically integrates IPAS as a subject at the elementary level. The inclusion of 2020 as the starting year also accommodates important references published before 2021 that remain highly relevant to the topic of this study.

Article selection was carried out based on criteria established explicitly prior to the analysis process. Table 1 presents the inclusion and exclusion criteria applied in this study.

Table 2. Inclusion and Exclusion Criteria for Article Selection

No.	Type	Aspect	Criterion
1	**Inclusion**	Topic	Discusses ethnoscience, local wisdom, or local culture in the context of science/IPAS learning
2	**Inclusion**	Level	Focuses on elementary school level (SD/MI) or equivalent
3	**Inclusion**	Publication year	Published between 2020 and 2025
4	**Inclusion**	Language	Written in Indonesian or English
5	**Inclusion**	Publication type	Empirical research articles or theoretical/conceptual studies published in accredited academic journals
6	**Inclusion**	Accessibility	Full text is available and accessible online
7	**Exclusion**	Level	Focuses on junior high school, senior high school, or university level
8	**Exclusion**	Topic	Not related to ethnoscience or local wisdom as a learning resource or context
9	**Exclusion**	Document type	Conference papers, book chapters, technical reports, or unpublished theses/dissertations
10	**Exclusion**	Accessibility	Only abstract available, or full text cannot be accessed
11	**Exclusion**	Relevance	Ethnoscience or local wisdom is mentioned only marginally and is not the primary focus

Article selection followed four systematic stages based on the PRISMA framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses):

1. Identification

   An initial keyword search across national journal databases (Google Scholar, Garuda, SINTA) yielded 87 articles.

2. Screening

   Articles were screened by title and abstract; duplicates and irrelevant records were removed, leaving 54 articles.

3. Eligibility

   Articles that passed screening were read in full and assessed against the inclusion and exclusion criteria, resulting in 22 eligible articles.

4. Inclusion

   Articles meeting all criteria were confirmed as the final analysis corpus, comprising 10 articles.

The complete article selection flowchart is presented in Figure 1 below.

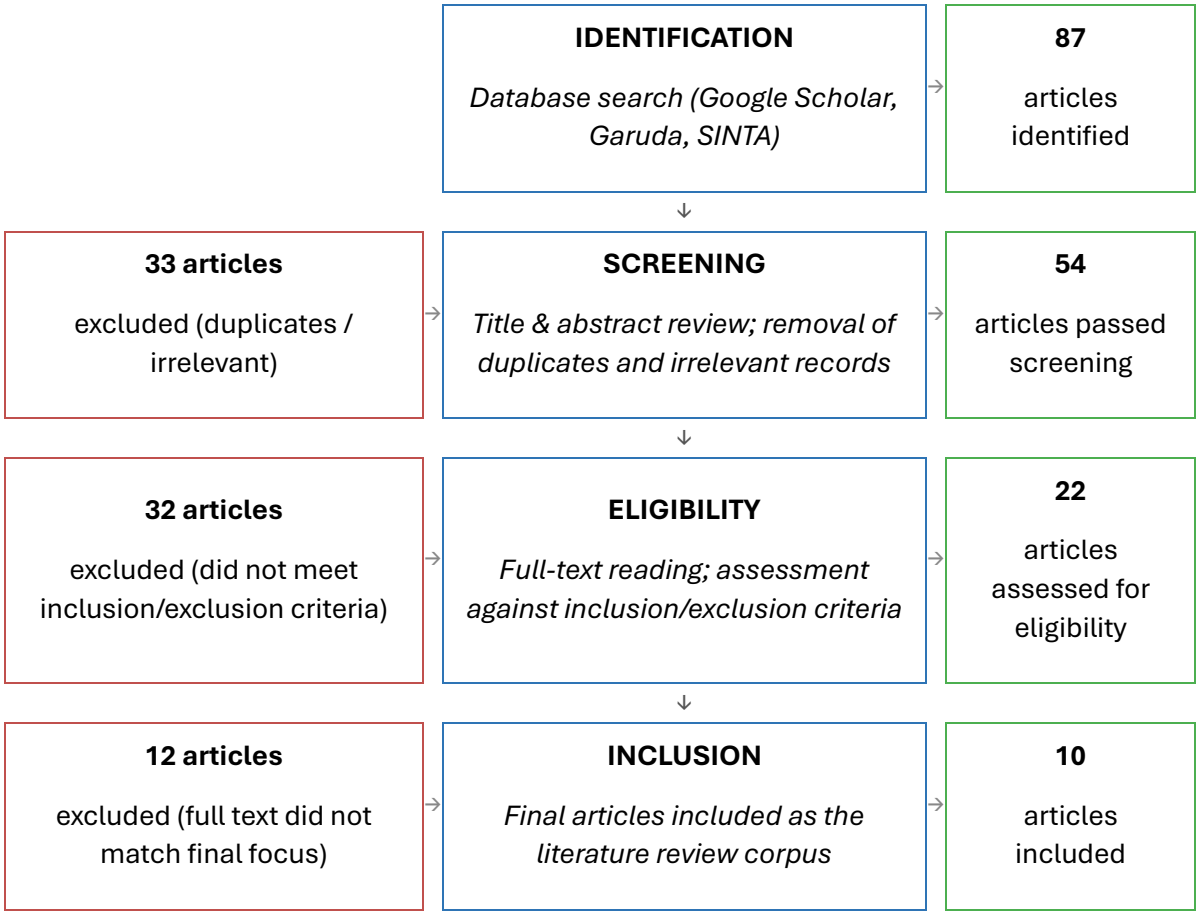


Figure 1. Article Selection Flowchart (Adapted from PRISMA)

Data were analyzed through three stages: (1) selection and verification of articles based on the established criteria; (2) classification of articles by research focus, methodological approach,

type of local wisdom, and geographic context; and (3) synthesis of findings to identify research trends, contributions, and gaps in the existing literature.

The results of the analysis were presented in a State of the Art mapping comprising columns for author, year, region/context, local wisdom type, subject focus, research design, and contribution. This mapping serves as the basis for identifying the urgency of developing local wisdom-based IPAS learning that has not yet been comprehensively studied.

Result

Patterns of Local Wisdom Types Documented in the Literature

The analysis of ten reviewed articles reveals three dominant categories of local wisdom that have been explored as potential learning resources for IPAS at the elementary school level. The most frequently documented category is traditional food practices, appearing in four of the ten studies, including the production of rempeyek (Maharani & Siwi, 2025) and sate bandeng (Kholidah et al., 2023). These food-based practices were found to contain concepts spanning physical and chemical change, biological processes, and local economic activity — all of which align directly with IPAS competencies. The second category, environmental and ecological management, was identified in three studies (Adellestia et al., 2025; Wardani et al., 2025; Alviya et al., 2025), encompassing practices related to traditional agriculture, water management, and community-based conservation. The third category, traditional handicrafts and artisanal technology, was documented in two studies, most notably the ethnoscience analysis of Sidoarjo batik (Fitriyah et al., 2025), which revealed embedded concepts of chemistry, cultural economics, and social identity. A smaller cluster of studies touched on traditional medicine and herbal knowledge as a fourth emerging category, though this remains the least systematically explored. Table 2 summarizes the distribution of local wisdom types across the reviewed studies.

Geographic Distribution of Research

A clear geographic pattern emerges from the mapping: eight of the ten reviewed studies were conducted in Java-based cultural contexts, specifically drawing on Sundanese (Nurulaeni & Rahma, 2024), Madurese, Betawi, and East Javanese (Banyuwangi and Sidoarjo) traditions. Only two studies included references to cultural contexts outside Java. This concentration indicates a significant geographic gap in the existing literature, with the local wisdom of communities in Sumatra, Kalimantan, Sulawesi, Maluku, Nusa Tenggara, and Papua remaining largely undocumented as IPAS learning resources. Given Indonesia's extraordinary cultural diversity, this imbalance substantially limits the generalizability of current findings to national curriculum development.

Research Design Trends

The reviewed literature is dominated by qualitative and descriptive approaches. Six of the ten studies employed exploratory qualitative or qualitative descriptive designs, two used research and development (R&D) methods to produce ethnoscience-based instructional materials, one conducted an experimental study, and only one adopted a systematic literature review approach (Supriatna et al., 2024). No study in the corpus employed mixed-methods, quantitative, or large-scale comparative designs. This methodological pattern suggests that while the conceptual potential of local wisdom for IPAS learning is well-argued, empirical evidence of its learning outcomes particularly through controlled or quasi-experimental designs remains scarce.

Subject Focus: Science vs. Integrated IPAS

A consistent pattern across the reviewed literature is a tendency to frame local wisdom within science (IPA) learning rather than within the fully integrated IPAS framework that combines natural and social sciences. Eight of the ten studies focused primarily on science concepts, with social dimensions such as economic activity, cultural identity, and community practices treated as contextual background rather than as co-equal instructional targets. Only two studies (Maharani & Siwi, 2025; Kholidah et al., 2023) explicitly discussed local wisdom in relation to both the natural and social dimensions of IPAS. This finding reveals a conceptual gap: the integration of local wisdom into the full IPAS framework, as mandated by the Merdeka Curriculum, has not yet been systematically realized in the literature.

Contribution and Research Gaps

All ten reviewed studies reported positive contributions of ethnoscience-based local wisdom to learning outcomes, including improvements in students' conceptual understanding, engagement, and scientific attitudes. However, a consistent limitation across the corpus is the absence of systematic, cross-regional mapping of local wisdom as a structured IPAS learning resource. Individual studies tend to be bounded by a single cultural object, a single region, or a single science topic, without situating their findings within a broader national framework. Furthermore, none of the reviewed studies explicitly mapped the alignment between specific forms of local wisdom and the competency standards of the IPAS curriculum under Kurikulum Merdeka. These gaps collectively affirm the strategic importance of the present study as the first systematic effort to map this potential across multiple studies, regions, and local wisdom types.

Discussion

The findings of this study indicate that local wisdom has very strong potential to be utilized as a learning resource for IPAS in elementary schools, particularly due to its contextual nature and close connection to students' everyday life experiences. Local wisdom embedded in community practices, such as traditional agricultural systems, food processing, handicrafts, and environmental management, naturally contains integrated concepts of natural and social sciences. This is consistent with the characteristics of IPAS, which emphasize the integration of understanding natural phenomena and social dynamics. When IPAS learning is linked to local contexts, students not only learn concepts in an abstract manner but also understand how these concepts are applied and interpreted in real-life situations within their environment.

The ethnoscience approach plays a crucial role in integrating local wisdom into IPAS learning, as it bridges indigenous knowledge with modern science taught in schools. Through ethnoscience, cultural practices and traditional knowledge are not positioned as contradictory to science but rather as empirical sources that can be reconstructed into scientific concepts. This approach enables students to understand that science develops through human interactions with nature and the environment and is closely related to cultural and social values. Consequently, ethnoscience-based IPAS learning is oriented not only toward conceptual mastery but also toward strengthening cultural identity and fostering appreciation for local knowledge.

The results also reveal that the types of local wisdom utilized as learning resources for IPAS are still dominated by certain aspects, such as traditional food, environmental practices, and handicrafts, while other forms of local wisdom remain underexplored. This condition indicates that the utilization of local wisdom in IPAS learning is still partial and highly dependent on specific research contexts or regions. In fact, Indonesia's cultural diversity provides a vast and rich range

of learning resources that, if systematically mapped, could enrich IPAS learning at the national level. This limitation highlights the need for more comprehensive studies to identify and classify the potential of cross-regional local wisdom as IPAS learning resources aligned with the curriculum.

Furthermore, ethnoscience-based IPAS learning has been shown to contribute positively to the improvement of students' scientific literacy. Students become more capable of understanding concepts, relating knowledge to real-life contexts, and developing critical thinking skills and scientific attitudes. In addition, the integration of local wisdom into IPAS learning also affects affective aspects, such as the development of pride in regional culture, environmental awareness, and cultural identity. This demonstrates that ethnoscience-based IPAS learning plays a role not only in cognitive development but also in the formation of students' character and national values.

Overall, this discussion confirms that the utilization of local wisdom through the ethnoscience approach represents a relevant and promising strategy for improving the quality of IPAS learning in elementary schools. Nevertheless, the findings also reveal research gaps, particularly the limited number of literature studies that specifically and systematically map the potential of local wisdom as an integrated IPAS learning resource. Therefore, this study makes a conceptual contribution by presenting an ethnoscience-based literature mapping that can serve as a foundation for developing contextual, meaningful, and culturally grounded IPAS instruction rooted in Indonesia's rich local heritage.

Conclusion

The following table presents a consolidated summary of the key patterns identified across the ten reviewed studies, providing an evidence-based foundation for the conclusions drawn in this section:

Aspect	Main Findings
Research design	Dominated by qualitative descriptive and exploratory studies (6 of 10); limited use of experimental and systematic review approaches
Learning focus	Majority focus on science (IPA) only; only 2 of 10 studies explicitly addressed the fully integrated IPAS framework combining natural and social sciences
Local wisdom themes	Three dominant categories: traditional food practices (rempeyek, sate bandeng), environmental and ecological management, and traditional handicrafts (batik); traditional medicine emerging but underexplored
Geographic scope	Predominantly regional case studies concentrated in Java; minimal representation from Sumatra, Kalimantan, Sulawesi, and Eastern Indonesia
Research scope	Single cultural object or single region per study; no study conducted cross-regional or national-scale mapping
Outcomes reported	All studies reported positive contributions to conceptual understanding, student engagement, and scientific literacy, but lacked large-scale empirical validation

The patterns presented in Table 2 reveal that while the evidence base is consistently positive, the existing literature remains geographically concentrated, methodologically narrow, and framed predominantly around science (IPA) rather than the fully integrated IPAS framework. No prior study has conducted systematic cross-regional mapping of local wisdom types in alignment with IPAS competency standards under the Merdeka Curriculum. These converging gaps affirm the strategic necessity and original contribution of the present study.

Based on the results of the literature analysis and discussion, it can be concluded that local wisdom defined as the cultural knowledge and practices collectively held and passed down within a community has substantial potential as a learning resource for IPAS in elementary schools, as it contains an integrated combination of contextual natural and social science concepts that are closely related to students' life experiences. The ethnoscience approach, which reconstructs local knowledge into formal scientific concepts applicable in classroom instruction, has been shown to play a strategic role in integrating indigenous knowledge into IPAS learning. The three most consistently documented categories of local wisdom across the reviewed studies are traditional food practices, environmental and ecological management, and traditional handicrafts all of which contain concepts spanning physical change, biological processes, economic activity, and cultural identity that align directly with IPAS competencies. The findings also indicate that the utilization of ethnoscience-based local wisdom contributes positively to the improvement of conceptual understanding, scientific literacy, and the strengthening of students' scientific attitudes and cultural identity.

Nevertheless, the review reveals that previous studies have been largely dominated by local case studies and partial science instruction concentrated in Java, while systematic studies that comprehensively map the potential of local wisdom as an integrated IPAS learning resource across Indonesia's diverse regions remain limited. Therefore, this study occupies an important position in enriching ethnoscience research by presenting a literature mapping that emphasizes the urgency of utilizing local wisdom as a contextual, meaningful, and culturally grounded learning resource for IPAS rooted in Indonesia's cultural heritage.

Recommendations

Based on these conclusions, the following recommendations are proposed. First, elementary school teachers are encouraged to more actively explore and utilize the potential of local wisdom in the school environment as learning resources for IPAS, so that instruction becomes more contextual and relevant to students' lives. Second, curriculum developers and instructional material designers should systematically integrate local wisdom into IPAS learning tools through the ethnoscience approach, including teaching modules, student worksheets (LKPD), and digital learning media. Third, future researchers are advised to conduct empirical studies particularly experimental and mixed-methods designs to examine the effectiveness of ethnoscience-based IPAS learning in improving students' scientific literacy and character development, as well as to expand cross-regional studies beyond Java to more comprehensively map Indonesia's local wisdom. Fourth, educational policy support is needed to encourage the implementation of local wisdom-based learning as part of efforts to improve the quality of IPAS instruction and preserve national cultural heritage.

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