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Teacher Collaboration in Integrative Curriculum Development at Nature-Based Schools

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ABSTRACT

Nature-based schools have grown rapidly worldwide, yet research on how teachers collaborate to develop integrative curricula within these settings—and what ecosystem factors shape such collaboration—remains limited. This study aimed to systematically synthesise existing literature on teacher collaboration in integrative curriculum development at nature-based schools, identify enabling and impeding ecosystem factors, and map current research gaps. A Systematic Literature Review (SLR) following the PRISMA protocol was conducted, screening 90 articles from four databases (ERIC, Google Scholar, Scispace, and Semantic Scholar) published between 2015 and 2026, from which 43 articles met all inclusion criteria. Thematic analysis revealed four main forms of teacher collaboration: curriculum co-planning and co-design, interdisciplinary team teaching, professional learning communities (PLC), and collaboration with external actors. Four ecosystem factor categories were identified as enablers and barriers: school leadership (the most determinant factor), school culture, educational policy, and the physical-community ecosystem of nature-based schools. Five critical research gaps were identified, notably the scarcity of studies in Asian and Indonesian contexts, the absence of integrative research simultaneously examining all three variables, and the lack of longitudinal studies. These findings indicate that effective teacher collaboration in nature-based schools requires distributed principal leadership, autonomy-supporting policies, and a systemic collaborative culture, with implications for school principals, policymakers, and researchers.

Article Information

Keywords:

Kolaborasi guru; Kurikulum integratif; Sekolah alam; Faktor ekosistem; Tinjauan sistematis literatur

ABSTRACT

Sekolah alam telah berkembang pesat di seluruh dunia, namun penelitian tentang bagaimana guru berkolaborasi dalam mengembangkan kurikulum integratif di lingkungan ini—serta faktor-faktor ekosistem yang membentuk kolaborasi tersebut—masih sangat terbatas. Penelitian ini bertujuan untuk mensintesis literatur yang ada secara sistematis mengenai kolaborasi guru dalam pengembangan kurikulum integratif di sekolah alam, mengidentifikasi faktor-faktor ekosistem yang mendukung dan menghambat kolaborasi tersebut, serta memetakan kesenjangan penelitian yang masih ada. Tinjauan Sistematis Literatur (SLR) mengacu pada protokol PRISMA dilakukan dengan menyaring 90 artikel dari empat database (ERIC, Google Scholar, Scispace, dan Semantic Scholar) yang diterbitkan antara 2015 hingga 2026, di mana 43 artikel memenuhi seluruh kriteria inklusi. Analisis tematik mengungkap empat bentuk utama kolaborasi guru: co-planning dan co-design kurikulum, team teaching lintas disiplin, komunitas belajar profesional (PLC), dan kolaborasi dengan aktor eksternal. Empat kategori faktor ekosistem diidentifikasi sebagai pendukung dan penghambat: kepemimpinan kepala sekolah (faktor paling determinan), budaya sekolah, kebijakan pendidikan, dan ekosistem fisik-komunitas sekolah alam. Lima kesenjangan penelitian kritis ditemukan, terutama minimnya studi di konteks Asia dan Indonesia, ketiadaan penelitian integratif yang mengkaji ketiga variabel secara bersamaan, dan kurangnya studi longitudinal. Temuan ini mengindikasikan bahwa kolaborasi guru yang efektif di sekolah alam memerlukan distributed leadership kepala sekolah, kebijakan yang mendukung otonomi guru, dan budaya kolaboratif yang sistemik, dengan implikasi bagi kepala sekolah, pembuat kebijakan, dan peneliti.

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1. Introduction

The rapid proliferation of nature-based schools—

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encompassing forest schools, bush kinders, and outdoor schools—across Europe, North America, Australia, and Southeast Asia has generated sustained interest in understanding the pedagogical conditions that sustain their effectiveness [1], [2]. Among these conditions, teacher collaboration in integrative curriculum development occupies a central position: the holistic, cross-disciplinary philosophy that defines nature-based schooling cannot be realised by any single teacher working in isolation [3], [4]. Yet the conditions under which this collaboration thrives or stagnates remain poorly understood, particularly in non-Western settings where the field is expanding most rapidly [5]

Existing scholarship has examined teacher collaboration and integrative curriculum development as largely separate domains. Studies on teacher collaboration have illuminated how accountability structures constrain professional autonomy [6], how teachers' mental models shape the quality of collegial interaction [7], and how professional learning communities function as structural vehicles for sustained collaborative practice [8], [9]. Parallel research on nature-based education has documented implementation challenges in forest school curricula [10], [11], characterised the pedagogical features of bush kinder environments [12], [13], and assessed outdoor learning interventions longitudinally [14]. A systematic review by Klopčič and Torkar [15] on outdoor science teaching confirmed that collaboration among teachers, school leaders, researchers, and policymakers is critical—yet rarely studied as an integrated phenomenon. Research specifically on integrative curriculum development in nature-based schools has explored co-design processes in the United Kingdom [12] and project-based learning models in Indonesia [16], [17], but these studies address the practice without systematically examining the school ecosystem conditions that enable or constrain it.

Three critical gaps emerge from this body of work. First, no study has simultaneously examined teacher collaboration, integrative curriculum development, and school ecosystem factors as an integrated triad within nature-based school contexts. Second, the overwhelming majority of available evidence originates from Western countries, leaving nature-based school practice in Indonesia and Southeast Asia—where growth is fastest—without a systematic evidence base. Third, existing reviews have not mapped the specific ecosystem factors—leadership, school culture, policy, and the distinctive physical-community environment—that shape collaborative curriculum work in these settings.

This review addresses these gaps by producing the first systematic synthesis that integrates all three variables—teacher collaboration, integrative curriculum, and school ecosystem factors—within a unified analytical framework, with explicit attention to non-Western, particularly Indonesian, contexts. In doing so, it generates a structured map of research gaps that positions future empirical work more precisely than prior narrative accounts.

This study addresses three research questions: (1) What forms of teacher collaboration in integrative curriculum development at nature-based schools are documented in the scientific literature? (2) What ecosystem factors enable and impede teacher collaboration in integrative curriculum development at nature-based schools? (3) What research gaps remain regarding teacher collaboration and ecosystem factors in integrative curriculum development at nature-based schools?

2. Research Method

2.1 Research Design

This study employed a Systematic Literature Review (SLR) as its research design, guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol [18]. SLR was selected because it enables a systematic, transparent, and replicable synthesis of dispersed scientific evidence while permitting the structured identification of research gaps—a primary objective of this study. The review followed four sequential stages: identification, screening, eligibility assessment, and inclusion.

2.2 Data Collection

Literature searches were conducted systematically across four databases. The selection rationale for each is presented in Table 2

Database	Rationale for Selection
ERIC	Most authoritative international database dedicated to education research
Google Scholar	Broad coverage including Scopus- and Web of Science-indexed journals; captures Indonesian-language publications
Scispace	Semantic search capabilities suited to interdisciplinary topics; filters by year, method, and citation count
Semantic Scholar	AI-enhanced indexing of open-access articles; strong coverage of non-Western educational research

The following search strings were applied consistently across all databases:

- English: "teacher collaboration" AND ("integrated curriculum" OR "integrative curriculum") AND ("nature-based school" OR "forest school" OR "outdoor school" OR "sekolah alam")
- Indonesian: "kolaborasi guru" AND ("kurikulum integratif" OR "kurikulum terpadu") AND ("sekolah alam")

All searches were restricted to publications from 2015 to 2026. Searches were conducted in [Month] 2025.

Inclusion and exclusion criteria were established prior to searching, as presented in Table 3.

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Table 3. Inclusion and Exclusion Criteria

Code	Criterion	Inclusion	Exclusion
I1/E1	Topic	Addresses nature-based/forest/outdoor school context AND at least one of: teacher collaboration OR integrative curriculum	Does not address nature-based school context, teacher collaboration, or integrative curriculum
I2/E2	Year	Published 2015–2026	Published before 2015
I3/E3	Document type	Peer-reviewed journal article, conference paper, or review article	Textbook, dissertation, thesis, technical report, non-peer-reviewed book chapter, or community service journal
I4	Method	Any research method accepted (qualitative, quantitative, mixed methods)	—
I5/E4	Language	Indonesian or English	Language other than Indonesian or English
I6/E5	Accessibility	Full-text available	Full-text unavailable; abstract only
E6	Duplication	—	Same article appearing in more than one database

2.3 Article Selection Process

Article selection followed the four PRISMA stages. Results at each stage are summarised in Table 4.

Table 4. Article Selection Results by Stage

Stage	n	Notes
Identification	90	ERIC=52, Google Scholar=5, Scispace=26, Semantic Scholar=7
After deduplication	87	3 duplicate articles removed
After title/abstract screening	49	38 excluded: E1-irrelevant topic (27), E2-pre-2015 (5), E4-language (6)
After full-text review	43	6 excluded: E3 — dissertations (3), book (1), book chapter (1), community service article (1)
Final included	43	Eligible for thematic analysis

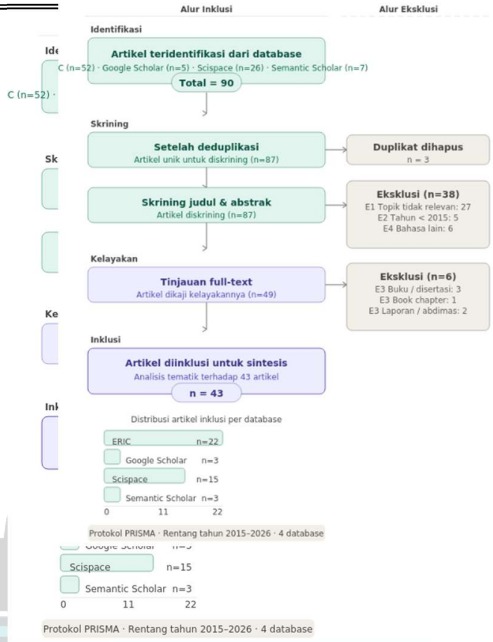

Figure 1. PRISMA Flow Diagram of Article Selection Process

2.4 Data Analysis Techniques

Data analysis proceeded in three sequential and documented stages to ensure replicability:

Stage 1 — Data extraction. Each of the 43 included articles was systematically extracted using a structured extraction table capturing: author(s), year, country/context, research method, school type, and findings relevant to each of the three RQs. The extraction table was piloted on five articles and refined before full application.

Stage 2 — Thematic coding. Extracted findings were subjected to inductive open coding, in which initial codes were generated directly from the data without a predetermined coding frame. Open codes were then grouped into sub-themes through axial coding, following the thematic analysis procedures established by Braun and Clarke (2006) Coding was conducted by the primary researcher and cross-checked against the full text of each article.

Stage 3 — Thematic synthesis. Sub-themes were synthesised into four main ecosystem factor categories—school leadership, school culture, policy, and the physical-community ecosystem of nature-based schools—through iterative comparison across all 43 articles. Each category was mapped against the three RQs to ensure systematic and comprehensive coverage of the evidence base.

Location and Time. This systematic review was conducted at Universitas Negeri Yogyakarta. Database searches were performed in February 2026, with data extraction and thematic analysis completed in March – May 2026

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3. Results and Discussion

3.1 Overview of Included Articles

Of the 43 articles analysed, the majority employed qualitative approaches (n=28, 65.1%), followed by mixed methods (n=7, 16.3%), literature review or SLR (n=5, 11.6%), and quantitative methods (n=3, 7.0%). Geographic distribution spanned Australia (n=8), Indonesia (n=7), the United Kingdom (n=6), Finland (n=4), the United States (n=4), Canada (n=3), Turkey (n=2), Italy (n=1), Spain (n=1), China (n=1), Belgium (n=1), Greece (n=1), and Ireland (n=1), plus several multinational studies. School contexts included forest schools and bush kinders (n=14), Indonesian nature-based schools (n=7), outdoor or nature-based schools broadly (n=12), and formal schools with nature-based elements (n=10). Articles from 2025–2026 dominated (n=19, 44.2%), indicating rapidly growing academic interest in this topic.

Table 1. Characteristics of Included Articles (n=43)

Characteristic	Category	Number (n=43)
Research Method	Qualitative	28 (65.1%)
	Mixed Methods	7 (16.3%)
	Literature Review / SLR	5 (11.6%)
	Quantitative	3 (7.0%)
Year Range	2015–2020	4 (9.3%)
	2021–2022	9 (20.9%)
	2023–2024	11 (25.6%)
	2025–2026	19 (44.2%)
School Context	Forest school / Bush kinder	14 (32.6%)
	Indonesian nature-based school	7 (16.3%)
	Outdoor / nature-based (general)	12 (27.9%)
	Formal school with nature-based elements	10 (23.2%)
Dominant Region	Australia	8 (18.6%)
	Indonesia	7 (16.3%)
	United Kingdom	6 (14.0%)
	Others (multinational)	22 (51.1%)

3.2 Forms of Teacher Collaboration in Integrative Curriculum Development at Nature-Based Schools (RQ1)

Thematic analysis of the 43 articles identified four main forms of teacher collaboration: (1) co-planning and co-design of curriculum, (2) interdisciplinary team teaching, (3) professional learning communities (PLC), and (4) collaboration with external actors.

First, curriculum co-planning and co-design was the most frequently documented form. Haapaniemi et al. [10]demonstrated that teacher collaboration in designing integrative curricula through structured joint planning forms the primary foundation in the Finnish context, with professional autonomy as a prerequisite for success. In Indonesian nature-based schools, Januardi et al. [11] reported that teachers collaborate to design project-based learning integrating nature experiences across disciplines, while Hughes and Davis [12] documented iterative co-design processes between principals and teachers for incorporating forest school philosophy into the national curriculum in England. Tolppanen [14] developed a dedicated planning tool to facilitate multidisciplinary teacher collaboration in project-based curriculum design.

Second, interdisciplinary team teaching emerged as a characteristic form in nature-based education contexts. Neville et al. [19] developed a pedagogical model supporting teachers from various subject areas to collaborate in designing and delivering cross-disciplinary outdoor learning. Speldewinde [13] found that teachers in Australian bush kinders organically integrate STEM into nature-based learning through collaborative practice. Suharto and Syaifuddin [20]reported that forest schools in Indonesia and the United Kingdom employ a 'flipped curricula' model in which teacher collaboration centres on creating space for students to design their own learning.

Third, professional learning communities (PLCs) serve as the primary structural vehicle for teacher collaboration in nature-based schools. Agustina et al. [8] found that PLCs represent an effective strategy for sustainable professional development in the Indonesian context. Gryson et al. [21] documented the effectiveness of teacher design teams as a specialised PLC format for interdisciplinary curriculum development, while Foster [9] showed that curriculum-based PLCs yield positive outcomes for both teachers and students. [22] documented a co-design model between teachers and researchers in the Morecambe Bay Curriculum project, producing more contextually meaningful nature-based curricula.

Fourth, collaboration with external actors distinguishes nature-based schools from conventional settings. [23] reported that Indonesian nature-based schools integrate local communities into curriculum development through research-based culinary festival activities, while Speldewinde and [24] showed that teacher-family collaboration is integral to the Australian bush kinder ecosystem. [25] affirmed that collaboration among teachers, administrators, families, and communities constitutes the foundation of an effective and sustainable outdoor learning ecosystem. At the Minangkabau nature-based kindergarten, teacher-parent collaboration in developing culturally grounded curricula was documented as a meaningful practice [26].

3.3 Ecosystem Factors Enabling and Impeding Teacher Collaboration (RQ2)

Thematic analysis identified four ecosystem factor categories that simultaneously shape the quality and sustainability of

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teacher collaboration in integrative curriculum development at nature-based schools.

3.3.1 School Leadership

School leadership consistently emerged as the most determinant ecosystem factor. [12] found that the principal's strategic leadership is the key factor enabling forest school integration into the mainstream curriculum, as principals with a clear vision of nature-based education can mobilise resources and build inter-teacher trust systematically. [27] empirically demonstrated through a quantitative study in China that transformational principal leadership mediates the relationship between curriculum reform policy and teacher collaboration, with the school's emotional climate as a significant intervening variable. Karsantık [28] concluded in a systematic review that strong instructional leadership consistently correlates positively with the quality of teacher collaboration. Vidal et al. [16] further showed that distributed leadership fosters a more collaborative and innovative learning ecosystem.

Conversely, a lack of principal support constitutes the primary barrier to teacher collaboration. Whincup et al. [17]found that forest school teacher-leaders in England faced conflicts between forest school philosophy and national curriculum demands, exacerbated by the absence of institutional support from principals. Demirer [29] found that rigid administrative hierarchies impeded more organic and participatory principal-teacher collaboration in Turkish forest schools.

3.3.2 School Culture

A collaborative school culture was the second most consistently identified enabling factor. [30] found that a collective school culture—characterised by inter-teacher trust, professional norms supporting knowledge sharing, and shared vision—is a prerequisite for successful nature-based sustainability education.[31]documented that transforming school culture towards nature education requires a systemic process; yet once established, teacher collaboration becomes more organic and self-sustaining. [32]used a complex systems framework to show that a reflective culture and high teacher agency drive collaborative curriculum design that is more adaptive to change.

Toikka and Tarnanen [33]found that differences in teachers' mental models of collaboration—between those who view it as mere administrative coordination versus those who view it as knowledge co-construction—constitute a significant barrier to meaningful collaboration. Teacher individualism and resistance to cultural change were also identified as obstacles requiring systemic intervention by school leadership.

3.3.3 Policy

Educational policy plays a dual role as both enabler and barrier. As an enabler, [10] demonstrated that Finland's curriculum policy—which explicitly supports integrative approaches and grants broad autonomy to teachers—provides a powerful structural foundation for collaboration. [34] found that policies empowering teacher agency encourage more proactive collaboration. In Indonesia, Tunggal et al. [36] found that Kurikulum Merdeka opens broader collaborative space through school-level curriculum flexibility, though implementation remains hampered by principals' limited facilitation capacity. [8] reinforced this by showing that Ministry of Education policy support significantly strengthens PLCs in Indonesian schools.

As a barrier, Holloway and Parcerisa [35]found that strict accountability systems and standardisation pressures constrain teacher autonomy and impede organic collaboration. Ávalos-Bevan and Flores [36], in a comparative study of Chile and Portugal, showed that centralised curriculum regulation significantly limits the form and depth of teacher collaboration, indicating that curriculum autonomy policy is an indispensable structural precondition.

3.3.4 Physical and Community Ecosystem of Nature-Based Schools

Ecosystem factors specific to nature-based schools exert a significant and distinctive influence.] [27] found that accessible natural environments and school policies supporting outdoor learning systematically drive stronger, multidimensional teacher collaboration. [11] and Suharto and Syaifuddin [20] showed that the nature-based school philosophy inherently encourages interdisciplinary collaboration, as no single teacher can independently cover all dimensions of the natural environment. Speldewinde [13] affirmed that the Australian bush kinder ecosystem creates conditions that naturally foster teacher-parent-community collaboration.

However, environmental factors can also serve as barriers. Karppinen [37] and Harris [24] found that limited infrastructure, unpredictable weather, and time constraints constitute significant practical impediments. Klopčič and Torkar [15]concluded that these ecosystem challenges can only be overcome through the collective commitment of all actors—teachers, principals, researchers, and policymakers—working in synergy.

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Table 5. Ecosystem Factors Enabling and Impeding Teacher Collaboration at Nature-Based Schools

Factor Category	Enablers	Barriers
School Leadership	Distributed leadership, transformational leadership, nature-based curriculum vision, strong instructional leadership [13][26][27][28]	Rigid administrative hierarchy, lack of vision, weak institutional support [29][30]
School Culture	Inter-teacher trust, collaborative norms, reflective culture, shared vision, PLC [31][32][33]	Teacher individualism, differing conceptions of collaboration, cultural resistance [34]
Policy	Curriculum autonomy, decentralisation, Kurikulum Merdeka, PLC policy support [11][18][35][36]	Strict accountability, curriculum centralisation, standardisation pressure [37][38]
Nature-Based School Ecosystem	Accessible natural environment, nature-based philosophy, community and parental involvement [12][23][24]	Limited infrastructure, unpredictable weather, time and resource constraints [39][40]

3.4 Existing Research Gaps (RQ3)

Analysis of the 43 articles identified five significant research gaps that simultaneously constitute the principal contribution of this review to the field of nature-based education.

First, there is a scarcity of research in Asian contexts, particularly Indonesia and developing countries. Most literature originates from Western countries, while research on Indonesian nature-based schools, though emerging [11], [20], [23]remains limited in scope and methodological depth. Ecosystem factors identified in Western contexts may not translate to Indonesian settings shaped by distinct Kurikulum Merdeka dynamics, gotong royong cultural values, and different community ecosystems.

Second, no study has simultaneously integrated all three core variables: teacher collaboration, integrative curriculum, and nature-based school ecosystem factors. Existing research examines pairs of variables in isolation—teacher collaboration and curriculum without a nature-based context, or nature-based schools and curriculum without a focus on teacher collaboration. Klopčič and Torkar [15] identified similar fragmentation in their outdoor science teaching review.

Third, longitudinal studies tracing the development of teacher collaboration in nature-based schools over time are absent. Most research is cross-sectional or single-point-in-time case studies. Sutherland et al. [32] and Karsantık [28] both recommended longitudinal designs to understand how collaboration develops, is sustained, or declines within the dynamic ecosystem of nature-based schools.

Fourth, no comprehensive, empirically validated model exists to describe the interaction between nature-based school ecosystem factors and teacher collaboration quality in integrative curriculum development. Existing models—including Sutherland et al.'s [33] complex systems framework, Neville et al.'s [19] pedagogical model, and Oberle et al.'s [25] systemic perspective—were developed in different contexts and have not been integrated into a single applicable framework.

Fifth, the role of school principal leadership in Asian nature-based school contexts—specifically the relationship between principals' leadership styles, school culture, and teacher collaboration quality—has never been systematically examined. [29] has only begun to address this in the Turkish context, while Indonesia and Southeast Asia remain entirely unexamined despite rapid sector growth.

Table 6. Research Gap Map and Implications for Future Research

No	Research Gap	Implications for Future Research
1	Scarcity of research in Asia/Indonesia on teacher collaboration at nature-based schools	Empirical qualitative multi-site case studies in Indonesian nature-based schools
2	No integrative research simultaneously examining teacher collaboration + integrative curriculum + ecosystem factors	Multivariable mixed-methods research examining all three elements concurrently
3	Shortage of longitudinal studies on teacher collaboration development at nature-based schools	Longitudinal designs of 2–3 years to understand collaboration dynamics at nature-based schools
4	No comprehensive framework describing ecosystem–collaboration–curriculum interaction at nature-based schools	Development and empirical validation of a theoretical model across diverse nature-based school contexts
5	Principal leadership role at Asian nature-based schools not yet systematically examined	Focused studies on principal leadership styles at nature-based schools in Indonesia and Southeast Asia

4. Conclusion

This systematic literature review addressed three research questions through comprehensive analysis of 43 articles from four international databases published between 2015 and 2026.

Regarding forms of teacher collaboration (RQ1), four main forms were identified: curriculum co-planning and co-design,

interdisciplinary team teaching, professional learning communities (PLC), and collaboration with external actors. Each form carries distinct characteristics and prerequisites, yet all demand inter-teacher trust, professional autonomy, and structural support from the nature-based school ecosystem.

Regarding ecosystem factors (RQ2), four factor categories—school leadership, school culture, policy, and the physical-community ecosystem—simultaneously and interactively shape the quality and sustainability of teacher collaboration. School leadership emerged as the most determinant factor, while the philosophy and physical ecosystem of nature-based schools constitute factors that uniquely distinguish this context from conventional schooling.

Regarding research gaps (RQ3), five critical gaps were identified: the scarcity of research in Asian and Indonesian contexts, the absence of integrative three-variable research, the shortage of longitudinal studies, the lack of a comprehensive model, and the unexamined role of principal leadership in Asian nature-based schools.

Effective teacher collaboration in nature-based schools requires distributed principal leadership that actively facilitates collaborative space, curriculum policies granting adequate teacher autonomy—as demonstrated by Indonesia's Kurikulum Merdeka and Finland's curriculum—and systemic collaborative cultures built through PLCs and teacher design teams rather than individual enthusiasm alone. Future research should examine these ecosystem factors empirically in Indonesian nature-based school contexts using multi-site case study or longitudinal mixed-methods designs.

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