International Journal of Contextual Science Education (IJCSE)
e-ISSN: 3046-8876
Vol. 3, No. 3, September 2025
pp. 97-103

Developmental Research On Science Learning Based On Local Wisdom In Sumatra Island: A Systematic Literature Review

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Accepted: August 29th 2025, Approved: September 20th 2025, Published: September 30th 2025

Abstract— *This study aims to analyze developmental research on science learning based on local wisdom in Sumatra Island. The method employed is a Systematic Literature Review (SLR), allowing for a structured and comprehensive review of relevant articles by following pre-established steps. A total of 10 articles met the inclusion and exclusion criteria and were included in the final analysis. The findings reveal that science learning can be effectively integrated with local wisdom values, as science is closely related to the surrounding environment. Forms of local wisdom in Sumatra identified in the articles include the Musi River, regional flora and fauna, clay brick-making, local fermented food "dadiah," "Pempek" ethnoscience, tourist attractions such as Bukit Sulap Nature Park, Water Vang Dam Park, Temam Waterfall Nature Park, and various local natural disasters. The instructional design models employed include ADDIE, Four-D, Borg & Gall, and Plomp. The majority of research outcomes focus on the development of media and instructional materials based on technology.*

Keywords— Developmental Research; Science Learning; Local Wisdom; Sumatra Island.
How to Cite— Mahmudah, H., Harjono, A., Naf'atuzzahrah, Fadila, N., & Ansumarwaty, F. 2025. Developmental Research On Science Learning Based On Local Wisdom In Sumatra Island: A Systematic Literature Review. *International Journal of Contextual Science Education (IJCSE), 3* (3), 97-103. https://10.29303/ijcse.v3i3.1153

1. Introduction

Education is a fundamental human endeavor aimed at transmitting, developing, and constructing culture and civilization for future generations. In response to the challenges posed by global transformation, governments continuously seek to improve educational quality. A key issue is developing human resources with globally competitive competencies and skills. This aligns with the goal of education as stipulated in Law No. 20 of 2003, which identifies education as a strategic means to enhance human resource quality and ensure sustainable national development [1].

Within the Indonesian educational system, science education plays a critical role. Science is introduced early, beginning at the elementary level, as it pertains to the study of natural phenomena and environmental systems [2]. Science is defined as a body of knowledge that systematically explores the natural world and the causal relationships within it [3].

Local wisdom, meanwhile, serves as an essential instrument for fostering environmental awareness and preserving cultural identity in the face of globalization. In education, it provides a vehicle for safeguarding and promoting regional culture [4]. Local wisdom encompasses the unique characteristics and values of a community, developed through generational experiences and deeply embedded in local traditions [5]. Sumatra Island is one example of a region rich in local wisdom.

Integrating science education with local wisdom is both relevant and beneficial, as science is intrinsically linked to the environment. This integration allows educators to contextualize scientific concepts using familiar local elements and is expected to enhance students' character development [6][7].

A practical approach to achieving this integration is the development of science learning media that incorporate local cultural values. However, such development must adhere to a structured instructional design model. Therefore, this study aims to analyze instructional design models and key outputs from developmental research on science education that incorporates the local wisdom of Sumatra Island.

2. Method

This study employed the Systematic Literature Review (SLR) methodology, a structured research approach used to collect, identify, and synthesize findings related to a specific topic. The purpose of an SLR is to identify, critically evaluate, and interpret all relevant research concerning a defined research question or area of interest [8]. In this case, the SLR focused on science learning based on local wisdom in Sumatra Island.

The review and identification of articles were conducted systematically through a series of predetermined steps. Several key stages in conducting an SLR include:

2.1 Formulating the research question involves determining the scope and objectives of the review.

2.2 Developing inclusion and exclusion criteria to select relevant studies. The inclusion and exclusion criteria for the articles reviewed in this study are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	1.	Articles published within the last 5 years (2017–2023)
	2.	Indexed in SINTA 1–6
	3.	Research topics on local wisdom, ethnoscience, Sumatra Island
	4.	Literature related to science learning in elementary and secondary schools
	5.	Articles employing the Research and Development (R&D) method
Exclusion Criteria	1.	Theses and undergraduate research papers
	2.	Publications from 2015-2023

2.3 Conducting a comprehensive search for articles using Google Scholar.

2.4 Screening and selecting articles based on the predetermined inclusion and exclusion criteria.

2.5 Collecting relevant data from the reviewed articles, including study design, types of local wisdom integrated into science learning, types of educational products developed, and key findings.

2.6 Evaluating the literature to reduce the risk of bias in the information obtained.

2.7 Analyzing and synthesizing the findings through in-depth examination.

2.8 Drawing conclusions based on the findings [9].

The article selection process followed the flowchart illustrated in Figure 1.

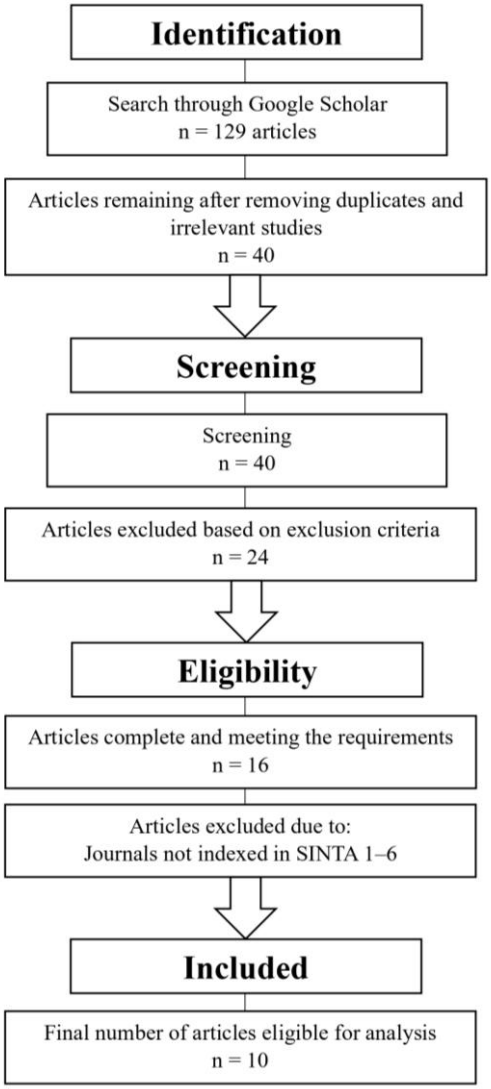

Fig 1. Article Selection Process

3. Results and Discussion

Based on the systematic literature review (SLR) method and the PRISMA diagram, the identification stage yielded a total of 129 articles from a Google Scholar search. After removing duplicates and irrelevant studies, 40 articles remained. During the screening stage, 24 articles were excluded based on the exclusion criteria. At the eligibility stage, 16 articles met the requirements, but 6 were further excluded because the journals were not indexed in SINTA 1–6. Ultimately, 10 articles were included for analysis. Table 2 provides a summary of the key information from each article:

Table 2. Article Analysis Results

Author(s)	Title	Year & SINTA Rank	Region	Design Model	Type of Local Wisdom	Product
Suratmi Suratmi, Laihat Laihat, Didi Jaya Santri	Development of Teaching Materials Based on Local Excellences of South Sumatra for Science Learning in Elementary School	2018 SINTA 2	Palembang, South Sumatra	ADDIE	Local wisdom of Palembang City	Teaching Materials
Yunita Wardianti, Ria Dwi Jayati	Validitas Modul Biologi Berbasis Kearifan Lokal	2018 SINTA 3	Lubuklinggau, South Sumatra	Four D	Bukit Sulap Nature Park, Water Vang Dam Tourism Park, Temam Waterfall Nature Park	Module
Zaitul Hidayat, Rahima Syabrina Sarmi, Ratnawulan	Efektivitas Buku Siswa IPA Terpadu dengan Tema Energi dalam Kehidupan berbasis Materi Lokal Menggunakan Model Integrated untuk Meningkatkan Kecakapan Abad 21	2020 SINTA 3	Sijunjung, West Sumatra	Plomp	Community activities, food, tourism, and disasters in Sijunjung, West Sumatra	Science Student Book
Tiurida Intika, Jumiati	Pengembangan Bahan Ajar Etnospem (Etnosains Pempek) Terhadap Keterampilan Proses Sains Sekolah Dasar	2020 SINTA 4	Muara Enim, South Sumatra	Borg & Gall	Pempek Ethnoscience	Teaching Materials
Mansyur Romadhon Putra, Andri Valen, Asep Sukenda Egok	Pengembangan Media Monopoly Game Pada Pembelajaran Sains Berbasis Kearifan Lokal Siswa Sekolah Dasar	2020 SINTA 5	Lubuklinggau, South Sumatra	Borg & Gall	Local flora and fauna	Monopoly Game Media
Siti Sriyati, Amira Ivana, Didik Pryandoko	Pengembangan Perangkat Pembelajaran Biologi Berbasis Potensi Lokal Dadiah Untuk Meningkatkan Keterampilan Proses Sains Siswa	2021 SINTA 2	Sijunjung, West Sumatra	ADDIE	Local potential of Dadiah	Learning Tools
Puji Ayurachmawati, Sylvia Lara Syaflin, Mega Prasrihamni	Pengembangan Multimedia Berbasis Kearifan Lokal Pada Muatan Materi IPA di SD	2022 SINTA 3	Palembang, South Sumatra	ADDIE	Local flora and fauna	Interactive Multimedia
Atika Riani, Maharani Oktavia, Aldora Pratama	Pengembangan Multimedia Berbasis Kearifan Lokal Pada Tema 7 Siswa Kelas V SD Negeri 06 Payaraman	2022 SINTA 5	Payaraman, Ogan Ilir, South Sumatra	ADDIE	Clay brick production	Interactive PowerPoint

Rama Fitri Destiana, Misdalina Misdalina, Putri Dewi Nurhasana	Pengembangan LKPD Berbasis Kearifan Lokal Kota Palembang	2022 SINTA 5	South Sumatra	ADDIE	Local wisdom of Palembang City	Student Worksheet (LKPD)
Elda Theresia, Rohana, Imelda Ratih Ayu	Pengembangan Media Video Blog (Vlog) Berbasis Kearifan Lokal Materi Kegunaan dan Siklus Air Pada Siswa Kelas V SD	2023 SINTA 4	Palembang, South Sumatra	Four D	Musi River	Video Blog (Vlog) Media

Based on the results of the study, which analyzed 10 articles, it was found that there has been a growing body of developmental research on science learning based on local wisdom in Sumatra Island. The instructional design models used in these studies include the ADDIE model, the Four-D model, the Plomp model, and the Borg & Gall model. The frequency of each model's usage across the 10 analyzed articles is illustrated in Figure 2 below.

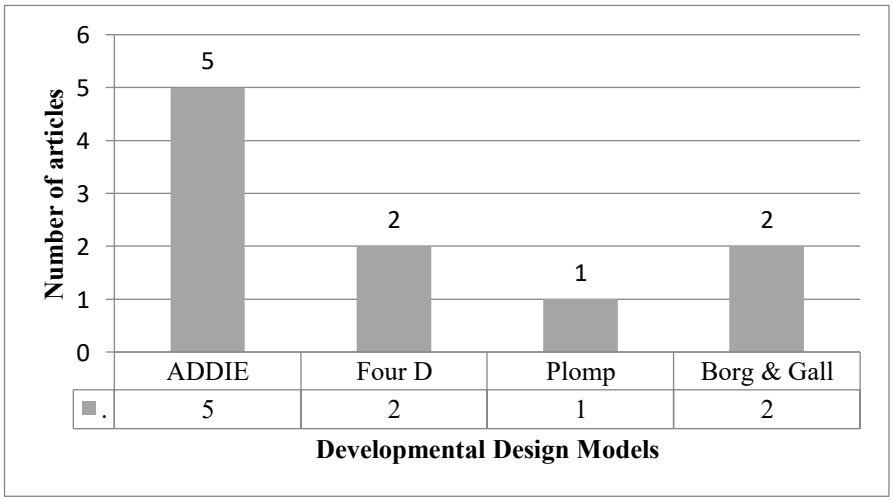

Fig 2. Instructional Design Models

Figure 2 above shows that five articles used the ADDIE research model, two articles used the Four-D model, one article used the Plomp model, and two articles used the Borg & Gall model. The ADDIE model has the advantage of evaluating each stage, minimizing errors or product deficiencies at the final stage, making it more effective [10]. Therefore, it can be concluded that the ADDIE model is the most widely used design model.

This study found 10 research articles on local wisdom development related to science learning. Some articles specifically mentioned the types of local wisdom integrated into the learning process, while others discussed local wisdom in general and did not specifically mention these aspects. Each of these studies will be described in detail below.

The study conducted by Suratmi et al. (2018) developed teaching materials based on local wisdom in Palembang. Local wisdom was integrated into science learning, specifically on topics such as ecosystem balance and the food chain. Analysis of local wisdom was conducted by visiting the South Sumatra Provincial Tourism Office to obtain relevant data and information [11]. Furthermore, research by Wardianti et al. (2018) discussed the creation of a local wisdom-based biology module that covered ecosystem material by describing situations around students, such as natural tourist attractions in Lubuklinggau. This will facilitate student understanding of the material and improve learning outcomes. Local wisdom that can be utilized as learning resources includes the Bukit Sulap nature tourism park, which is part of the Kerinci Seblat National Park (TNKS), the Dam Water tourism park, and the Temam waterfall nature tourism park [12][13].

Research by Hidayat et al. (2020) examined local potential in the Sijunjung area, Sijunjung Regency, West Sumatra. The local material utilized included community activities, food, tourist attractions, and disasters in the area. This local wisdom was integrated into an Integrated Science Student Textbook. The use of this book is expected to enhance students' creativity and innovation skills. Furthermore, the book's effectiveness can also be used as a reference for improving communication and collaboration skills [14][15][16]. Intika & Jumiati's (2020) research developed teaching materials based on the local wisdom of the people of South Sumatra Province, namely pempek. The use of ETNOSPEM teaching materials as a medium is considered effective, good, and practical for developing students' science process skills. ETNOSPEM comes from the word "ETNOS" which stands for "ETNOSAINS" and "PEM" which stands for "PEMPEK". Students are directed to practice directly making pempek by referring to ETNOSPEM teaching materials [17][18]. Furthermore, Putra et al.'s (2020) research discusses a monopoly game media based on local wisdom that illustrates the concept or material of adaptation of living things and the environment. This research also incorporates local wisdom from the city of Lubuklinggau. This research makes students more active in learning, enthusiastic in working on questions, attracts students' attention and makes it easier for students to understand the material being

taught [19].

Sriyati's (2021) research examines the local potential of dadiah, a fermented product derived from simple biotechnology originating from the Minangkabau region of West Sumatra. This research developed learning resources integrated with biotechnology material in high school biology lessons. These resources included lesson plans (RPP), student worksheets (LKS), handouts, and questions to enhance students' science process skills. Students conducted practical work to make dadiah. After implementing the local dadiah-based learning tools, they were given a Science Process Skills (KPS) test to assess their science process skills. The results showed that the learning tools, utilizing the local dadih potential, improved science process skills [20].

Ayurachmawati et al.'s (2022) research developed local wisdom-based multimedia for science content related to plant and animal reproduction. The plant examples used in this study were the langsat and tembesu plants, while the animal examples were the belida fish, the bluwok stork, and the Sumatran tiger. The goal is to familiarize students with the plants and animals characteristic of their region. The local wisdom-based multimedia developed in this study is categorized as valid and practical for use, making learning more enjoyable [13]. Furthermore, research by Riani et al. (2022) discusses the development of interactive PowerPoint multimedia based on local wisdom, which uses bricks made from clay dough that is then fired. The properties of clay are very different from those of stone. The resulting stone remains unchanged due to the mixing process with water and firing. This relates to the topic of temperature and heat. The results obtained are valid and practical interactive PowerPoint multimedia for application in learning [21].

Research by Destiana et al. (2022) discusses the development of student worksheets (LKPD) in science learning based on local wisdom in the city of Palembang in general. Integrating local wisdom into learning aims to help students better understand the local potential of their region. The science material linked to local wisdom is about the environment and the water cycle. The results indicate that the developed student worksheets are highly valid, practical, and effective for implementation in learning [22]. Furthermore, research by Theresia et al. (2023) discussed the development of video blog (vlog) learning media on the use and water cycle by linking it to local wisdom found in South Sumatra, namely the Musi River. The results showed that the development of the video blog (vlog) learning media was valid, practical, and effective [23].

The development research in the articles analyzed resulted in a variety of learning products. The following diagram shows the types of products produced. Data obtained showed that four articles produced learning media products, four articles produced teaching materials, one article produced learning tools, and one article produced student worksheets (LKPD).

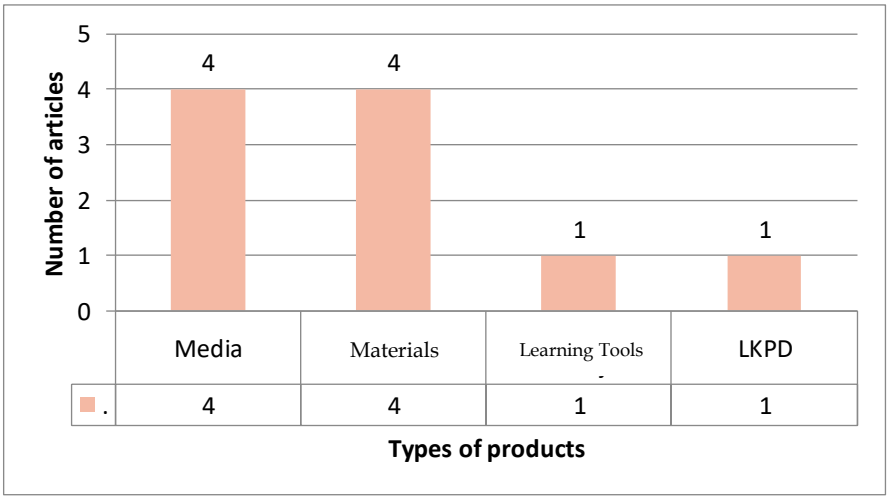

Fig 3. Research Products

Developmental research based on local wisdom in Sumatra Island has been predominantly conducted at the elementary school (SD) level. The primary objective of these studies is to introduce students to local wisdom from an early age, allowing them to become familiar with the cultural and environmental characteristics of their surroundings. The science topics most frequently associated with local wisdom are those related to environmental education. The following figure illustrates the distribution of research across primary and secondary education levels.

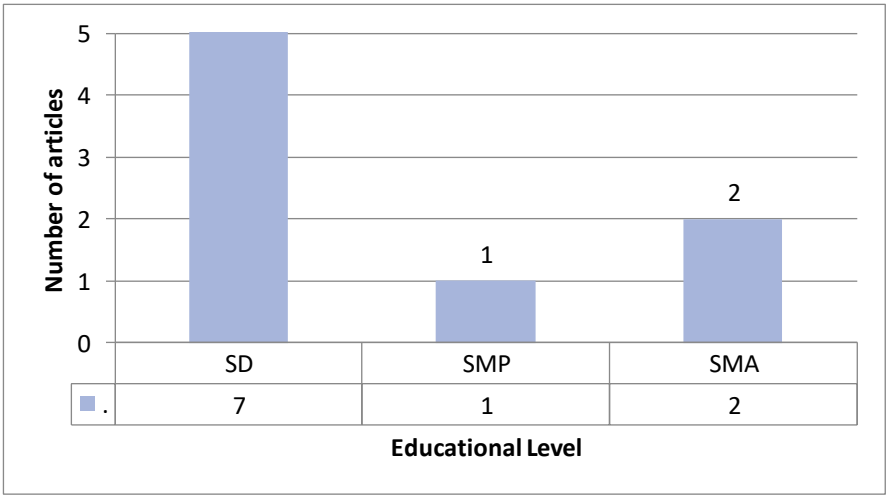

Fig 4. Number of Articles by Educational Level

4. Conclusion

Based on the results and discussion, it can be concluded that integrating local wisdom into the context of science learning offers significant benefits. The reviewed studies demonstrate that the development of multimedia, educational games, video blogs, presentation media, and other learning resources rooted in local wisdom can enhance students' engagement, interest, and understanding of science content.

Furthermore, integrating local wisdom into science learning—especially in topics such as biotechnology, ecosystems, and natural sciences—provides students with practical learning experiences and enables them to connect scientific concepts to real-life contexts. Among the instructional design models applied in the development of science learning based on local wisdom in Sumatra Island, the ADDIE model emerged as the most frequently used. This model is considered more effective due to its evaluation process at each stage, which minimizes errors or weaknesses in the final product.

In conclusion, incorporating local wisdom into science education not only makes learning more engaging and meaningful for students but also contributes to the preservation and appreciation of local culture. The products developed through these studies primarily consisted of technology-based instructional media and teaching materials.

Acknowledgment

The authors would like to express their sincere gratitude to the Postgraduate Program of Science Education, University of Mataram, for the academic and administrative support provided throughout the completion of this research. Special thanks are also extended to all researchers whose works were reviewed in this study for contributing valuable insights into the integration of local wisdom into science learning. Lastly, the authors thank their families and colleagues for their encouragement and support during the research and writing process.

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