Journal of Smart Pedagogy and Education
Published by Yayasan Cerdas Pedia Indonesia
Volume 2 Issue 2, Oktober 2026 ISSN (Online) ***3110-4169***
Journal Homepage: **https://jurnal.smartpedia.co.id/index.php/spedu**

Elementary Teachers' Perceptions of Language Literacy in Science-Social Learning: A Case Study

Persepsi Guru Sekolah Dasar terhadap Literasi Bahasa dalam Pembelajaran Sains-Sosial: Studi Kasus

Fadhil Nur Hidayat[1], **Dexani Widyasari**[2], **Firda Annisa Sholehats**[3], **Imam Ahmadi**[4]
[1,4]Islamic Elementary School Teacher Education, STIT Al Mubarok Bandar Mataram, Indonesia
[2]Elementary Education, Universitas Negeri Yogyakarta, Indonesia
[3]Islamic Educational Management, STIT Al Mubarok Bandar Mataram, Indonesia

Article Info

Corresponding Author:
Fadhil Nur Hidayat
✉kisangga1986@gmail.com

History:
Submitted: 01-08-2026
Revised: 01-09-2026
Accepted: 20-10-2026

Keyword:
Classroom Teacher Perceptions; Cross-Curricular Literacy; Natural and Social Sciences; Merdeka Curriculum; Smart Pedagogy.

Kata Kunci:
Persepsi Guru Kelas; Literasi Lintas Kurikulum; Ilmu Pengetahuan Alam dan Sosial; Kurikulum Merdeka; Pedagogi Cerdas.

Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA).

https://doi.org/10.65101/spedu.v2i2.464

Abstract

Merging natural and social sciences into Natural and Social Sciences (IPAS) under Indonesia's Merdeka Curriculum heightens disciplinary literacy demands in upper elementary grades, yet classroom teachers rarely integrate Indonesian language literacy despite teaching both subjects. This study examined how upper-grade classroom teachers conceptualize and operationalize Indonesian language literacy within IPAS instruction, alongside barriers and systemic support needs. Employing a qualitative single-site case study at SD Islami Qur'ani, East Lampung, involving three classroom teachers across Grades IV through VI, data from semi-structured interviews, participatory observations, and document analysis were examined through interactive thematic analysis. Findings reveal that teachers mentally compartmentalize language and content, restricting literacy to routine textbook reading and unguided answers without linguistic feedback due to time pressure, assessment ambiguity, varied reading proficiency, and absent specialized training. Uncovering generalist cognitive compartmentalization, this study advances smart pedagogy by proposing literacy-embedded modules, dual-aspect rubrics, adaptive tiered texts, and school-based professional learning communities.

Abstrak

Penggabungan sains dan sosial menjadi Ilmu Pengetahuan Alam dan Sosial (IPAS) pada Kurikulum Merdeka meningkatkan tuntutan literasi disipliner di kelas tinggi sekolah dasar, namun guru kelas jarang mengintegrasikan literasi bahasa Indonesia meski mengampu kedua mata pelajaran tersebut. Penelitian ini mengkaji konseptualisasi dan praktik integrasi literasi bahasa Indonesia oleh guru kelas tinggi dalam pembelajaran IPAS, beserta hambatan dan kebutuhan dukungan sistemik. Menggunakan studi kasus kualitatif tunggal di SD Islami Qur'ani, Lampung Timur, bersama tiga guru kelas IV hingga VI, data wawancara semiterstruktur, observasi partisipatif, dan analisis dokumen dikaji melalui analisis tematik interaktif. Temuan menunjukkan guru memisahkan bahasa dari konten secara mental, membatasi literasi sebatas membaca buku paket dan menjawab soal tanpa umpan balik kebahasaan akibat tekanan waktu, ambiguitas penilaian, keragaman kemampuan baca, serta ketiadaan pelatihan khusus. Mengungkap kompartementalisasi kognitif guru kelas, studi ini memajukan pedagogi cerdas melalui modul bermuatan literasi, rubrik penilaian ganda, teks berjenjang adaptif, dan komunitas belajar profesional sekolah.

A. INTRODUCTION

1. Background

The nationwide implementation of Indonesia's Merdeka Curriculum in the 2022/2023 academic year restructured upper-elementary instruction by merging Natural Sciences (*Ilmu Pengetahuan Alam*) and Social Sciences (*Ilmu Pengetahuan Sosial*) into a single interdisciplinary subject—Natural and Social Sciences (*Ilmu Pengetahuan Alam dan Sosial*, hereafter IPAS)—for Grades IV, V, and VI.[1] Intended to foster systemic thinking from an early age, this curricular reform requires learners to analyze interconnected natural and social phenomena holistically, such as examining flooding through both scientific determinants (rainfall and topography) and social dimensions (community behavior and spatial planning policy).[2] Yet this convergence exposes an urgent, underexamined instructional tension within the smart pedagogy landscape: upper-grade IPAS materials rely densely on scientific explanations, experimental procedures, observation reports, and socio-scientific arguments whose comprehension and written expression depend directly on Indonesian language literacy.[3] During Grades IV through VI—when students undergo the critical developmental transition from learning to read to reading to learn—treating literacy as peripheral to socio-scientific inquiry undermines adaptive, evidence-based meaning-making and reduces integrated learning to passive content recall.

This policy-to-practice disconnect is especially pronounced within the institutional structure of Indonesian elementary schools. Unlike secondary schools, where non-language disciplines are delivered by subject-specialist educators, Indonesian elementary schools assign specialist teachers primarily to Religious Education, Physical Education, and Regional or English Language. Core subjects—including Indonesian Language, IPAS, Mathematics, and Civic Education—are taught by a single generalist classroom teacher (*guru kelas*) who instructs the same cohort of students throughout the school day.

---

[1] Beni Setiawan and Edi Suwandi, "The Development of Indonesia National Curriculum and Its Changes: The Integrated Science Curriculum Development in Indonesia," *Journal of Innovation in Educational and Cultural Research* 3, no. 4 (July 4, 2022): 528–35, https://doi.org/10.46843/jiecr.v3i4.211.

[2] Jamilah and Yeni Puji Astuti, "Science Learning in Primary Schools: A Comprehensive Analysis of Curriculum Merdeka Implementation," *Journal of Education Research and Evaluation* 9, no. 2 (May 25, 2025): 269–81, https://doi.org/10.23887/jere.v9i2.91470.

[3] Johan Mahyudi et al., "Exploration of Scientific Literacy in Indonesian Language Textbooks for Elementary and Secondary School," *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran, Dan Pembelajaran* 9, no. 2 (June 1, 2023): 521–29, https://doi.org/10.33394/jk.v9i2.7758.

Structurally, this arrangement creates an optimal foundation for cross-curricular smart pedagogy: because classroom teachers routinely teach reading comprehension, academic vocabulary, effective sentence construction, and standard spelling in Indonesian language periods, they already command the pedagogical repertoire needed to scaffold students' disciplinary reading and writing inside IPAS. Paradoxically, however, classroom enactment indicates that Indonesian language literacy integration within IPAS remains persistently minimal, revealing a sharp divide between teachers' structural dual role and their everyday instructional decisions.

Recent educational scholarship illuminates this dilemma across three distinct yet insufficiently bridged strands. Internationally, researchers investigating disciplinary literacy and content-language integration—including Colwell, Hutchison, and Woodward, Aguirre-Muñoz, Pando, and Liu, Holdinga, van Drie, and Rijlaarsdam, and Domke and Cerrato—converge on the argument that language operates as the core cognitive medium through which scientific and disciplinary knowledge is constructed.[4] Collectively, these scholars demonstrate that meaningful content mastery depends on explicit instructional scaffolding in disciplinary reading and writing, adaptive or digitally supported texts, and curriculum frameworks that embed language objectives directly alongside content assessments. Within Indonesia's Merdeka Curriculum context, a second strand of scholarship—exemplified by Chasanah and Wiyani, Desstya et al., and Susilowati, Saputro, and Sutono—has focused on designing nested instructional models, socio-scientific learning frameworks, and literacy-oriented IPAS interventions that report gains in students' scientific literacy and critical thinking.[5] Tempering this model-driven optimism,

[4] Jamie Colwell, Amy Hutchison, and Lindsay Woodward, "Digitally Supported Disciplinary Literacy in Elementary Instruction," *The Reading Teacher* 75, no. 4 (January 11, 2022): 463–74, https://doi.org/10.1002/trtr.2070; Zenaida Aguirre-Muñoz, Magdalena Pando, and Chen Liu, "Enhancing Bilingual/ESL Teachers' STEM Instruction with Targeted Content and Disciplinary Literacy Professional Development: A Study on Knowledge and Practice Outcomes," *Education Sciences* 14, no. 7 (July 7, 2024): 745, https://doi.org/10.3390/educsci14070745; Lieke Holdinga, Jannet van Drie, and Gert Rijlaarsdam, "Enhancing Disciplinary Literacy Through Integrated Writing and Process Instruction: An Intervention Study," *Reading and Writing* 39, no. 1 (January 15, 2026): 141–83, https://doi.org/10.1007/s11145-025-10630-2; Lisa M. Domke and María A. Cerrato, "Integrating Content and Language Instruction for Multilingual Learners: A Systematic Review Across Program Types," *Review of Educational Research* 96, no. 1 (February 14, 2026): 299–338, https://doi.org/10.3102/00346543241298667.

[5] Maghfirotun Chasanah and Novan Ardy Wiyani, "Implementation of the Nested Integrated Learning Model in IPAS Material for 4th Grade," *Formatif: Jurnal Ilmiah Pendidikan MIPA* 14, no. 2 (September 28, 2024), https://doi.org/10.30998/formatif.v14i2.27798; Anatri Desstya et al., "Development of a Natural and Social Sciences Learning Model Based on Socio Scientific Issues to Strengthen Scientific Literacy of Islamic Elementary School Students," *Jurnal Penelitian Pendidikan IPA* 10, no. 11 (November 25, 2024): 8703–11, https://doi.org/10.29303/jppipa.v10i11.9094; Diah Susilowati, Bagus Ardi Saputro, and Agus Sutono, "The Effect of Strengthening the Literacy Movement in Natural and Social Sciences (IPAS) Learning on Improving

however, a third body of empirical work on Indonesian elementary classrooms—such as Amellia, Heryadi and Anriani, and Syahda et al.—shows that literacy in everyday school practice remains largely compartmentalized into standalone habituation programs (such as *Gerakan Literasi Sekolah*) rather than embedded into cross-subject instructional goals.[6] Meanwhile, studies addressing institutional and educator readiness, including Wibowo, Sayekti, and Dewanti and Andriyati, Amin, and Li, primarily examine school leadership structures or pre-service multiliteracies competencies rather than how in-service generalist teachers mentally frame subject boundaries.[7]

Synthesizing these competing strands reveals three critical blind spots in the existing literature. First, prior studies on cross-curricular literacy in Indonesia rarely differentiate between subject-specialist teachers and elementary classroom teachers, overlooking the unique paradox of generalist educators who simultaneously teach both Indonesian Language and IPAS. Second, investigations of teacher perceptions have disproportionately prioritized external, school-level determinants—such as facilities, reading corners, leadership, or policy mandates—while leaving underexplored the internal cognitive schemas and affective dispositions that shape how classroom teachers separate language from content. Third, the upper elementary grades (Grades IV–VI), despite serving as the pivotal bridge into disciplinary literacy, remain largely unexamined regarding how classroom teachers conceptualize and operationalize Indonesian language literacy inside the integrated IPAS curriculum.

In contrast to previous studies that predominantly focus on standalone school literacy habituation programs, subject-specialist instructional deficits, or top-down curricular model design, this research offers a novel perspectival approach within the smart pedagogy landscape by centering the cognitive, affective, and practical perceptions

---

Students' Scientific Literacy and Critical Thinking Skills," *Primary: Jurnal Pendidikan Guru Sekolah Dasar* 14, no. 1 (February 7, 2025): 11–28, https://doi.org/10.33578/jpfkip-v14i1.p11-28.

[6] Mia Amellia, "Pengamatan Pelaksanaan Program Literasi Di Sekolah Dasar," *ELSCHO: Jurnal Pendidikan Guru Sekolah Dasar* 1, no. 2 (July 29, 2023): 23–29, https://doi.org/10.25299/elscho.2023.13394; Yadi Heryadi and Nurul Anriani, "Budaya Literasi Melalui Program Gerakan Literasi Sekolah (GLS) Dalam Menumbuhkembangkan Minat Baca Siswa Di Sekolah Dasar," *Jurnal Basicedu* 7, no. 6 (December 15, 2023): 3717–23, https://doi.org/10.31004/basicedu.v7i6.6506; Alya Nurfaira Syahda et al., "Studi Literatur: Peran Guru Dalam Mengintegrasikan Literasi Membaca Pada Pembelajaran Tematik Di Sekolah Dasar," *Jurnal Tinta* 7, no. 2 (September 28, 2025): 252–60, https://doi.org/10.35897/jurnaltinta.v7i2.1949.

[7] Udik Budi Wibowo, Octavian Muning Sayekti, and Septinda Rima Dewanti, "Nature and Skills of Effective Leadership for The Success of Literacy Programs in Elementary Schools," *Jurnal Prima Edukasia* 11, no. 2 (July 31, 2023): 286–93, https://doi.org/10.21831/jpe.v11i2.62816; Nofica Andriyati, Abdul Amin, and Yanping Li, "Exploring Multiliteracies Competencies in Indonesian Teacher Education: A Cross-Disciplinary Survey of Pre-Service Teachers," *Frontiers in Education* 10 (December 30, 2025), https://doi.org/10.3389/feduc.2025.1710081.

of upper-grade elementary classroom teachers who concurrently teach both Indonesian Language and IPAS under the Merdeka Curriculum. By foregrounding how generalist teachers construct mental boundaries between disciplines they both teach, this inquiry shifts the analytical lens from presumed individual incompetence toward the fragmented pedagogical culture and institutional gaps sustaining disciplinary segregation.

This study argues that the persistent separation between Indonesian language literacy and IPAS instruction in upper elementary grades stems not from a deficit in teachers' linguistic competence, but from a compartmentalized pedagogical perception reinforced by content-centric teaching modules, single-aspect assessment practices, and generic professional development. This insight carries direct significance for the international education research community, as elementary generalist teachers worldwide face parallel tensions when translating interdisciplinary STEM and social studies reforms into coherent disciplinary literacy instruction. Drawing on a qualitative case study of upper-grade classroom teachers at SD Islami Qur'ani, East Lampung, this article shows how classroom teachers currently restrict literacy integration to routine textbook reading and unguided written responses, diagnoses the temporal, evaluative, student-readiness, and institutional barriers sustaining this practice, and outlines targeted smart-pedagogy solutions—specifically integrated classroom-teacher mentoring, literacy-embedded IPAS teaching modules, dual-focus assessment rubrics, tiered reading resources, and school-based professional learning communities—to align national curriculum reform with classroom reality.

2. Research Questions

Guided by the problem and gap analysis above, this study examines two interrelated research questions addressed sequentially in the subsequent analysis:

a. How do upper-grade elementary classroom teachers conceptualize and operationalize the integration of Indonesian language literacy within IPAS learning under the Merdeka Curriculum?
b. What instructional, student-related, and institutional challenges hinder classroom teachers from integrating Indonesian language literacy into IPAS learning, and what forms of professional and systemic support do they require?

3. Research Methods

This study employed a qualitative approach using a single-site case study design.[8] A qualitative case study was academically justified as the most appropriate design for answering the research questions because teachers' cognitive framing of disciplinary boundaries, affective orientations toward cross-curricular literacy, and unstated classroom routines cannot be captured adequately through standardized quantitative instruments. Examining the paradox of generalist teachers who teach both Indonesian Language and IPAS requires naturalistic, contextualized inquiry within an authentic school setting where national curriculum policy meets everyday instructional practice.

The research was conducted from February to April 2026 at SD Islami Qur'ani, East Lampung, Indonesia. Participants were selected using purposive sampling encompassing all upper-grade classroom teachers responsible for teaching both Indonesian Language and IPAS in Grades IV, V, and VI. Inclusion criteria required each teacher to have taught at least one full semester and to consent voluntarily to participate. Based on these criteria, three classroom teachers ($n = 3$) served as primary informants: the Grade IV teacher (coded G1), the Grade V teacher (coded G2), and the Grade VI teacher (coded G3). Primary data consisted of verbatim transcripts from semi-structured in-depth interviews and narrative field notes from participatory classroom observations during IPAS lessons, while secondary data comprised IPAS teaching modules, curriculum planning documents, official IPAS textbooks and guidebooks, and student written artifacts such as observation reports and textbook responses.

Data collection integrated three complementary techniques to compare teachers' articulated perceptions against enacted classroom behavior. First, semi-structured in-depth interviews explored each informant's cognitive understanding, affective beliefs, and classroom practices using the three-dimensional instrument matrix presented in Table 1. Second, participatory observations of live IPAS sessions documented how teachers utilized disciplinary texts, whether explicit reading or writing strategies were modeled, and whether linguistic feedback was provided. Third, document analysis examined lesson planning materials, textbooks, and student assignments to verify whether language literacy objectives and linguistic criteria were embedded in IPAS instruction. As illustrated in Table 1, the cognitive and affective indicators directly

[8] Sharan B. Merriam and Elizabeth J. Tisdell, *Qualitative Research: A Guide to Design and Implementation*, 4th ed. (San Francisco: Jossey-Bass, 2016), 37–40.

address the first research question by probing how teachers define and value literacy integration, whereas the action indicators address both research questions by tracing enacted classroom practices, perceived implementation barriers, and required institutional support.

Table 1. Qualitative Research Instrument Matrix for Classroom Teacher Perceptions of Literacy Integration in IPAS

Dimension	Operational Indicators
Cognitive	Teachers' conceptual understanding of Indonesian language literacy integration in IPAS learning; Teachers' knowledge of concrete pedagogical forms of literacy integration in IPAS classrooms.
Affective	Teachers' beliefs regarding the importance of integrating Indonesian language literacy in IPAS learning; Teachers' attitudes toward their professional responsibility for developing cross-curricular literacy.
Actions	Teachers' enacted classroom efforts to integrate Indonesian language literacy in IPAS learning; Perceived pedagogical, student-related, and institutional obstacles to literacy integration; Specific professional and institutional support needed by classroom teachers.

Source: Researchers' qualitative instrument framework adapted from study data (2026).

To ensure data trustworthiness, the study implemented source triangulation, technique triangulation, and member checking. Source triangulation cross-verified recurring patterns across all three upper-grade classrooms (Grades IV, V, and VI), whereas technique triangulation compared interview accounts against direct classroom observations and instructional documents. Member checking was performed by sharing interview summaries and preliminary findings with informants G1–G3 to verify interpretive accuracy and minimize researcher bias.

Data were analyzed using the interactive thematic analysis model of Miles, Huberman, and Saldaña, comprising three iterative stages: data condensation, data display, and conclusion drawing and verification.[9] During data condensation, transcripts, observation notes, and documentary extracts were selected, simplified, and coded according to the cognitive, affective, and practical indicators in Table 1. During data display, coded themes were organized into comparative matrices across G1, G2, and G3 to highlight both shared patterns of disciplinary compartmentalization and grade-level variations. In the final stage, conclusions were drawn and continuously verified against the raw empirical evidence to ensure analytical rigor. Because this study involved human

[9] Matthew B. Miles, A. Michael Huberman, and Johnny Saldaña, *Qualitative Data Analysis: A Methods Sourcebook*, 3rd ed. (Thousand Oaks, CA: SAGE Publications, 2014), 12–14.

participants, ethical protocols—including voluntary informed consent and participant identity anonymization (G1–G3)—were strictly maintained as detailed in the Ethics Statement.

B. RESULTS

1. Classroom Teachers' Conceptualizations and Enacted Forms of Indonesian Language Literacy Integration in IPAS

Data from semi-structured interviews, participatory classroom observations, and document analysis involving all three upper-grade classroom teachers at SD Islami Qur'ani, East Lampung, reveal a consistent pattern: teachers hold a narrow, operational conceptualization of Indonesian language literacy and treat it as conceptually detached from IPAS instruction. Across Grades IV, V, and VI, literacy is understood primarily as basic mechanical decoding and transcription rather than as a deliberate pedagogical strategy for constructing scientific and social knowledge.

At the conceptual level, subtle variations emerged across grade levels, yet none of the informants articulated literacy integration as an intentional cross-curricular instructional framework. The Grade IV classroom teacher (G1) equated literacy strictly with routine textbook reading and written task completion, measuring instructional success solely by whether students grasped factual content. As G1 explained, "Literacy is reading and writing, so when it comes to IPAS, children read the textbook and write their answers or assignments; in my view, as long as the children understand the material, that is enough" (Interview, G1, 2026). Although G1 formally teaches reading and writing skills during Indonesian Language periods, G1 did not perceive a functional pedagogical relationship between those linguistic competencies and conceptual comprehension in IPAS.

The Grade V classroom teacher (G2) demonstrated slightly broader terminological familiarity, recalling references to literacy from general Merdeka Curriculum training as careful reading and paraphrasing texts in students' own words. Nevertheless, G2 explicitly questioned the pedagogical relevance of applying these practices within IPAS, maintaining a rigid mental boundary between language instruction and disciplinary content. G2 remarked, "I have heard about literacy in the Merdeka Curriculum training; as far as I understand, children are trained to read texts carefully and then rewrite them in their own language, but I am not sure that should be done in IPAS because IPAS is more

about discussing nature and social interaction, not language" (Interview, G2, 2026). Reinforcing this compartmentalization despite teaching both subjects to the same cohort, G2 added, "In Indonesian Language, I focus on how to read and write, whereas in IPAS, I focus on the material—those are two different things" (Interview, G2, 2026).

The Grade VI classroom teacher (G3) exhibited the most limited conceptual awareness, candidly stating unfamiliarity with the notion of integrating Indonesian language literacy into IPAS and relying entirely on prescribed textbook procedures. G3 stated, "I teach according to the guidebook; if there is a text in the book, I tell students to read it, and if there is a question, I tell them to write an answer. I have never thought about connecting Indonesian Language lessons with IPAS" (Interview, G3, 2026). From G3's perspective, dedicated Indonesian Language class hours are sufficient to cultivate students' literacy skills, rendering cross-curricular reinforcement during IPAS unnecessary.

Classroom observations and analyses of instructional documents corroborated these conceptual boundaries, demonstrating that enacted literacy integration across all three grades remains rudimentary and content-bound. In Grade IV, G1's primary classroom practice involved having students take turns reading passages aloud from the IPAS textbook, followed by brief oral recall questions. Describing this routine, G1 noted, "After reading, I ask, 'What happens if the forest is deforested?' The students answer, 'Flood.' That counts as reading, right? They read and then understand" (Interview, G1, 2026). Participatory observations confirmed that instruction stopped at surface-level oral questioning without structured reading comprehension strategies or extended writing activities, positioning the textbook strictly as an information delivery tool.

In Grade V, G2 implemented a comparatively more substantive literacy activity by instructing students to compose paragraph-length conclusions summarizing one week of recorded observations on mung bean growth. However, both interview data and classroom observations revealed that G2's instructional guidance and evaluation addressed factual content exclusively while withholding linguistic feedback. As G2 acknowledged, "Regarding whether the sentences are effective or not, I rarely check; even though I know how to improve sentences because I also teach Indonesian Language, in IPAS I feel it is unnecessary—as long as the answer matches the learning objective, that is enough" (Interview, G2, 2026). During observed lessons, students wrote their observation conclusions independently without explicit modeling of paragraph organization,

academic vocabulary usage, or sentence revision.

In Grade VI, G3 enacted the most minimal level of text engagement, instructing students to read IPAS textbook passages silently on their own and complete short-answer exercises drawn directly from the page. G3 explained, "I have never asked them to write an essay or a report—just read and answer the questions, because everything is already in the book; they simply look for the answers in the text" (Interview, G3, 2026). Classroom observations verified that students scanned passages mechanically to locate literal answers, receiving no instructional scaffolding on identifying main ideas, skimming explanatory structures, or decoding unfamiliar disciplinary vocabulary. Across all three classrooms, therefore, teachers' established linguistic expertise from teaching Indonesian Language remained systematically unapplied during IPAS instruction.

2. Implementation Challenges and Systemic Support Needs

Analysis of interviews, classroom observations, and institutional documents indicates that the persistence of compartmentalized instruction stems from an interplay of classroom-level constraints—specifically instructional time pressure, assessment ambiguity, and heterogeneous student reading readiness—and broader systemic gaps in professional development and curricular resources.

For the Grade IV teacher (G1), perceived time constraints driven by dense IPAS syllabus coverage constituted the primary barrier. Concerned about falling behind scheduled curricular targets, G1 defaulted to teacher-centered oral explanation rather than embedding reading or writing instruction. As G1 explained, "There is a lot of IPAS material, so if I also have to teach how to read accurately or write well during IPAS instructional hours, there certainly will not be enough time" (Interview, G1, 2026). Notably, although G1 possessed prior experience with thematic instruction and taught Indonesian Language daily, the perceived pressure of content coverage reinforced the view that language scaffolding belonged outside IPAS class periods.

For the Grade V teacher (G2), the central challenge lay in evaluative ambiguity regarding how to assess student writing within a content-area subject. Lacking integrated scoring criteria, G2 expressed uncertainty about balancing conceptual accuracy against linguistic quality: "I am confused about how to assess students' writing in IPAS—should I assess the accuracy of the content or assess the language?" (Interview, G2, 2026). Classroom observations and document checks of student observation reports confirmed that G2 evaluated only data completeness and factual accuracy, omitting sentence

structure and language conventions altogether due to the absence of dual-aspect assessment rubrics.

For the Grade VI teacher (G3), wide variations in students' foundational reading abilities posed an immediate instructional obstacle. G3 reported that several upper-grade students still struggled to decode and comprehend informational passages independently, hindering their engagement with IPAS texts. Yet despite routinely employing supportive strategies such as shared reading and guided paragraph discussions during Indonesian Language lessons, G3 refrained from transferring those practices into IPAS out of fear of depleting content-instruction time. Classroom observations confirmed that struggling readers were left to complete textbook tasks individually without targeted teacher scaffolding.

Beyond these classroom-specific barriers, all three informants identified severe institutional and systemic deficits. None of the teachers had participated in specialized professional development addressing how to integrate Indonesian language literacy within IPAS. Prior workshops focused broadly on general Merdeka Curriculum policies without demonstrating actionable strategies for teaching disciplinary reading and writing through socio-scientific content. Furthermore, teachers lacked access to concrete reference models, sample integrated teaching modules, or practical implementation guides, leaving them dependent on familiar routines that keep Indonesian Language and IPAS instruction separate.

In response to these barriers, the informants articulated targeted, complementary support needs aligned with their classroom realities. G1 prioritized concrete sample teaching tools and lesson modules illustrating how literacy activities fit within standard IPAS time allocations. G2 emphasized practice-oriented professional training designed specifically for elementary classroom teachers to dissolve the artificial boundary between Indonesian Language and IPAS. G3 called for streamlined, user-friendly assessment instruments capable of evaluating conceptual mastery and linguistic accuracy simultaneously. Collectively, all three teachers underscored the necessity of school-level structural support, particularly dedicated time for regular collaborative discussions among classroom teachers and access to leveled supplementary reading materials matched to students' diverse reading proficiencies.

As synthesized in Table 2, cross-case comparison across Grades IV, V, and VI demonstrates that while classroom teachers recognize the potential value of literacy in

supporting comprehension, their enacted practices remain restricted to unguided text use because institutional training, instructional modules, and assessment tools do not yet operationalize cross-curricular integration.

Table 2. Cross-Case Empirical Synthesis of Classroom Teachers' Conceptualizations, Enacted Practices, Challenges, and Support Needs in IPAS Learning

Informant (Grade)	Conceptualization of Literacy in IPAS	Enacted Classroom Practice	Primary Implementation Challenge	Priority Support Needed
G1 (Grade IV)	Basic reading of textbooks and writing task answers to grasp factual content.	Turn-taking oral textbook reading followed by simple oral comprehension questions; no writing tasks or reading strategy instruction.	Limited instructional time amid broad IPAS syllabus coverage, prompting reliance on oral lectures.	Concrete sample teaching modules demonstrating embedded literacy integration.
G2 (Grade V)	Aware of literacy (careful reading and paraphrasing) from general training, but views IPAS content and language as separate domains.	Assigned paragraph-form conclusions from week-long mung bean observation data; graded factual content only without linguistic guidance or feedback.	Assessment ambiguity and absence of rubrics balancing content accuracy with linguistic quality.	Practical, classroom-teacher-specific training bridging Indonesian Language and IPAS.
G3 (Grade VI)	Unfamiliar with cross-curricular literacy integration; adheres strictly to the guidebook and confines literacy to Indonesian Language hours.	Independent silent textbook reading to answer literal short-answer questions; no extended writing or reading comprehension scaffolding.	Heterogeneous student reading proficiency; reluctance to apply Indonesian Language scaffolding strategies due to time fears.	Simple dual-aspect assessment instruments evaluating both content and language.
Shared Systemic Pattern (G1–G3)	Strong conceptual compartmentalization between Indonesian Language and IPAS despite teaching both subjects.	Linguistic knowledge from teaching Indonesian Language is not transferred systematically into IPAS instruction.	Lack of specialized literacy-in-IPAS training, sample instructional models, and integrated curricular references.	Scheduled school-level collaborative discussion forums and leveled supplementary reading materials.

Source: Synthesized from semi-structured interviews, participatory classroom observations, and document analysis at SD Islami Qur'ani, East Lampung (2026).

C. DISCUSSION

1. Cognitive Compartmentalization Versus Cross-Curricular Literacy Demands

Addressing the first research question, the empirical evidence from SD Islami Qur'ani, East Lampung, uncovers a compelling pedagogical paradox: although upper-grade elementary classroom teachers concurrently teach both Indonesian Language and IPAS to the same cohort of students, they conceptualize and enact Indonesian language literacy as an isolated instructional silo. Interpreting these findings analytically demonstrates that the primary mechanism driving weak cross-curricular integration is not a deficit in teachers' linguistic proficiency. Rather, the dysfunction stems from generalist cognitive compartmentalization—an internalized pedagogical schema in which teachers mentally assign reading comprehension, academic writing, and language feedback exclusively to Indonesian Language periods while reducing IPAS to the transmission of natural and social facts.

Operated through the theoretical lens of Language Across the Curriculum (LAC)—originating in the Bullock Report tradition and expanded by Russell Cross—this mental segregation fundamentally contradicts how learners build disciplinary knowledge.[10] Cross conceptualizes language not as an auxiliary subject boundary, but as the primary cognitive tool operating within a unified curriculum space through which students negotiate, synthesize, and articulate disciplinary concepts. When classroom teachers (G1–G3) treat IPAS strictly as factual content delivery and restrict literacy to literal textbook reading or unguided written answers, they sever the constitutive link between linguistic reasoning and conceptual mastery.

Analyzing teachers' enacted classroom routines through disciplinary literacy theory further clarifies how this cognitive divide degrades instructional quality. As Patricia Paugh and Kristen Wendell argue in their functional STEM literacy framework, comprehending scientific and socio-scientific phenomena cannot be separated from reading, interpreting, and producing discipline-specific texts, because explanatory relationships are embedded directly in academic language.[11] Yet in Grades IV and VI (G1 and G3), IPAS textbooks functioned solely as static information repositories for extracting literal answers rather than as pedagogical arenas for teaching main-idea identification, textual inference, or technical vocabulary decoding. This mechanism confirms the empirical conclusions of Sarah K. Clark et al., who demonstrate that elementary science learning remains suboptimal when teachers deploy informational texts merely as content sources without explicitly modeling how disciplinary texts are structured and written.[12]

A parallel mechanism explains the instructional gap observed in Grade V (G2). Even when G2 assigned a substantive writing task—having students compose paragraph-length conclusions from a week of mung bean growth observations—the teacher graded factual accuracy alone and deliberately withheld feedback on sentence effectiveness or paragraph cohesion. Interpreted through the scaffolding framework of Albertus Djoko Lesmono and Sri Astutik, omitting linguistic feedback undermines students' scientific writing development because effective written communication of empirical observations

[10] Russell Cross, "Language and Content 'Integration': The Affordances of Additional Languages as a Tool within a Single Curriculum Space," *Journal of Curriculum Studies* 48, no. 3 (May 3, 2016): 388–408, https://doi.org/10.1080/00220272.2015.1125528.
[11] Patricia Paugh and Kristen Wendell, "Disciplinary Literacy in STEM: A Functional Approach," *Journal of Literacy Research* 53, no. 1 (March 21, 2021): 122–44, https://doi.org/10.1177/1086296X20986905.
[12] Sarah K. Clark et al., "Using Disciplinary Literacy to Teach Children to Write Science Informational Text," *Reading Psychology* 42, no. 5 (July 4, 2021): 455–83, https://doi.org/10.1080/02702711.2021.1888353.

relies directly on teacher-provided language scaffolding across sentence structure, precise terminology, and textual organization.[13] By decoupling content evaluation from language feedback, classroom enactment inadvertently teaches upper-grade students that coherent academic writing is unnecessary outside Indonesian Language hours.

Placing these findings in explicit scholarly dialogue with the literature reviewed in the Introduction demonstrates how this study simultaneously confirms, extends, and refutes prevailing claims. First, the surface-level reading and writing practices documented across G1–G3 confirm Indonesian classroom studies by Amellia, Heryadi and Anriani, and Syahda et al., verifying that elementary literacy remains largely divorced from cross-subject learning objectives.[14] Second, this study extends and complicates IPAS model-development scholarship—such as Chasanah and Wiyani, Desstya et al., and Susilowati, Saputro, and Sutono—which demonstrates positive student gains under researcher-designed integrated interventions.[15] The divergence between those favorable outcomes and the fragmented routines at SD Islami Qur'ani arises from methodological and contextual differences: whereas model-development studies evaluate short-term, researcher-scaffolded implementations, this naturalistic case study captures everyday baseline practices where external scaffolding is absent. Third, and most critically, the findings refute the dominant assumption in earlier Indonesian literature that weak cross-curricular literacy stems primarily from non-language teachers' lack of linguistic competence. That divergence stems directly from sample composition: previous studies largely sampled subject-specialist educators or collapsed teacher roles without distinguishing generalist classroom teachers. Because G1–G3 explicitly teach Indonesian Language daily and acknowledge knowing how to correct sentence structure and guide reading, their non-transfer exposes a fragmented pedagogical culture rather than an individual skill gap.

---

[13] Albertus Djoko Lesmono and Sri Astutik, "The Effect of Scaffolding Prompting Questions on Scientific Writing Skills in the Inquiry Classroom," *JPI (Jurnal Pendidikan Indonesia)* 12, no. 1 (2023): 30–38, https://doi.org/10.23887/jpiundiksha.v12i1.54655.

[14] Amellia, "Pengamatan Pelaksanaan Program Literasi Di Sekolah Dasar"; Heryadi and Anriani, "Budaya Literasi Melalui Program Gerakan Literasi Sekolah (GLS)"; Syahda et al., "Studi Literatur: Peran Guru Dalam Mengintegrasikan Literasi Membaca".

[15] Chasanah and Wiyani, "Implementation of the Nested Integrated Learning Model"; Desstya et al., "Development of a Natural and Social Sciences Learning Model"; Susilowati, Saputro, and Sutono, "The Effect of Strengthening the Literacy Movement".

2. Systemic Misalignment, Global Comparisons, and Boundary Conditions

Addressing the second research question, examining the interplay of classroom barriers—instructional time pressure amid dense IPAS coverage (G1), evaluative ambiguity between content and language accuracy (G2), heterogeneous student reading proficiency (G3), and the absence of specialized training and reference modules across all informants—reveals that compartmentalized practice is sustained by systemic institutional misalignment rather than isolated teacher reluctance. Because existing professional workshops, official guidebooks, and assessment tools continue to separate literacy instruction from socio-scientific content delivery, generalist teachers lack operational mechanisms to reconcile content coverage with language scaffolding within finite instructional periods.

Avoiding a narrow local context trap requires situating these Indonesian findings within global educational evidence across both developed and developing systems. In developed educational systems—such as the United States, Western Europe, and Australia—empirical studies by Lieke Holdinga, Jannet van Drie, and Gert Rijlaarsdam, Zenaida Aguirre-Muñoz, Magdalena Pando, and Chen Liu, and Lisa M. Domke and María A. Cerrato document remarkably similar tensions: even in well-resourced elementary and multilingual classrooms, teachers consistently revert to content-only delivery unless professional development explicitly bridges language and disciplinary inquiry and formal assessments codify linguistic criteria.[16,17] Comparable systemic dynamics appear across developing educational contexts characterized by rapid curriculum reform and linguistic diversity. In Indonesia, studies by Aninditya Sri Nugraheni and Moh Ferdi Hasan as well as Tati Lathipatud Durriyah et al. highlight how primary teachers struggle to adapt standardized national texts to varied student reading readiness and local linguistic realities when tiered resources and practical pedagogical models are scarce.[18,19] Likewise, macro-level studies by Udik Budi Wibowo, Octavian Muning Sayekti, and Septinda Rima

[16] Holdinga, van Drie, and Rijlaarsdam, "Enhancing Disciplinary Literacy Through Integrated Writing and Process Instruction"; Aguirre-Muñoz, Pando, and Liu, "Enhancing Bilingual/ESL Teachers' STEM Instruction".
[17] Domke and Cerrato, "Integrating Content and Language Instruction for Multilingual Learners".
[18] Aninditya Sri Nugraheni and Moh Ferdi Hasan, "Indonesian Language Learning Adaptation Strategies in Regional Language Environment: A Phenomenological Study in Rural Primary Schools," *Cogent Education* 13, no. 1 (2026), https://doi.org/10.1080/2331186X.2026.2635805.
[19] Tati Lathipatud Durriyah et al., "Indonesian Literacy Teachers' Efforts to Integrate Children's Literature in Literacy Classrooms," *The Australian Journal of Language and Literacy* 47, no. 2 (2024): 161–79, https://doi.org/10.1007/s44020-023-00056-0.

Dewanti and Nofica Andriyati, Abdul Amin, and Yanping Li underscore that school leadership support and pre-service multiliteracies preparation have not yet translated into coherent in-service instructional frameworks.[20]

At the macro-global level, leaving upper-grade disciplinary literacy unaddressed carries direct consequences for international development priorities and the digital economy. Under United Nations Sustainable Development Goal 4 (SDG 4)—particularly Target 4.1, which calls for equitable, quality primary education achieving minimum proficiency in reading alongside core disciplinary competencies—the Grades IV–VI transition from learning to read to reading to learn is a decisive inflection point. Furthermore, as global education undergoes rapid digital transformation and shifts toward a knowledge-driven digital economy, students must navigate multimodal informational texts, evaluate socio-scientific evidence critically, and communicate reasoning clearly across digital and print platforms. When elementary IPAS instruction reduces text engagement to literal answer-hunting, learners enter secondary schooling and future digital learning ecosystems underprepared for higher-order analytical literacy.

At the same time, assessing external validity requires stating the boundary conditions of these findings candidly. The mechanism of generalist cognitive compartmentalization documented here is most directly transferable to primary educational systems structured around generalist classroom teachers operating under centralized, recently converged interdisciplinary curricula (such as Indonesia's Merdeka Curriculum or comparable integrated STEM/social studies reforms in Southeast Asia and other developing nations). Its transferability is bounded by institutional context: private faith-based elementary schools (*SD Islami*) with limited instructional resources may experience sharper training and textbook constraints than heavily funded urban public or international schools with dedicated literacy coaches. Similarly, these dynamics differ fundamentally from secondary schools employing subject-specialist teachers, where barriers genuinely include deficits in pedagogical language knowledge rather than non-transfer of existing linguistic expertise.

[20] Wibowo, Sayekti, and Dewanti, "Nature and Skills of Effective Leadership"; Andriyati, Amin, and Li, "Exploring Multiliteracies Competencies in Indonesian Teacher Education".

3. Theoretical Contributions and Multi-Stakeholder Smart Pedagogy Implications

Theoretically, this study contributes to smart pedagogy, Language Across the Curriculum (LAC), and disciplinary literacy frameworks in two distinct ways. First, it advances the concept of generalist cognitive compartmentalization, demonstrating that structural co-location of language and content subjects within a single elementary classroom teacher is a *necessary* institutional affordance but not a *sufficient* condition for cross-curricular integration. Second, within smart pedagogy theory—which defines instructional innovation as the intelligent, adaptive, and evidence-based alignment of progressive pedagogy with modern learning ecosystems—these findings establish that curricular convergence and educational technologies cannot improve learning outcomes unless teachers' internal subject-boundary schemas, instructional modules, and assessment architectures are redesigned simultaneously.

Translating these analytical mechanisms into concrete action requires coordinated interventions across four stakeholder groups—classroom educators, school leaders, educational technology developers, and national policymakers—as synthesized in Table 3.

Table 3. Mapping Empirical Barriers to Theoretical Mechanisms and Multi-Stakeholder Smart Pedagogy Prescriptions

Empirical Barrier (Section B)	Underlying Theoretical Mechanism	Actionable Stakeholder Prescriptions
Mental separation of Indonesian Language and IPAS despite dual teaching role (G1–G3)	Generalist cognitive compartmentalization overriding LAC curriculum-space affordances	**Educators:** Repurpose daily Indonesian Language scaffolding routines (guided reading, main-idea mapping, paragraph revision) directly inside IPAS lessons.
Instructional time pressure amid dense syllabus coverage (G1)	Content-centric curriculum design framing literacy as an add-on rather than a medium of learning	**Policymakers:** Redesign official IPAS teaching modules (*modul ajar*) to embed explicit disciplinary reading and writing indicators within existing time allocations.
Evaluative ambiguity between factual accuracy and writing quality (G2)	Absence of dual-aspect assessment alignment decoupling language feedback from inquiry	**Policymakers & Educators:** Adopt streamlined dual-aspect IPAS rubrics scoring conceptual accuracy alongside sentence clarity, terminology, and report structure.
Heterogeneous student reading proficiency and reliance on single textbooks (G3)	Mismatch between uniform print texts and differentiated disciplinary literacy readiness	**Ed-Tech Developers:** Build adaptive, AI-assisted, or tiered digital IPAS reading repositories with built-in vocabulary scaffolding and formative writing prompts.
Lack of specialized	Fragmented professional	**School Leaders & Policymakers:**

training and reference models across school routines (G1–G3)	development decoupling general policy workshops from classroom practice	Institutionalize school-based Professional Learning Communities (PLCs) and classroom-mentored in-service practicums for upper-grade generalist teachers.

Source: Analytical synthesis developed by the authors from empirical case study findings at SD Islami Qur'ani, East Lampung (2026), and smart pedagogy literature.

As structured in Table 3, each prescription targets a specific institutional failure point identified in Section B. For classroom educators, immediate pedagogical improvement does not require learning an entirely unfamiliar skill set; rather, it entails intentionally transferring established Indonesian Language practices—such as modeling how to dissect scientific explanatory paragraphs, guiding collaborative text discussions for struggling readers, and providing brief formative comments on observation-report sentences—directly into IPAS inquiry. For school leaders and institutional managers, fostering sustainable instructional change requires protecting scheduled collaborative time for school-based Professional Learning Communities (PLCs) among Grades IV, V, and VI teachers. As Andrew M. Clark et al. demonstrate, PLCs catalyze pedagogical innovation because teachers co-design contextualized lessons and troubleshoot classroom obstacles through ongoing peer exchange rather than one-off external seminars.[21]

For educational technology (ed-tech) developers, these findings highlight an urgent market and pedagogical gap in elementary digital learning ecosystems. Drawing on Jamie Colwell, Amy Hutchison, and Lindsay Woodward's framework for digitally supported disciplinary literacy, ed-tech platforms targeting the Merdeka Curriculum should move beyond static digitized textbooks.[22] Developers should build lightweight, low-bandwidth adaptive reading modules offering tiered IPAS passages matched to varying student reading levels, interactive academic vocabulary glossaries, structured digital templates for observation reports, and automated dual-aspect rubric assistants that reduce teachers' grading burden while sustaining linguistic feedback. For education policymakers, including the Ministry of Primary and Secondary Education and national teacher training agencies, policy reform must realign three systemic levers simultaneously: embedding explicit Indonesian language literacy benchmarks inside official IPAS teaching modules, replacing generic curriculum socialization with

[21] Andrew M. Clark et al., "Innovating Teaching Practice Through Professional Learning Communities: Determining Knowledge Sharing and Program Value," *Sage Open* 13, no. 4 (October 3, 2023), https://doi.org/10.1177/21582440231200983.
[22] Colwell, Hutchison, and Woodward, "Digitally Supported Disciplinary Literacy in Elementary Instruction".

classroom-mentored practicum training tailored to generalist teachers, and issuing standardized dual-aspect assessment guides that legitimize language feedback inside content-area grading.

4. Limitations and Future Research Directions

The interpretations and prescriptions above must be weighed against four candid methodological limitations. First, regarding design and sample size, this research employed a single-site qualitative case study involving three upper-grade classroom teachers ($n = 3$) at one private Islamic elementary school in East Lampung. While purposive sampling captured the complete population of upper-grade teachers at the site and enabled rich analytical depth, the findings do not permit statistical generalization across all Indonesian elementary schools. Second, regarding data scope, the study examined teacher perceptions, observed classroom routines, and instructional artifacts, but did not administer standardized measurements of students' reading comprehension or scientific writing gains; consequently, the downstream impact of teachers' compartmentalized practices on learner achievement is inferred theoretically rather than measured quantitatively. Third, the three-month observation window (February–April 2026) captured a cross-sectional snapshot of instructional enactment rather than longitudinal shifts across an entire academic year. Fourth, reliance on self-reported interviews carries the inherent risk of social desirability bias, although this risk was actively mitigated through participatory classroom observations, document triangulation, and member checking.

Building directly on these boundaries, future scholarship should advance beyond diagnostic perception studies along four concrete trajectories. First, multi-site comparative studies comparing public urban, rural, and private elementary schools across diverse regional language contexts in Indonesia—and cross-nationally across Southeast Asia—are needed to test the external validity and contextual moderators of generalist cognitive compartmentalization. Second, design-based research (DBR) and quasi-experimental intervention studies should develop and empirically evaluate literacy-embedded IPAS teaching modules, dual-aspect assessment rubrics, and digitally supported tiered reading tools, measuring direct effects on both teacher scaffolding fidelity and students' disciplinary reading and writing performance. Third, longitudinal PLC and mentoring evaluations spanning one or more academic years should trace how sustained peer collaboration reshapes classroom teachers' cognitive schemas over time.

Fourth, mixed-methods investigations integrating classroom observations with learning analytics from digital reading platforms could illuminate how adaptive ed-tech scaffolds support heterogeneous upper-grade learners during the critical transition from learning to read to reading to learn.

D. CONCLUSIONS

Upper-grade elementary classroom teachers at SD Islami Qur'ani, East Lampung, continue to conceptualize and enact Indonesian language literacy as an isolated domain separate from IPAS instruction, confining daily classroom practice to routine textbook reading and unguided written responses without linguistic feedback despite teaching both subjects. This instructional disconnect arises not from deficits in teachers' linguistic competence, but from generalist cognitive compartmentalization reinforced by syllabus time pressure, evaluative ambiguity between content and language, heterogeneous student reading proficiency, and the absence of specialized training and reference tools. Bridging this gap within Indonesia's Merdeka Curriculum requires coordinated smart-pedagogy interventions comprising classroom-mentored in-service training, literacy-embedded IPAS teaching modules, streamlined dual-aspect assessment rubrics, adaptive tiered reading resources, and school-based professional learning communities. Because structurally holding a generalist classroom-teacher role does not automatically generate cross-curricular literacy integration, future empirical research should test targeted pedagogical and technological interventions across diverse elementary school contexts to strengthen students' transition into higher-order disciplinary literacy.

Required Statements

CRediT authorship contribution statement. F.N.H.: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft. D.W.: Methodology, Validation, Formal analysis, Writing – review & editing. F.A.S.: Data curation, Investigation, Visualization, Writing – review & editing. I.A.: Supervision, Project administration, Resources, Writing – review & editing.

Funding. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Declaration of competing interest. The authors declare that they have no known competing financial interests or personal relationships over the past 36 months that could have appeared to influence the work reported in this paper.

Data availability. The interview transcripts, classroom observation field notes, and student written artifacts contain contextual details that could identify individual teachers and the participating school and, per the informed consent obtained, cannot be shared publicly. The qualitative research instrument framework (Table 1) is presented within this article, and de-identified thematic excerpts are available from the corresponding author upon reasonable request, subject to institutional approval by the Research and Community Service Institute (LPPM), STIT Al Mubarok Bandar Mataram.

Ethics statement. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and Indonesia's Personal Data Protection Law (Law No. 27 of 2022). Because formal Institutional Review Board review was not mandated at the lead institution for non-clinical classroom observation research, ethical oversight and prior written research permission were obtained from the Research and Community Service Institute (LPPM) of STIT Al Mubarok Bandar Mataram and the leadership of SD Islami Qur'ani, East Lampung, before data collection commenced. All adult classroom-teacher participants provided voluntary written informed consent prior to participating; no identifiable minor student data were collected, and all participant records were anonymized using alphanumeric codes (G1–G3) and stored securely.

Declaration of generative AI and AI-assisted technologies in the writing process. The authors did not use generative AI or AI-assisted technologies in the preparation of this manuscript.

REFERENCES

Aguirre-Muñoz, Zenaida, Magdalena Pando, and Chen Liu. "Enhancing Bilingual/ESL Teachers' STEM Instruction with Targeted Content and Disciplinary Literacy Professional Development: A Study on Knowledge and Practice Outcomes." *Education Sciences* 14, no. 7 (July 7, 2024): 745. https://doi.org/10.3390/educsci14070745.

Amellia, Mia. "Pengamatan Pelaksanaan Program Literasi di Sekolah Dasar." *ELSCHO: Jurnal Pendidikan Guru Sekolah Dasar* 1, no. 2 (July 29, 2023): 23–29. https://doi.org/10.25299/elscho.2023.13394.

Andriyati, Nofica, Abdul Amin, and Yanping Li. "Exploring Multiliteracies Competencies in Indonesian Teacher Education: A Cross-Disciplinary Survey of Pre-Service Teachers." *Frontiers in Education* 10 (December 30, 2025). https://doi.org/10.3389/feduc.2025.1710081.

Chasanah, Maghfirotun, and Novan Ardy Wiyani. "Implementation of the Nested Integrated Learning Model in IPAS Material for 4th Grade." *Formatif: Jurnal Ilmiah Pendidikan MIPA* 14, no. 2 (September 28, 2024). https://doi.org/10.30998/formatif.v14i2.27798.

Clark, Andrew M., Monica Zhan, Justin T. Dellinger, and Peggy L. Semingson. "Innovating Teaching Practice Through Professional Learning Communities: Determining Knowledge Sharing and Program Value." *Sage Open* 13, no. 4 (October 3, 2023). https://doi.org/10.1177/21582440231200983.

Clark, Sarah K., Leigh K. Smith, Emma Judd, and Victoria Rosdahl. "Using Disciplinary Literacy to Teach Children to Write Science Informational Text." *Reading Psychology* 42, no. 5 (July 4, 2021): 455–83. https://doi.org/10.1080/02702711.2021.1888353.

Colwell, Jamie, Amy Hutchison, and Lindsay Woodward. "Digitally Supported Disciplinary Literacy in Elementary Instruction." *The Reading Teacher* 75, no. 4 (January 11, 2022): 463–74. https://doi.org/10.1002/trtr.2070.

Cross, Russell. "Language and Content 'Integration': The Affordances of Additional Languages as a Tool within a Single Curriculum Space." *Journal of Curriculum Studies* 48, no. 3 (May 3, 2016): 388–408. https://doi.org/10.1080/00220272.2015.1125528.

Desstya, Anatri, Ika Candra Sayekti, Fitri Puji Rahmawati, Yulia Maftuhah Hidayati, Honest Ummi Kaltsum, Yogi Muthohir Zuhad Mahya, Shafa Joyce Putri Kamila, Nur Ahlul Khotimah, Nita Fidyastuti, and Alfina Mutiara Diaz. "Development of a Natural and Social Sciences Learning Model Based on Socio Scientific Issues to Strengthen Scientific Literacy of Islamic Elementary School Students." *Jurnal Penelitian Pendidikan IPA* 10, no. 11 (November 25, 2024): 8703–11. https://doi.org/10.29303/jppipa.v10i11.9094.

Domke, Lisa M., and María A. Cerrato. "Integrating Content and Language Instruction for Multilingual Learners: A Systematic Review Across Program Types." *Review of Educational Research* 96, no. 1 (February 14, 2026): 299–338. https://doi.org/10.3102/00346543241298667.

Durriyah, Tati Lathipatud, Firman Parlindungan, Sofie Dewayani, Sary Silvhiany, and Yukari Amos. "Indonesian Literacy Teachers' Efforts to Integrate Children's Literature in Literacy Classrooms." *The Australian Journal of Language and Literacy* 47, no. 2 (2024): 161–79. https://doi.org/10.1007/s44020-023-00056-0.

Heryadi, Yadi, and Nurul Anriani. "Budaya Literasi Melalui Program Gerakan Literasi Sekolah (GLS) dalam Menumbuhkembangkan Minat Baca Siswa di Sekolah Dasar." *Jurnal Basicedu* 7, no. 6 (December 15, 2023): 3717–23. https://doi.org/10.31004/basicedu.v7i6.6506.

Holdinga, Lieke, Jannet van Drie, and Gert Rijlaarsdam. "Enhancing Disciplinary Literacy Through Integrated Writing and Process Instruction: An Intervention Study."

Reading and Writing 39, no. 1 (January 15, 2026): 141–83. https://doi.org/10.1007/s11145-025-10630-2.

Jamilah, and Yeni Puji Astuti. "Science Learning in Primary Schools: A Comprehensive Analysis of Curriculum Merdeka Implementation." *Journal of Education Research and Evaluation* 9, no. 2 (May 25, 2025): 269–81. https://doi.org/10.23887/jere.v9i2.91470.

Lesmono, Albertus Djoko, and Sri Astutik. "The Effect of Scaffolding Prompting Questions on Scientific Writing Skills in the Inquiry Classroom." *JPI (Jurnal Pendidikan Indonesia)* 12, no. 1 (2023): 30–38. https://doi.org/10.23887/jpiundiksha.v12i1.54655.

Mahyudi, Johan, Mahsun Mahsun, Sukri Sukri, Ahmad Sirulhaq, Syaiful Musaddat, and B. Siti Hijriah. "Exploration of Scientific Literacy in Indonesian Language Textbooks for Elementary and Secondary School." *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran, dan Pembelajaran* 9, no. 2 (June 1, 2023): 521–29. https://doi.org/10.33394/jk.v9i2.7758.

Merriam, Sharan B., and Elizabeth J. Tisdell. *Qualitative Research: A Guide to Design and Implementation*. 4th ed. San Francisco: Jossey-Bass, 2016.

Miles, Matthew B., A. Michael Huberman, and Johnny Saldaña. *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. Thousand Oaks, CA: SAGE Publications, 2014.

Nugraheni, Aninditya Sri, and Moh Ferdi Hasan. "Indonesian Language Learning Adaptation Strategies in Regional Language Environment: A Phenomenological Study in Rural Primary Schools." *Cogent Education* 13, no. 1 (2026). https://doi.org/10.1080/2331186X.2026.2635805.

Paugh, Patricia, and Kristen Wendell. "Disciplinary Literacy in STEM: A Functional Approach." *Journal of Literacy Research* 53, no. 1 (March 21, 2021): 122–44. https://doi.org/10.1177/1086296X20986905.

Setiawan, Beni, and Edi Suwandi. "The Development of Indonesia National Curriculum and Its Changes: The Integrated Science Curriculum Development in Indonesia." *Journal of Innovation in Educational and Cultural Research* 3, no. 4 (July 4, 2022): 528–35. https://doi.org/10.46843/jiecr.v3i4.211.

Susilowati, Diah, Bagus Ardi Saputro, and Agus Sutono. "The Effect of Strengthening the Literacy Movement in Natural and Social Sciences (IPAS) Learning on Improving Students' Scientific Literacy and Critical Thinking Skills." *Primary: Jurnal Pendidikan Guru Sekolah Dasar* 14, no. 1 (February 7, 2025): 11–28. https://doi.org/10.33578/jpfkip-v14i1.p11-28.

Syahda, Alya Nurfaira, Dea Mustika, Balqis Nuroniyah, Hafifah Gina Salsabillah, Indah Kurnia, and Veriska Nofita Putri. "Studi Literatur: Peran Guru dalam Mengintegrasikan Literasi Membaca pada Pembelajaran Tematik di Sekolah Dasar." *Jurnal Tinta* 7, no. 2 (September 28, 2025): 252–60. https://doi.org/10.35897/jurnaltinta.v7i2.1949.

Wibowo, Udik Budi, Octavian Muning Sayekti, and Septinda Rima Dewanti. "Nature and Skills of Effective Leadership for the Success of Literacy Programs in Elementary

Schools." *Jurnal Prima Edukasia* 11, no. 2 (July 31, 2023): 286–93. https://doi.org/10.21831/jpe.v11i2.62816.