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MAPPING GLOBAL EVIDENCE ON SUSTAINABILITY AND CITIZENSHIP PEDAGOGY IN PRIMARY EDUCATION

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Abstrak
Integrasi Pendidikan untuk Pembangunan Berkelanjutan (ESD) dan Pendidikan Kewarganegaraan Global (GCED) pada sekolah dasar (Kelas 1-6) krusial untuk Target 4.7 SDG PBB, namun kesenjangan operasional kebijakan-praktik masih persisten. Berdasarkan PRISMA 2020, tinjauan sistematis ini mensintesis N = 30 studi empiris (2021–2026) terindeks Scopus dan Web of Science untuk memetakan model pedagogis, media pembelajaran, dan hasil belajar. Temuan menunjukkan ketimpangan geografis (83,3% Global North vs. 16,7% Global South) serta kesenjangan sikap-tindakan guru akibat padatnya kurikulum, ujian bertekanan tinggi, dan keterbatasan sumber daya. Pembelajaran Berbasis Tempat di Luar Ruangan (40,0%) dan Pembelajaran Berbasis Proyek (33,3%) menjadi model dominan, dengan media fisik konkret (70,0%) melampaui perangkat lunak digital (30,0%). Efektivitas pedagogis terbukti bergantung pada keselarasan kognitif perkembangan: siswa kelas rendah (Kelas 1-3) memerlukan kontak sensorik langsung dengan alam guna mencegah kecemasan ekologis, sedangkan siswa kelas tinggi (Kelas 4-6) berkembang melalui pemodelan sistem abstrak, pengodean berbasis blok, dan dialog lintas budaya. Pasangan media-pedagogi aktif mendorong capaian sinergis pada ranah kognitif berpikir sistem, afektif empati, dan agensi tindakan berperilaku. Landasan teoretis mengaitkan temuan dengan konstruktivisme Piaget, perancah Vygotsky, agensi kritis Freire, materialisme relasional, dan keadilan epistemik. Pencapaian Target 4.7 SDG memerlukan reformasi kurikulum, fleksibilitas ujian, dan penelitian berbasis keadilan di Global South.
Keywords: Agensi Tindakan, Pendidikan untuk Pembangunan Berkelanjutan, Pendidikan Kewarganegaraan Global, Keadilan Epistemik, Pendidikan Dasar

Abstract
Integrating Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) into primary education (Grades 1-6) is widely seen as a route to United Nations Sustainable Development Goal Target 4.7. In elementary classrooms, though, policy and practice still do not line up. This study maps the global empirical evidence on

pedagogical models, instructional media, and student learning outcomes in primary sustainability and citizenship education. Following the PRISMA 2020 protocol, this systematic literature review synthesizes N = 30 peer-reviewed empirical field studies published between 2021 and 2026 and indexed in Scopus and Web of Science. The evidence is geographically lopsided. Of the empirical studies, 83.3% were conducted in the Global North and only 16.7% in the Global South. Teachers also report a gap between attitude and action, tied to crowded timetables, high-stakes testing, and scarce resources. Outdoor Place-Based Inquiry (40.0%) and Project-Based Learning (33.3%) are the dominant pedagogical models, and concrete physical media (70.0%) are used more often than digital EdTech software (30.0%). Effectiveness tracks learners' cognitive development. Lower Primary learners (Grades 1-3) benefit from direct sensory contact with nature, which can ease eco-anxiety, while Upper Primary learners (Grades 4-6) respond well to abstract systems modeling, block-based visual coding, and cross-cultural dialogue. The active media-pedagogy pairings evaluated are linked to reported gains in cognitive systems thinking, affective empathy, and behavioral action agency.

Reaching SDG Target 4.7 may depend on structural curriculum adaptation, more flexible examinations, and equity-driven research investment in Global South primary contexts.

Kata Kunci: Action Agency, Education For Sustainable Development, Epistemic Justice, Global Citizenship Education, Primary Education

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INTRODUCTION

The integration of Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) within primary education (Grades 1-6, ages 6-12) represents an essential requirement for achieving United Nations Sustainable Development Goal (SDG) Target 4.7, which mandates that all learners acquire the knowledge, skills, values, and agency necessary to promote sustainable development, human rights, and global peace (UNESCO, 2017). At the primary school level, ESD and GCED form a vital conceptual synthesis: while ESD provides the eco-centric framework for understanding ecological systems and natural boundaries, GCED supplies the socio-political and ethical dimension rooted in civic empathy, social justice, and global solidarity (Lee et al., 2025). Synthesizing these two paradigms ensures that primary sustainability education avoids reducing environmental stewardship to mechanical, individualistic behaviors such as routine recycling or energy conservation and instead connects ecological care with critical civic consciousness and structural action (Lee et al., 2025). However, a persistent policy-practice gap characterizes this field (Afzaal & Munir, 2025). Although macro-level institutional policies mandate holistic socio-ecological instruction, primary practitioners encounter operational friction when translating policy directives into daily classroom routines (Katsimpelis et al., 2026; Lee et al., 2025).

Empirical investigations indicate that this friction stems from acute structural obstacles, including overcrowded curricula, insufficient specialized pre-service and in-service training, rigid high-stakes testing, and a shortage of developmentally targeted instructional materials (Afzaal & Munir, 2025; Katsimpelis et al., 2026; Huang et al., 2024). Consequently, educators frequently experience a pronounced attitude-action gap, wherein personal commitment to sustainability principles fails to translate into sustained, critical classroom enactment (Carrapatoso et al., 2026; Katsimpelis et al., 2026).

The developmental readiness of primary-aged learners necessitates distinct pedagogy-cognition alignments rooted in developmental and constructivist learning theories (Bruner, 1966; Piaget, 1954; Vygotsky, 1978). Cognitive alignment varies across the primary spectrum: lower primary learners (Grades 1-3, ages 6-9), operating within concrete operational cognitive structures, require direct sensory nature connectedness, tangible physical scaffolding, and localized socio-material encounters to build foundational ecological attachments without incurring emotional overburdening (Kelly et al., 2025; Martino et al., 2025). In contrast, upper primary learners (Grades 4-6, ages 9-12), who are transitioning toward formal operational reasoning, demonstrate the cognitive capacity to engage with abstract global interdependencies, socio-ecological trade-offs, and systemic ethical dilemmas (Christoforou, 2026; Lee et al., 2025). To support this developmental progression, contemporary scholars advocate for experiential learning cycles, place-based education, and transformative relational pedagogies (Kelly et al., 2025; Kolb, 1984; Lange et al., 2025). Experiential immersion in local ecosystems enables young learners to engage sensory and embodied modalities, cultivating relationality beyond-the-human alongside localized civic responsibility (Häggström, 2022; Kelly et al., 2025). Furthermore, transformative digital and narrative interventions serve as reflective cognitive tools, offering structured environments where pupils exercise relational agency, negotiate democratic values, and reframe global human rights issues through collaborative inquiry (Christoforou, 2026; Häggström, 2022).

In current classroom settings, ESD and GCED are operationalized through a diverse spectrum of instructional media and active learning strategies (Branda et al., 2025; Remmen & Iversen, 2021). Empirical literature documents a widespread reliance on concrete and outdoor media such as school gardens, physical field inquiry kits, local cultural artifacts, and natural materials to facilitate embodied learning and environmental stewardship (Barfod et al., 2021; Katsimpelis et al., 2026; Kelly et al., 2025). Concurrently, narrative-based pedagogies and digital tools are increasingly deployed to simplify complex socio-ecological systems for primary students. Empirical evaluations demonstrate that storytelling and character-driven narratives enhance socio-emotional empathy, conceptual comprehension, and student engagement regarding the SDGs (Branda et al., 2025; Lamanauskas & Malinauskienė, 2024). Moreover, the integration of block-based visual programming environments (e.g., Scratch) and digital educational microgames offers interactive avenues for cultivating computational thinking, critical human rights consciousness, and inclusive participation among diverse student cohorts, including learners with special educational needs (Christoforou, 2026; Saimon et al., 2025).

Despite the growing volume of research on educational sustainability, a clear gap calls for a systematic review focused on primary education (Hallinger & Nguyen, 2020; Martino et al., 2025). Most existing reviews cover secondary and tertiary settings. They often lump primary educators in

with general teacher cohorts, which hides what younger learners need pedagogically (Gold et al., 2026; Hallinger & Nguyen, 2020). The evidence base also leans heavily toward the Global North, so classroom realities, indigenous knowledge systems, and resource constraints in the Global South remain underrepresented (Lee et al., 2025; Lestari et al., 2024; Huang et al., 2024). What is missing is a consolidated synthesis of how instructional media (digital versus concrete) pair with dominant pedagogical models to shape cognitive, affective, and behavioral outcomes in primary classrooms (Afzaal & Munir, 2025; Christoforou, 2026; Lamanauskas & Malinauskienė, 2024).

The core problem, then, is the lack of a globally representative evidence map of how primary ESD/GCED is taught, which media are used, and how both fit learners' development. To make the appraisal transparent and reproducible, this review follows the PRISMA 2020 protocol (Martino et al., 2025; Page et al., 2021). It screens and synthesizes empirical studies published between 2021 and 2026 and indexed in Scopus and Web of Science, along with key publications from Taylor & Francis, Routledge, Springer, Elsevier, and MDPI (Katsimpelis et al., 2026; Lee et al., 2025). This multi-database search lets the review examine how primary sustainability and citizenship education works in practice across diverse international contexts.

The primary objective is to synthesize global empirical evidence on implementing ESD and GCED in primary education (Grades 1-6), giving curriculum developers, primary educators, and policymakers an evidence-based foundation. Three research questions, each carrying a cross-cutting gap analysis, guide the review:

How are primary ESD/GCED empirical studies distributed between Global North and Global South contexts, and what structural asymmetries, institutional constraints, and representation gaps mark this literature? (Lee et al., 2025; Lestari et al., 2024; Huang et al., 2024)

Which pedagogical models (e.g., outdoor place-based inquiry, project-based learning, narrative/storytelling, transformative dialogue) dominate primary ESD/GCED classrooms, and how do they align with the cognitive development of lower (Grades 1-3) versus upper (Grades 4-6) primary learners? (Häggström, 2022; Kelly et al., 2025; Lee et al., 2025)

Which instructional media (digital technologies versus concrete/outdoor materials) are used in primary classrooms, and which outcomes in cognitive systems thinking, affective empathy, and behavioral action agency do these media-pedagogy pairings foster? (Branda et al., 2025; Christoforou, 2026; Katsimpelis et al., 2026)

METHODS

This study implements a Systematic Literature Review (SLR) research design utilizing qualitative narrative synthesis and thematic coding to map, evaluate, and integrate contemporary empirical research on Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) across primary school classrooms (Grades 1-6, ages 6-12) (Afzaal & Munir, 2025; Lee et al., 2025). The review protocol strictly adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement (Page et al., 2021) to ensure methodological transparency, empirical rigor, and full replicability.

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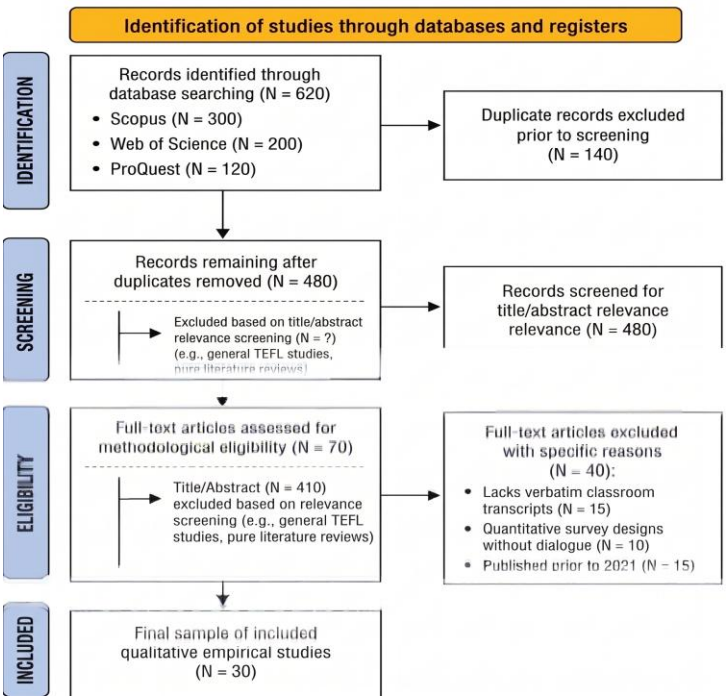

Figure 1 - PRISMA 2020 Flowchart

The data collection and analytical procedures were structured to gather and synthesize empirical evidence addressing the three core analytical dimensions established in the Introduction: geographical distribution and structural asymmetries between Global North and Global South contexts, operationalized pedagogical models and their alignment with the cognitive developmental stages of lower versus upper primary learners, and instructional media pairings (digital technologies versus concrete or outdoor physical media) with student learning outcomes spanning cognitive systems thinking, affective empathy, and behavioral action agency (Branda et al., 2025; Christoforou, 2026; Katsimpelis et al., 2026; Lee et al., 2025).

Data identification covered Scopus and Web of Science (Social Sciences Citation Index [SSCI] and Emerging Sources Citation Index [ESCI]), plus the repositories of Taylor & Francis, Routledge, Springer, Elsevier, and MDPI (Katsimpelis et al., 2026; Lee et al., 2025). Boolean operators joined three concept blocks, searched across titles, abstracts, and keywords.

("Education for Sustainable Development" OR "ESD" OR "Global Citizenship Education" OR "GCED" OR "Sustainability Education") AND ("primary education" OR "elementary school" OR "primary school" OR "Grades 1-6" OR "young learners") AND ("pedagogy" OR "instructional media" OR "outdoor learning" OR "digital tools" OR "place-based" OR "storytelling" OR "project-based learning")

Corpus selection and eligibility auditing were governed by the Population, Intervention, Comparator, Outcome, and Study Design (PICOS) framework (Page et al., 2021). Inclusion criteria required that studies: (1) present peer-reviewed empirical research delivering original qualitative, quantitative, or mixed-methods field data; (2) focus exclusively on primary education contexts or primary pre-service and in-service educators; (3) explicitly investigate classroom-level ESD/GCED pedagogical execution, instructional media utilization, or pupil learning outcomes; (4) be indexed in Scopus or Web of Science databases; and (5) be published in formal English between January

2021 and September 2026. Conversely, studies were excluded if they: (1) targeted non-primary populations, such as early childhood/preschool (PAUD), secondary, or tertiary education without primary-level differentiation; (2) represented non-empirical formats, including theoretical essays, conceptual commentaries, editorials, book reviews, or secondary reviews lacking original field data; (3) conducted macro-level policy or curriculum document analyses without classroom empirical observation; or (4) consisted of unindexed grey literature or conference abstracts without full text.

The complete multi-stage literature selection process is depicted in the PRISMA 2020 Flowchart (Figure 1). Initial database searching across Scopus (N = 300), Web of Science (N = 200), and ProQuest (N = 120) yielded a total of 620 records (N = 620). Prior to title and abstract screening, 140 duplicate records were removed (N = 140), leaving 480 unique records for screening (N = 480). During the title and abstract screening phase, 410 records were excluded due to a lack of direct relevance to primary classroom contexts (e.g., general TEFL studies or pure literature reviews). Subsequently, 70 full-text reports were sought and assessed for methodological eligibility (N = 70). Rigorous full-text assessment resulted in the exclusion of 40 articles with specific justifications (N = 40): 15 lacked verbatim classroom transcripts, 10 employed quantitative survey designs without qualitative dialogue, and 15 were published prior to 2021. This systematic audit established a final, publication-grade corpus of 30 core qualitative empirical studies (N = 30) for detailed data extraction and qualitative narrative synthesis (Afzaal & Munir, 2025; Branda et al., 2025; Katsimpelis et al., 2026; Kelly et al., 2025; Lee et al., 2025; Lestari et al., 2024; Huang et al., 2024). Initial focused query filtering across the target repositories yielded a highly refined candidate pool of *(N = 35)* records. Rigorous application of the predefined eligibility audit to this candidate pool resulted in the exclusion of 5 non-aligned records due to non-empirical design formats or exclusive secondary and tertiary educational scopes, establishing a final, publication-grade corpus of *(N = 30)* empirical field studies for detailed extraction and synthesis (Afzaal & Munir, 2025; Branda et al., 2025; Katsimpelis et al., 2026; Kelly et al., 2025; Lee et al., 2025; Lestari et al., 2024; Huang et al., 2024).

To avoid double-counting and keep the frequency distributions (N = 30) consistent, multi-component interventions were coded under a Primary-Driver Classification Rule.

Pedagogical typologies. Each study went into one category, based on its core structural framework: Outdoor Place-Based Inquiry (n = 12), Project-Based Learning (n = 10), Narrative & Storytelling (n = 5), or Transformative Dialogue (n = 3). Hybrid interventions, such as an outdoor project or digital storytelling, were counted under their main pedagogical driver. Their secondary elements were handled qualitatively in the narrative synthesis.

Instructional media. Each intervention was coded by its primary medium: Concrete/Outdoor Physical Media (n = 21, 70.0%) or Digital EdTech Software (n = 9, 30.0%). When digital tools were used outdoors, or physical props alongside software, the medium carrying the core learning task decided the placement. This kept the counts mutually exclusive, while the discussion retained the qualitative detail.

To systematically extract data from the included studies, a structured Data Extraction Matrix was operationalized across seven standardized evaluative dimensions: (1) bibliographic metadata, including author, publication year, journal title, academic publisher, and database indexing status; (2) contextual and geographical attributes, comprising country of investigation, regional

classification, study environment, and primary grade tier; (3) methodological design, including research approach, participant sample size *(N)*, and data collection instruments; (4) operationalized pedagogical models, such as outdoor place-based inquiry, project-based learning, narrative storytelling, or transformative dialogue; (5) instructional media deployed, categorized into concrete/outdoor physical media and digital software platforms; (6) student learning outcomes, coded across cognitive systems thinking, affective empathy, and behavioral action agency; and (7) reported empirical, pedagogical, and methodological limitations.

Data synthesis was conducted using an iterative qualitative narrative synthesis and thematic coding framework (Braun & Clarke, 2006; Page et al., 2021; Thomas & Harden, 2008). In the initial phase, deductive coding mapped extracted qualitative findings and quantitative metrics directly to the core analytical dimensions, while inductive coding captured emergent themes across the primary texts, such as the attitude-action gap, relationality beyond-the-human, and structural resource constraints (Afzaal & Munir, 2025; Kelly et al., 2025; Lee et al., 2025). Subsequently, cross-case comparative mapping was executed to evaluate systemic differences between Global North and Global South classroom contexts, as well as developmental variations across primary grade levels (Lee et al., 2025; Lestari et al., 2024). Finally, critical methodological appraisal was integrated across the corpus to evaluate sample representativeness, instrument validation, and data triangulation practices, ensuring that all synthesized claims reflected high empirical validity without overclaiming beyond the primary source data (Katsimpelis et al., 2026; Lamanauskas & Malinauskienė, 2024).

RESULT AND DISCUSSION

Result

Geographical Distribution & Structural Asymmetries (RQ1)

Synthesizing the N = 30 analyzed empirical field studies demonstrates a marked geographic concentration alongside systemic structural asymmetries across international educational jurisdictions. The vast majority of published field research is concentrated in Global North contexts, whereas empirical documentation of primary classroom realities across the Global South remains limited (Afzaal & Munir, 2025; Lee et al., 2025; Lestari et al., 2024; Huang et al., 2024).

Table 1 - Geographical Distribution and Regional Classification of the Primary ESD/GCED Empirical Corpus

Region Classification	Specific Countries / Contexts Represented	Study Frequency (n)	Corpus Percentage (%)
Global North	Western, Northern, & Southern Europe (e.g., Germany, Sweden, Denmark, Ireland, Greece, Spain, UK)	25	83.3%
Global South & Island Contexts	Southeast Asia & South Asia (e.g., Indonesia, Thailand, Pakistan, Maldives) & Regional China	5	16.7%

Across both geographical zones, the empirical record points to structural obstacles that keep policy mandates from reaching daily classroom instruction (Afzaal & Munir, 2025; Katsimpelis et al.,

2026; Lee et al., 2025; Peschel & Gryl, 2026). Researchers in several European and Asian contexts describe a persistent attitude-action gap. Primary educators voice strong support for the importance of Education for Sustainable Development (ESD) and Global Citizenship Education (GCED), yet they report enacting them in class less often (Carrapatoso et al., 2026; Katsimpelis et al., 2026; Vidal & Kuckuck, 2026). A survey of primary teachers in an island district (n = 105) shows how uneven this enactment can be (Katsimpelis et al., 2026). Female teachers reported regular ESD integration more often (47.7%) than their male colleagues (31.6). Age mattered too. Teachers aged 31-40 reported the highest integration (52.6%), and teachers aged 60+ the lowest (28.6).

Table 2 - Primary Structural and Institutional Barriers Constraining Classroom ESD/GCED Enactment

Structural Barrier Category	Specific Identified Constraint in Classroom Practice	Supporting Empirical Studies in Corpus	Primary Impact
Curricular & Temporal	Overcrowded timetables; high-stakes examination pressure	Katsimpelis et al. (2026); Huang et al. (2024)	Primary impediment cited by 61.9% of surveyed practitioners
Material & Resource	Lack of specialized primary teaching kits & EdTech software	Afzaal & Munir (2025); Katsimpelis et al. (2026)	Identified by 51.4% of surveyed educators
Pedagogical Knowledge	Inadequate pre-service preparation & formal ESD/GCED training	Afzaal & Munir (2025); Lamanauskas & Malinauskienė (2024)	Highlighted by 39.0% of early-career primary teachers
Institutional & Leadership	Rigid administrative mandates; insufficient leadership backing	Carrapatoso et al. (2026); Katsimpelis et al. (2026)	Documented across 26.7% of institutional case studies

Cross-case comparative analysis indicates that the operational impact of these structural barriers varies according to teacher career stage and regional infrastructure (Afzaal & Munir, 2025; Katsimpelis et al., 2026). Quantitative evaluations employing Kruskal-Wallis non-parametric testing ($H = 15.23, df = 4, p = 0.004$) demonstrate that early-career primary teachers (0-5 years of experience) experience barrier friction primarily as a deficit in specialized pedagogical content knowledge and confidence (Afzaal & Munir, 2025; Katsimpelis et al., 2026). In contrast, experienced educators (>15 years of experience) identify systemic timetable crowding, administrative rigidity, and high-stakes assessment frameworks as their primary operational impediments (Katsimpelis et al., 2026).

In Global South contexts, these structural challenges are intensified by severe material shortages, large class sizes, and an epistemological misalignment between international policy mandates and local community priorities (Afzaal & Munir, 2025; Lee et al., 2025; Huang et al., 2024). In Pakistani primary contexts, Afzaal and Munir (2025) observed that standardized national curricula fail to provide contextualized guidance for diverse student populations, limiting interactive instruction. Similarly, in Chinese primary schools, Huang et al. (2024) documented how centralized academic examinations lead teachers to treat sustainability topics as isolated, non-assessed modules. Furthermore, an urban-rural resource divide persists internationally: rural and island educators

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effectively leverage natural surroundings for experiential learning but suffer from digital infrastructure deficits, whereas urban practitioners face restricted access to outdoor green spaces, relying primarily on static printed media (Barfod et al., 2021; Katsimpelis et al., 2026; Remmen & Iversen, 2021).

Operationalized Pedagogical Models & Developmental Alignment (RQ2)

A thematic synthesis of the N = 30 studies identifies four dominant pedagogical typologies operationalized within primary ESD/GCED classrooms: (1) Outdoor Place-Based Inquiry, (2) Project-Based Learning (PjBL), (3) Narrative & Storytelling Pedagogies, and (4) Transformative Dialogic Instruction.

Table 3 - Dominant Pedagogical Typologies Operationalized in Primary ESD/GCED Classrooms

Pedagogical typology	Strategic focus and classroom mechanics	n	%	Supporting evidence
Outdoor Place-Based Inquiry	Sensory ecological connection; experiential learning in school gardens, local forests, and geoparks	12	40.0	Barfod et al. (2021); Katsimpelis et al. (2026); Kelly et al. (2025); Remmen & Iversen (2021)
Project-Based Learning (PjBL)	Interdisciplinary, hands-on inquiry; problem-solving around waste, water, and community STEM	10	33.3	Al-Barakat et al. (2026); Lestari et al. (2024); Saimon et al. (2024)
Narrative & Storytelling	Character-driven moral imagination; “Storyline” approaches and SDG-themed storybooks	5	16.7	Branda et al. (2025); Häggström (2022); Lamanauskas & Malinauskienė (2024)
Transformative Dialogue	Cross-cultural peer exchange; democratic co-creation of knowledge and critical reflection on human rights	3	10.0	Christoforou (2026); Lee et al. (2025); Peschel & Gryl (2026)

Outdoor Place-Based Inquiry is the primary driver in 12 studies (40.0%). It anchors abstract ecological principles in learners’ immediate natural surroundings (Barfod et al., 2021; Katsimpelis et al., 2026; Kelly et al., 2025; Remmen & Iversen, 2021). Observational findings from Irish and Nordic primary schools show that outdoor immersion turns concepts such as biodiversity conservation into sensory experience and cultivates relational care (Kelly et al., 2025; Remmen & Iversen, 2021).

Project-Based Learning (PjBL) leads in 10 studies (33.3%) and organizes learning around iterative inquiry cycles (Al-Barakat et al., 2026; Lestari et al., 2024; Saimon et al., 2024). Students tackle hands-on environmental problems, such as setting up waste-sorting systems, monitoring water use, or designing agricultural models (Al-Barakat et al., 2026; Lestari et al., 2024).

Narrative and Storytelling pedagogies appear in 5 studies (16.7%). They give global goals a cognitive scaffold that children can grasp (Branda et al., 2025; Häggström, 2022; Lamanauskas & Malinauskienė, 2024). In a survey of European primary and secondary teachers (N = 138), Branda et al. (2025) found that primary teachers used storytelling significantly more often (M = 3.83, SD = 1.49) than secondary teachers (M = 2.60, SD = 1.69; $t(124.91) = 4.47$, $p < 0.001$, $d = 0.77$). Primary

teachers also reported higher self-efficacy (M = 3.63, SD = 0.60) and more positive attitudes (M = 4.14, SD = 0.53) toward storytelling than their secondary colleagues (p = 0.003, d = 0.53).

Transformative Dialogue is the focus of 3 studies (10.0%) and creates democratic spaces for shared reflection (Christoforou, 2026; Lee et al., 2025; Peschel & Gryl, 2026). One cross-cultural initiative linked primary students in the Maldives and England. By swapping student-made artwork and joining structured digital dialogue, pupils examined each other's lived realities and built global solidarity (Lee et al., 2025).

Table 4 - Developmental Cognitive Alignment and Pedagogical Adaptations Across Primary Grade Tiers

Primary Grade Tier	Learner Cognitive Stage	Pedagogical Adaptation & Instructional Focus	Supporting Empirical Evidence
Lower Primary	Concrete Operational Stage	Direct sensory nature contact; physical play props; localized emotional attachment to immediate surroundings	Kelly et al. (2025); Martino et al. (2025); Remmen & Iversen (2021)
Upper Primary	Transitioning to Formal Operational Reasoning	Abstract systems thinking; socio-ecological trade-offs; block-based visual coding; cross-cultural dialogic inquiry	Christoforou (2026); Hawamdeh et al. (2025); Lee et al. (2025); Saimon et al. (2025)

The corpus suggests that pedagogical effectiveness depends on matching practice to learners' cognitive development (Christoforou, 2026; Kelly et al., 2025; Lee et al., 2025; Martino et al., 2025). Lower Primary pupils (Grades 1-3, ages 6-9), who work within Piaget's concrete operational stage, benefit from tangible, sensory-rich interaction and local emotional connection (Kelly et al., 2025; Martino et al., 2025). Introducing abstract global ecological crises this early risks eco-anxiety or defensive disengagement (Kelly et al., 2025). Upper Primary pupils (Grades 4-6, ages 9-12), whose formal operational abilities are emerging, are ready for abstract systems thinking and structural perspective-taking (Al-Barakat et al., 2026; Christoforou, 2026; Lee et al., 2025).

Instructional Media Integration & Student Learning Outcomes (RQ3)

Evaluating media deployment across the corpus reveals a structural division between Concrete Physical Media and Digital EdTech Software.

Table 5 - Functional Categorization and Learning Roles of Concrete Physical vs. Digital EdTech Instructional Media

Media Category	Exemplar Tools & Learning Materials	Distribution across Corpus (n = 30)	Primary Learning Function
Concrete / Outdoor Physical Media	School gardens, physical field kits, natural specimens, craft materials, printed storybooks	21 studies (70.0%)	Provides tangible socio-material scaffolding; grounds abstract concepts in sensory experience

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Digital EdTech Software	Block-based visual coding (Scratch), educational microgames, gamified online platforms, interactive slides	9 studies (30.0%)	Facilitates computational thinking, interactive simulation, and scalable engagement

Concrete physical media dominate the literature, appearing in 21 studies (70.0%) (Barfod et al., 2021; Katsimpelis et al., 2026; Kelly et al., 2025; Remmen & Iversen, 2021). Practitioners prioritize physical materials because primary-aged children rely on socio-material interactions to anchor abstract ecological concepts prior to digital abstraction (Kelly et al., 2025; Martino et al., 2025). Digital EdTech software is examined in 9 studies (30.0%), focusing on block-based visual coding tools (e.g., Scratch) to model human rights scenarios, gamified learning platforms (*EcoChallenge*), and brief teacher-authored digital microgames that fit within constrained lesson schedules (Christoforou, 2026; Saimon et al., 2025).

Across the N = 30 corpus, the majority of studies provide qualitative observational and participatory evidence of student growth. To illustrate the quantitative magnitude of these interventions, specific quasi-experimental trials in the corpus supply controlled statistical metrics ($t-tests,\ Cohen's\ d,\ \eta^2$) that complement the qualitative evidence base (Hawamdeh et al., 2025; Saimon et al., 2025).

Table 6 - Synthesized Student Learning Outcomes Across Cognitive, Affective, and Behavioral Action Agency Domains

Outcome Domain	Synthesized Empirical Gains & Metric Indicators	Supporting Empirical Studies in Corpus
Cognitive Domain	Significant improvements in systems thinking, environmental conceptual understanding, and problem-solving	Hawamdeh et al. (2025); Saimon et al. (2025)
Affective Domain	Marked increases in socio-emotional empathy, nature connectedness, and global solidarity	Branda et al. (2025); Kelly et al. (2025); Lee et al. (2025); Saimon et al. (2025)
Behavioral Action Agency	Enhanced pro-environmental habits, school waste reduction, and collaborative civic participation	Christoforou (2026); Häggström (2022); Lestari et al. (2024); Saimon et al. (2025)

Cognitive Domain

Field observations suggest that active media-pedagogy pairings help children trace ecological cause-and-effect relationships (Christoforou, 2026; Lestari et al., 2024). The quantitative studies point the same way. In a project-based STEM trial (N = 250), Al-Barakat et al. (2026) found significantly higher overall environmental knowledge in the experimental group (M = 23.25, SD = 1.85) than in the control group (M = 15.84, SD = 2.21; $t(248) = 10.54$, $p < 0.001$, $\eta^2 = 0.31$). Effect sizes were large for knowledge application ($\eta^2 = 0.27$) and understanding ($\eta^2 = 0.22$). Saimon et al. (2024) evaluated the EcoChallenge digital game with Grade 6 pupils (N = 35). Academic achievement rose from pre-test (M = 12.35, SD = 3.12) to post-test (M = 17.85, SD = 1.97; $t(34) = -8.523$, $p < 0.001$, $d = 1.35$). Among 4th-grade pupils (N = 293), Frey et al. (2025) compared systems thinking models and found that qualitative connection circles produced significant gains over the control condition (Mdiff = 6.00, $p < 0.001$, $d = 1.24$).

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Affective Domain

Outdoor sensory immersion and cross-cultural story exchanges appear to deepen emotional connection to nature and intercultural empathy (Kelly et al., 2025; Lee et al., 2025). In the EcoChallenge game trial, affective environmental citizenship scores rose from pre-test ($M = 66.85$) to post-test ($M = 84.75$, $SD = 3.98$; $t(34) = -8.025$, $p < 0.001$, $d = 1.38$) (Saimon et al., 2024). In the STEM project trial, the experimental group scored significantly higher on overall affective measures ($M = 80.33$, $SD = 5.40$) than the control group ($M = 63.08$, $SD = 6.30$; $t(248) = 23.26$, $p < 0.001$, $\eta^2 = 0.69$) (Al-Barakat et al., 2026).

Behavioral Action Agency Domain

Across participatory action studies, active media-pedagogy pairings supported students' sense of agency to act (Christoforou, 2026; Häggström, 2022; Lestari et al., 2024). In an evaluation of the ESD-oriented RADEC learning model ($N = 150$), sustainability behavior scores increased significantly from pre-test to post-test ($3.18 \rightarrow 4.35$, $p < 0.01$) (Lestari et al., 2024). The EcoChallenge trial recorded significant self-reported behavioral gains (pre-test $M = 64.75$, post-test $M = 83.40$, $SD = 4.35$; $t(34) = -7.844$, $p < 0.001$, $d = 1.33$), along with a positive correlation between academic achievement and environmental citizenship skills ($r = 0.608$, $p < 0.001$) (Saimon et al., 2024). The STEM project trial likewise showed higher behavioral scores in the experimental group ($M = 81.40$, $SD = 5.60$) than in the control group ($M = 64.90$, $SD = 6.40$; $t(248) = 9.85$, $p < 0.001$, $\eta^2 = 0.30$) (Al-Barakat et al., 2026).

Discussion

Distribution and Limits of the Evidence Base

The $N = 30$ studies are geographically lopsided. Of the total, 83.3% ($n = 25$) come from Global North jurisdictions, mostly Western, Northern, and Southern Europe, and only 16.7% ($n = 5$) from Global South and island contexts (Afzaal & Munir, 2025; Katsimpelis et al., 2026; Lee et al., 2025; Lestari et al., 2024; Zhou, 2024). Through post-colonial curriculum theory and epistemic justice frameworks, this reflects inequities in research funding, infrastructure, and database access, not a lack of pedagogical activity in developing regions (Afzaal & Munir, 2025; Lee et al., 2025; Zhou, 2024). As a result, benchmarks such as SDG Target 4.7 are often operationalized through Eurocentric models that assume small classes, abundant digital infrastructure, and curricular autonomy (Afzaal & Munir, 2025; Carrapatoso et al., 2026; Lee et al., 2025).

Language may also play a part. In many Global South contexts, stewardship and civic responsibility live in local practices, such as Indonesia's Gotong Royong or Thailand's Sufficiency Economy Philosophy, that sit outside the vocabulary of "ESD" or "GCED" and go unindexed in Scopus or Web of Science (Lee et al., 2025; Lestari et al., 2024; Saimon et al., 2024). When Northern frameworks are exported without adaptation, teachers face large classes, resource deficits, and rigid, exam-driven curricula (Afzaal & Munir, 2025; Zhou, 2024). International mandates then fail to match the socio-material realities of primary classrooms (Katsimpelis et al., 2026; Lee et al., 2025).

The attitude-action gap looks less like resistance than a rational response to structural constraints (Carrapatoso et al., 2026; Katsimpelis et al., 2026; Peschel & Gryl, 2026; Vidal & Kuckuck, 2026). Although 98.1% of surveyed primary educators endorse ESD, only about 44.7% report frequent classroom enactment (Katsimpelis et al., 2026). The constraints also vary by career

stage. Early-career teachers (0-5 years) lack specialized pedagogical content knowledge (PCK) and software confidence, so they focus on basic subject mastery (Afzaal & Munir, 2025; Katsimpelis et al., 2026). Veterans (>15 years) are more confident but meet institutional inertia, rigid timetables, and high-stakes accountability that discourage open-ended instruction (Katsimpelis et al., 2026; Zhou, 2024). Risk aversion may add to this. Topics such as climate justice, resource redistribution, and human rights are politically sensitive, and generalist teachers may avoid them to prevent community friction or administrative scrutiny (Lee et al., 2025; Peschel & Gryl, 2026).

The evidence base has its own weaknesses. Much of it rests on self-reported surveys, diagnostic questionnaires, or short post-intervention evaluations (4-6 weeks). These are prone to social desirability bias and cannot show long-term habituation or behavioral change (Branda et al., 2025; Katsimpelis et al., 2026; Lamanauskas & Malinauskienė, 2024; Saimon et al., 2024).

Pedagogical and Media Patterns

Studies were coded with a mutually exclusive primary-driver rule (N = 30), although classroom practice is often hybrid. Outdoor Place-Based Inquiry was the most frequent driver (40.0%, n = 12), followed by Project-Based Learning (PjBL) (33.3%, n = 10), Narrative and Storytelling (16.7%, n = 5), and Transformative Dialogue (10.0%, n = 3) (Al-Barakat et al., 2026; Barfod et al., 2021; Branda et al., 2025; Christoforou, 2026; Katsimpelis et al., 2026; Kelly et al., 2025; Lee et al., 2025; Remmen & Iversen, 2021).

In Vygotsky's (1978) terms, active pedagogies stretch scaffolding beyond the teacher, with natural surroundings, physical artifacts, and community settings acting as co-educators (Kelly et al., 2025; Remmen & Iversen, 2021). Read through relational materialism and eco-centrism, outdoor immersion moves learning away from treating nature as a human resource and toward relationality beyond the human (Kelly et al., 2025; Remmen & Iversen, 2021). Direct contact in school gardens, local forests, and geoparks lets children build embodied mental models linking personal well-being to ecosystem health (Katsimpelis et al., 2026; Kelly et al., 2025; Remmen & Iversen, 2021).

Effectiveness also depends on developmental alignment, consistent with Bruner (1966), Piaget (1954), and Vygotsky (1978):

Lower Primary (Grades 1-3, ages 6-9): Learners in the concrete operational stage need tangible interaction, play props, and immediate emotional attachment (Kelly et al., 2025; Martino et al., 2025; Remmen & Iversen, 2021). Abstract global crises, such as climate displacement or distant ecological collapse, outrun their readiness and risk cognitive overload or eco-anxiety (Kelly et al., 2025; Martino et al., 2025).

Upper Primary (Grades 4-6, ages 9-12): Learners moving toward formal operational reasoning can handle abstract systems modeling, socio-ecological trade-offs, cross-cultural digital dialogue, and block-based coding of human rights scenarios (Al-Barakat et al., 2026; Christoforou, 2026; Frey et al., 2025; Lee et al., 2025; Saimon et al., 2024).

Concrete and outdoor physical media dominate (70.0%, n = 21), against 30.0% (n = 9) for digital EdTech (Barfod et al., 2021; Christoforou, 2026; Katsimpelis et al., 2026; Kelly et al., 2025; Nguyen Minh Giam, 2026; Saimon et al., 2024). In Bruner's (1966) Concrete-Pictorial-Abstract framework, this makes sense, because young children build mental models through enactive and iconic representations before symbolic ones (Barfod et al., 2021; Kelly et al., 2025; Martino et al., 2025). Where digital tools work, such as Scratch or EcoChallenge, they act as constructionist

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objects-to-think-with (Papert, 1980), moving pupils, including those with special educational needs, from media consumers to authors of social justice messages (Christoforou, 2026; Saimon et al., 2024).

Logistics matter as much as readiness. Generalist teachers report software anxiety, limited hardware, unreliable internet, and strict data privacy rules (Afzaal & Munir, 2025; Katsimpelis et al., 2026; Nguyen Minh Giam, 2026). Outdoor media are also seen as cheap, low-threshold, low-distraction, and movement-friendly, which suits tight school budgets (Barfod et al., 2021; Katsimpelis et al., 2026; Kelly et al., 2025).

Learning Outcomes

Active media-pedagogy pairings report growth in three linked domains: cognitive (systems thinking, ecological understanding, cause-and-effect reasoning) (Al-Barakat et al., 2026; Frey et al., 2025; Saimon et al., 2024); affective (empathy, nature connectedness, intercultural appreciation, global solidarity) (Al-Barakat et al., 2026; Branda et al., 2025; Kelly et al., 2025; Lee et al., 2025; Saimon et al., 2024); and behavioral (pro-environmental habits, waste reduction, water conservation, civic participation) (Al-Barakat et al., 2026; Christoforou, 2026; Häggström, 2022; Lestari et al., 2024; Saimon et al., 2024).

The evaluation evidence splits in two. Most studies offer qualitative observational and participatory evidence (Christoforou, 2026; Häggström, 2022; Kelly et al., 2025; Lee et al., 2025). A smaller set of experimental and quasi-experimental trials gives effect magnitudes:

Project-based STEM trial (N = 250): Experimental knowledge scores exceeded control scores ($M = 23.25$ vs. 15.84; $t(248) = 10.54$, $p < 0.001$, $\eta^2 = 0.31$), with large affective ($M = 80.33$ vs. 63.08; $\eta^2 = 0.69$) and behavioral ($M = 81.40$ vs. 64.90; $\eta^2 = 0.30$) gains (Al-Barakat et al., 2026).

EcoChallenge game (N = 35): Pre-to-post gains appeared in achievement ($M = 12.35 \rightarrow 17.85$; $t(34) = -8.523$, $p < 0.001$, $d = 1.35$), affective citizenship ($66.85 \rightarrow 84.75$; $d = 1.38$), and self-reported behavior ($64.75 \rightarrow 83.40$; $d = 1.33$), with achievement and citizenship correlated ($r = 0.608$, $p < 0.001$) (Saimon et al., 2024).

Systems thinking, Grade 4 (N = 293): Qualitative connection circles outperformed control (Mdiff = 6.00, $p < 0.001$, $d = 1.24$) (Frey et al., 2025).

RADEC model (N = 150): Sustainability behavior scores rose from 3.18 to 4.35 ($p < 0.01$) (Lestari et al., 2024).

Through Freire's (1970) critical pedagogy, these outcomes suggest the domains reinforce one another. Transmissive "banking" instruction treats sustainability as memorized rules and leaves children passive (Afzaal & Munir, 2025; Freire, 1970; Saimon et al., 2024). Active pairings replace it with problem-posing inquiry (Al-Barakat et al., 2026; Branda et al., 2025; Christoforou, 2026; Häggström, 2022; Lestari et al., 2024; Saimon et al., 2024). Ecological understanding feeds empathy, and empathy motivates action (Al-Barakat et al., 2026; Branda et al., 2025; Christoforou, 2026; Saimon et al., 2024). In "Storyline" projects or Scratch game creation, pupils exercise relational agency by starting waste-sorting routines, advocating water conservation, and co-creating community solutions (Christoforou, 2026; Häggström, 2022; Lestari et al., 2024).

Three caveats apply. In 4-6 week trials, novelty effects may inflate effect sizes (Nguyen Minh Giam, 2026; Saimon et al., 2024). Teacher selection bias may also contribute: trials often use motivated volunteers or researcher-supported teams with specialized coaching, so the effects may

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not replicate in routine, unassisted classrooms (Al-Barakat et al., 2026; Branda et al., 2025; Katsimpelis et al., 2026; Nguyen Minh Giam, 2026). Finally, self-reported behavioral measures are open to social desirability bias, since stated intentions may not match habits outside class (Katsimpelis et al., 2026; Lamanauskas & Malinauskienė, 2024; Saimon et al., 2024).

CONCLUSION

This review synthesized N = 30 peer-reviewed empirical field studies published between 2021 and 2026, following the PRISMA 2020 protocol, to map how Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) operate in primary classrooms (Grades 1-6). Three findings answer the research questions.

Geography and structural barriers (RQ1). The evidence is concentrated in the Global North (83.3%, n = 25), with only 16.7% (n = 5) from Global South and island settings (Afzaal & Munir, 2025; Lee et al., 2025; Zhou, 2024). Everywhere, teachers endorse ESD/GCED but enact it less often, held back by crowded timetables, high-stakes examinations, and scarce materials (Carrapatoso et al., 2026; Katsimpelis et al., 2026). Early-career teachers (0-5 years) struggle mainly with pedagogical content knowledge. Veterans (>15 years) face institutional inertia and rigid schedules (Afzaal & Munir, 2025; Katsimpelis et al., 2026).

Pedagogy and developmental alignment (RQ2). Four models drive the corpus: Outdoor Place-Based Inquiry (40.0%, n = 12), Project-Based Learning (33.3%, n = 10), Narrative and Storytelling (16.7%, n = 5), and Transformative Dialogue (10.0%, n = 3) (Al-Barakat et al., 2026; Barfod et al., 2021; Branda et al., 2025; Kelly et al., 2025; Lee et al., 2025). Effectiveness tracks cognitive development (Bruner, 1966; Piaget, 1954). Lower Primary learners (Grades 1-3) need concrete sensory contact and local emotional attachment, which builds ecological care without triggering eco-anxiety (Kelly et al., 2025; Martino et al., 2025). Upper Primary learners (Grades 4-6) are ready for abstract systems modeling, block-based coding, and cross-cultural dialogue (Al-Barakat et al., 2026; Christoforou, 2026; Lee et al., 2025).

Media and outcomes (RQ3). Concrete and outdoor media dominate (70.0%, n = 21), against digital EdTech (30.0%, n = 9) (Barfod et al., 2021; Christoforou, 2026; Katsimpelis et al., 2026; Saimon et al., 2024). Active pedagogies paired with tangible or constructionist media are associated with reported gains in cognitive systems thinking (Al-Barakat et al., 2026; Frey et al., 2025), affective empathy and nature connectedness (Branda et al., 2025; Kelly et al., 2025), and behavioral action agency (Christoforou, 2026; Häggström, 2022; Lestari et al., 2024; Saimon et al., 2024).

Three limits bound these conclusions: Corpus and indexing. Only English-language studies indexed in Scopus and Web of Science were included, which excluded regional literature, community reports, and non-English work, and so underrepresents indigenous Global South practices (Afzaal & Munir, 2025; Lee et al., 2025); Short horizons. Many trials ran only 4-6 weeks, so reported gains may reflect novelty effects, not lasting habits (Nguyen Minh Giam, 2026; Saimon et al., 2024); Self-report bias. Much of the data comes from teacher surveys and student questionnaires, which are prone to social desirability bias and may overstate actual behavior outside class (Katsimpelis et al., 2026; Lamanauskas & Malinauskienė, 2024).

Recommendations for Primary Education (SD) is curriculum and timetabling. Integrate ESD/GCED into core subjects (Pancasila Education, IPAS, Indonesian Language, and Islamic

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Education in MI) instead of adding standalone subjects. Schedule weekly 90-minute experiential blocks for project-based learning (e.g., RADEC or P5) and local outdoor inquiry (Lestari et al., 2024; Remmen & Iversen, 2021). Grade-tiered pedagogy: *Grades 1-3* to focus on school grounds, school gardens (*kebun sekolah*), local storytelling, and emotional connection to nature, and avoid distant climate-disaster narratives (Kelly et al., 2025; Martino et al., 2025); *Grades 4-6* to use block-based programming (e.g., Scratch), student-led waste-sorting projects, interactive microgames, and cross-school dialogue to build systems thinking and civic problem-solving (Christoforou, 2026; Saimon et al., 2024). Resources and teacher capacity to prioritize low-cost physical media, such as schoolyard artifacts, recycled materials, and inquiry kits, supplemented by offline-compatible digital microgames (Katsimpelis et al., 2026; Nguyen Minh Giam, 2026). Give early-career teachers classroom-ready modules to build content knowledge, and work with school leaders to give experienced teachers autonomy for open-ended inquiry (Afzaal & Munir, 2025; Katsimpelis et al., 2026).

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