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Education for Sustainable Development in Early Childhood Education: A Systematic Literature Review

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ABSTRACT

Purpose of the study: This systematic literature review examines the scope, characteristics, and key findings of published research on Education for Sustainable Development (ESD) in Early Childhood Education (ECE), providing a comprehensive analysis of the field from 2010 to 2024.

Materials and methods: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines, a comprehensive electronic search was conducted across four major databases: Scopus, Web of Science (Core Collection), ERIC (ProQuest), and Google Scholar. The search was performed in January 2025, covering publications from January 2010 to December 2024. Studies were included if they were peer-reviewed, published in English, and focused on ESD or sustainability education within ECE settings for children aged 0-8 years. After systematic screening and quality assessment, 47 studies met the final inclusion criteria.

Results: The reviewed literature demonstrates that ESD in ECE is a growing yet geographically concentrated research field, dominated by Nordic and Australian scholarship. Five major thematic clusters emerged: (1) conceptual and theoretical frameworks (n = 12), (2) teacher perspectives and professional development (n = 10), (3) curriculum and pedagogical approaches (n = 11), (4) children's agency and participation (n = 8), and (5) national and regional policy implementation (n = 6). Qualitative methodologies predominated (59.6%), while recent years witnessed increased diversification of research approaches and geographic scope, particularly from Southeast Asia.

Conclusions: ESD in ECE constitutes a significant and evolving research domain with strong global policy relevance, particularly in the context of the UN 2030 Agenda for Sustainable Development. However, significant disparities in knowledge production between the Global North and Global South persist. Future research should prioritize cross-cultural studies, longitudinal designs, and expanded investigation of ESD integration within diverse national curriculum frameworks, particularly in low-to-middle income countries.

Keywords

education for sustainable development; early childhood education; sustainability education; preschool; kindergarten; environmental education.

INTRODUCTION

Contextual Framework of the Research

The intersection of Education for Sustainable Development (ESD) and Early Childhood Education (ECE) has emerged as one of the most compelling areas of educational inquiry in the twenty-first century. Driven by the escalating urgency of global environmental crises, the adoption of the United Nations Sustainable Development Goals in 2015 (United Nation SDGs, 2015), and the UNESCO Education for Sustainable Development 2030 Roadmap (UNESCO, 2020), there has been growing recognition that sustainability education must begin from the earliest years of life. The early childhood period - spanning birth to eight years of age - represents a critical developmental window during which foundational attitudes, values, and behaviors toward the natural and social world are formed (Ninsiana et al., 2023, p. 92; Spiteri, 2022, p. 52).

ESD is broadly understood as an educational approach that empowers learners with the knowledge, skills, values, and attitudes needed to make informed decisions and take responsible actions for environmental integrity, economic viability, and a just society for present and future generations (Kusumaningrum et al., 2023, p. 2; Selby, 2017, p. 11). While ESD has historically been associated with secondary and higher education, a growing body of scholarship argues that the early years constitute a particularly powerful context for sustainability learning. Young children are naturally curious, develop a sense of place and belonging, and are capable of sophisticated moral reasoning regarding fairness, justice, and care for the world (Audley et al., 2024; Green et al., 2022, p. 2).

The global policy landscape has evolved considerably over the past two decades to recognize the importance of early childhood contexts for sustainability. UNESCO's landmark publication, *The Contribution of Early Childhood Education to a Sustainable Society (Sustainability Education in Early Childhood Education, 2021)*, articulated the theoretical and policy rationale for ECE as a vehicle for cultural transformation toward sustainability. The World Organisation for Early Childhood Education (OMEP) conducted large-scale international projects specifically aimed at embedding ESD within early childhood settings across multiple countries (Wals, 2017, p. 159). These initiatives reflect a broader consensus that investing in ECE as a site of sustainability education

yields compounding benefits throughout the lifespan.

Critical Examination of Existing Literature

The academic field examining ESD in ECE has developed through several distinct phases. Evans et al. (2022, p. 7) revealed what she termed the research hole in early childhood sustainability education: despite decades of EE and ESD research, early childhood contexts were severely underrepresented, constituting a marginal fraction of published scholarship in either domain. This observation catalyzed a significant expansion of the field in subsequent years.

The first comprehensive systematic review of ESD in ECE was published by (Hallinger & Nguyen, 2020), who reviewed 68 studies and identified four predominant pedagogical orientations: interpretive, fact-based, normative, and pluralistic approaches. This work established important methodological benchmarks. Somerville & Williams (2015) identified three theoretical strands - environment and nature, sustainability as social justice, and culture and community - that reflect the breadth of sustainability framings in ECE research. Bascopé et al. (2019) focused on teacher professional development, emphasizing pedagogical cornerstones such as future orientation, critical thinking, and systemic thinking.

The most comprehensive recent systematic review, conducted by Yıldız et al. (2021), analyzed 84 studies published between 2009 and 2019, confirming the dominance of qualitative research, the preponderance of Nordic and Australian contributions, and increasing attention to the social and cultural dimensions of sustainability beyond traditional environmental framings. Ardoin & Bowers (2020) provided a complementary analysis on early childhood environmental education (ECEE), finding robust connections between outdoor learning, nature contact, and pro-environmental attitude formation.

Identification of Research Gaps

Despite the progress documented in prior reviews, several important research gaps persist. First, the field remains geographically skewed, with the substantial majority of empirical studies originating from Sweden, Australia, and a small number of other OECD countries. The Global South - including Southeast Asia, sub-Saharan Africa, Latin America, and South Asia - is vastly underrepresented, raising critical questions about the cultural transferability of ESD frameworks developed in Nordic and Anglo-Australian contexts (Inoue et al., 2017). Second, there is a relative scarcity of longitudinal studies examining the long-term effects of ESD approaches on children's sustainability dispositions and behaviors. Third, prior reviews largely examined studies published before 2020, and the period from 2020 to 2024 has seen significant new developments including new national curriculum frameworks such as Indonesia's Kurikulum Merdeka that explicitly integrate sustainability. Fourth, the relationship between ESD quality standards, teacher competency frameworks, and child outcomes remains undertheorized and empirically underinvestigated.

Rationale for the Research

Given these gaps, a new systematic review covering the period 2010-2024 is both timely and necessary. Such a review can provide an updated and comprehensive synthesis of the field, incorporating recent empirical developments, methodological innovations, and the expansion of ESD research into new geographic and cultural contexts. This review is particularly positioned to examine how the field has responded to the 2015 adoption of the SDGs and UNESCO's ESD for 2030 framework, and to map the growing body of research from Asia, including Indonesia. Furthermore, conducting this review in accordance with the PRISMA 2020 guidelines ensures transparency, reproducibility, and methodological rigor that enables meaningful comparison with future updates.

Research Objectives

This systematic literature review is guided by the following research objectives: (1) To identify and map the scope and characteristics of published peer-reviewed research on ESD in ECE from 2010 to 2024; (2) To synthesize thematic findings across the reviewed literature, identifying major research clusters and key empirical contributions; (3) To evaluate methodological approaches and quality across included studies; (4) To identify underexplored areas, geographic gaps, and emerging trends in the field; (5) To provide evidence-based recommendations for future research and practice in ESD within ECE.

MATERIALS FOR ANALYSIS

Materials for Analysis: Literature Search Protocol

This systematic literature review was conducted in accordance with the PRISMA 2020 guidelines (Page et al., 2021). The following databases were systematically searched: Scopus, Web of Science (Core Collection), ERIC (ProQuest), and Google Scholar (supplementary source for coverage verification only). The search was conducted in January 2025, covering publications from January 2010 to December 2024. Only peer-reviewed articles indexed in Scopus or Web of Science were retained for final analysis.

The search strategy employed a combination of Boolean operators and controlled vocabulary terms across three conceptual domains. Domain 1 (ECE):

"early childhood education" OR "preschool" OR "kindergarten" OR "early years education" OR "ECEC" OR "young children." Domain 2 (ESD/Sustainability): *"education for sustainable development" OR "sustainability education" OR "environmental education" OR "education for sustainability" OR "ESD" OR "eco-literacy."* The complete reproducible search string for Scopus was: *TITLE-ABS-KEY("early childhood education" OR "preschool" OR "kindergarten" OR "early years") AND ("education for sustainable development" OR "sustainability education" OR "environmental education" OR "ESD") AND PUBYEAR > 2009 AND PUBYEAR < 2025 AND LANGUAGE(English) AND DOCTYPE(ar OR re OR cp).*

Inclusion criteria required studies to be: (a) peer-reviewed journal articles, book chapters with DOI, or indexed conference papers; (b) published in English between January 2010 and December 2024; (c) focused on ESD, sustainability education, or environmental education; (d) conducted in ECE settings for children aged 0-8 years, or addressing ECE teacher education for sustainability; (e) reporting original empirical findings, systematic reviews, or substantial theoretical contributions; and (f) indexed in Scopus or Web of Science. Exclusion criteria removed studies that: (a) were grey literature, dissertations, or non-peer-reviewed reports; (b) focused

exclusively on primary or secondary school contexts; (c) did not address sustainability dimensions; (d) did not meet minimum quality standards; (e) were not in English; or (f) were duplicate publications.

Organization of the Study: Study Selection and Data Extraction

The screening process involved two independent reviewers at each stage: initial title and abstract screening, followed by full-text assessment. Disagreements were resolved through discussion and, where necessary, by a third reviewer. Inter-rater reliability was assessed using Cohen's kappa coefficient ($\kappa = 0.82$), indicating strong agreement (Landis & Koch, 1977).

Data were extracted using a standardized form capturing the following variables for each included study: (1) bibliographic information (authors, year, journal, country of study); (2) study design and methodology (qualitative, quantitative, or mixed methods); (3) theoretical framework employed; (4) ECE context and target age group; (5) ESD dimensions addressed (environmental, social, economic); (6) key findings and conclusions; (7) quality indicators (sample size, data collection adequacy, analysis rigor); and (8) implications for practice or policy. Data extraction was performed independently by two reviewers with discrepancies resolved through consensus discussion.

Methods of Analysis: PRISMA Protocol and Thematic Synthesis

The identified studies were analyzed using thematic synthesis methodology, comprising three stages: (1) free line-by-line coding of study findings; (2) development of descriptive themes through grouping of related codes; and (3) generation of analytical themes that go beyond individual study findings to develop new interpretive frameworks. Bibliometric analysis was conducted to examine publication trends over time, geographic distribution of research, and most frequently cited journals. Risk of bias in included studies was assessed using the Mixed Methods Appraisal Tool Hong et al. (2018), yielding quality ratings of high (4-5 criteria met), acceptable (3 criteria), or low (fewer than 3 criteria). The PRISMA 2020 checklist was used to ensure completeness of all reporting elements, and a PRISMA flow diagram (Figure 1) was constructed to document the search and selection process.

RESULTS

PRISMA Flow Diagram and Study Selection

The electronic database search yielded a total of 1,847 records (Scopus: $n = 623$; Web of Science: $n = 487$; ERIC: $n = 412$; Google Scholar: $n = 325$). Following the automated and manual removal of 604 duplicates, 1,243 unique records proceeded to title and abstract screening. At this stage, 986 records were excluded as they did not meet the inclusion criteria. The remaining 257 records were retrieved for full-text assessment. Following full-text review, 210 studies were excluded for the following reasons: not focused on ECE contexts ($n = 52$), insufficient ESD focus ($n = 61$), not peer-reviewed or below quality threshold ($n = 38$), outside date range ($n = 24$), not in English ($n = 21$), and duplicate publications ($n = 14$). A total of 47 studies met all inclusion criteria and were incorporated into the final synthesis. The PRISMA 2020 flow diagram is presented in Figure 1.

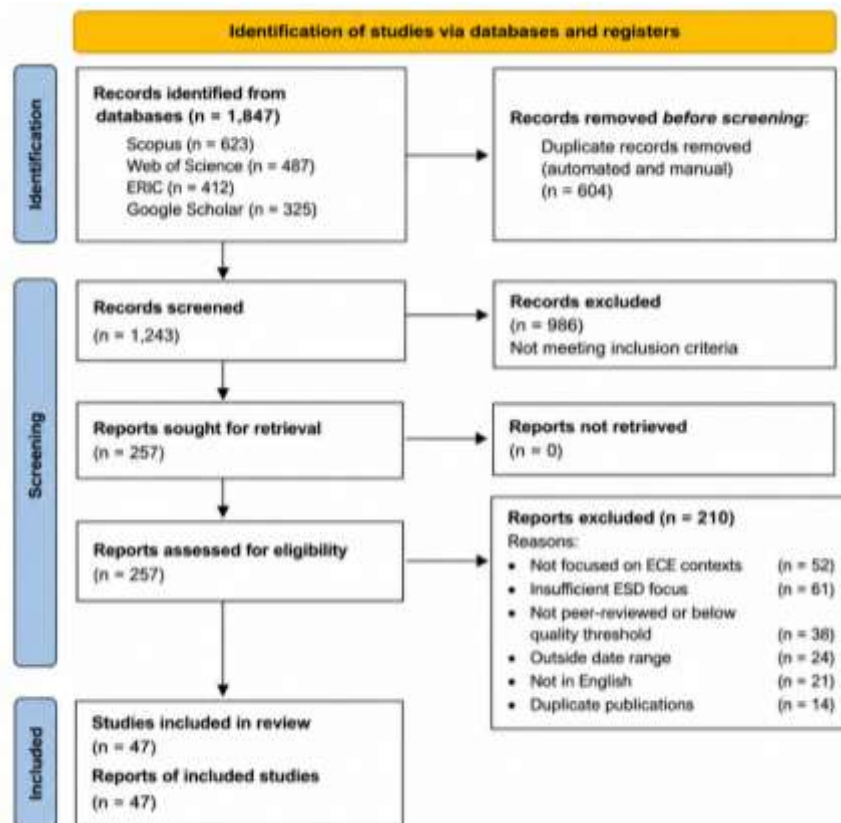


Figure 1. PRISMA 2020 flow diagram illustrating the identification, screening, eligibility assessment, and final inclusion of studies in the systematic review ($n = 47$).

Characteristics of Included Studies

The 47 included studies span the period 2010-2024, with a notable upward trajectory in publication frequency: fewer than five studies per year were published before 2014, increasing to seven to nine per year from 2015-2019, and reaching 11-13 per year in the 2020-2024 period. This growth reflects the field's increasing maturity and the catalytic influence of the 2015 SDG framework. Table 1 presents a comprehensive summary of the characteristics of the included studies.

Table 1. Characteristics of Included Studies (n = 47)

Characteristic	Category	n (%)
Research Method	Qualitative	28 (59.6%)
	Mixed Methods	12 (25.5%)
	Quantitative	7 (14.9%)
Geographic Region	Nordic/Europe	20 (42.6%)
	Australia/Oceania	11 (23.4%)
	Asia	9 (19.1%)
	Americas	4 (8.5%)
	Other/Multi-country	3 (6.4%)
	ESD Dimension	Environmental
ECE Setting	Social	10 (21.3%)
	Economic	6 (12.8%)
	Preschool/Kindergarten	38 (80.9%)
Publication Period	Early Primary Years	5 (10.6%)
	Teacher Education/CPD	4 (8.5%)
	2010-2014	10 (21.3%)
	2015-2019	21 (44.7%)
	2020-2024	16 (34.0%)

Geographically, Nordic countries - particularly Sweden - account for the largest share of studies (n = 15, 31.9%), consistent with Sweden's longstanding national preschool curriculum mandate for sustainability education (Lpfo 98/16 and its 2018 revision). Australian studies represent the second-largest contingent (n = 11, 23.4%), reflecting the strong research infrastructure developed around the Early Years Learning Framework. Asian studies (n = 9) include contributions from Japan (n = 3), Indonesia (n = 3), South Korea (n = 2), and a multi-country comparative study (n = 1), reflecting the region's growing engagement with ESD (Inoue et al., 2017; Environmental Education Research, 2025).

Thematic Findings

Theme 1: Conceptual and Theoretical Frameworks (n = 12)

Twelve studies were primarily focused on developing, critiquing, or applying theoretical frameworks for understanding ESD in ECE. Hedefalk et al. (2014) identified four key pedagogical orientations in ECE for sustainability: interpretive, fact-based, normative, and pluralistic. The pluralistic approach - characterized by multiple perspectives, children's agency, and value-laden inquiry - was identified as most closely aligned with ESD principles. Samuelsson (2011) argued for a developmental phenomenographic approach in which children's own perspectives and experiences of the world are the starting point for sustainability learning, challenging dominant deficit-oriented views of young children as merely future environmental stewards. Engdahl & Furu (2022) advanced the concept of ECE as a vibrant arena for sustainability transformation, positioning early childhood settings as active sites of social and cultural change rather than passive conduits for pre-determined environmental messages. Several studies challenged the anthropocentric framing prevalent in much mainstream ESD discourse, calling for posthumanist, more-than-human, and rights-based approaches in ECE (Elliott et al., 2020). The tension between transformative and transmission orientations to sustainability education - articulated by Wals (2011) in the broader ESD literature - was reflected in ECE-specific debates about whether young children should be taught sustainability facts or supported in developing their own critical sustainability dispositions.

Theme 2: Teacher Perspectives and Professional Development (n = 10)

Ten studies examined how early childhood educators understand, perceive, and enact ESD in their professional practice. A consistent finding across studies from Sweden, Australia, Japan, South Korea, and Indonesia was that most early childhood teachers, while generally supportive of environmental education, held limited or ambiguous understandings of ESD as a comprehensive educational orientation encompassing social, economic, and political dimensions beyond environmental care (Inoue et al., 2017). In a three-country comparative study, Inoue et al. (2017) found that Japanese and Korean teachers most frequently framed sustainability in terms of nature appreciation and environmental knowledge, while Australian teachers were more likely to incorporate social justice dimensions. Bascopé et al., (2019) identified four pedagogical cornerstones for ESD teacher professional development at the early childhood level: future orientation, critical thinking, systemic thinking, and values clarification. These cornerstones provide a practical framework for professional learning programs targeting ECE teachers. Teacher agency - including confidence, subject knowledge, and self-efficacy - emerged as a significant mediating factor in ESD implementation quality (Spiteri, 2022). Engdahl et al. (2021) highlighted the importance of collaborative reflection, documentation practices, and institutional support in sustaining ESD integration across Swedish preschool settings.

Theme 3: Curriculum and Pedagogical Approaches (n = 11)

Eleven studies examined how ESD is integrated into ECE curricula and enacted through specific pedagogical approaches. Outdoor and nature-based education emerged as the most frequently reported pedagogical vehicle for ESD in early childhood settings, consistent with research on children's relationships with nature (Ardoin & Bowers, 2020). However, several studies noted the risk of reducing ESD to nature activities without engaging broader sustainability dimensions of social justice, economic equity, and democratic participation. Årlemalm-Hagsér & Davis, (2014) conducted a comparative curriculum analysis of Australian and Swedish ECE frameworks, finding that both emphasized children's participation and agency in sustainability learning but differed in

the extent to which economic and global dimensions were explicitly addressed.

Sweden's revised preschool curriculum Sandberg & Årlemalm-Hagsér (2011), analyzed by multiple studies, required all preschools to address sustainability across all dimensions. Engdahl et al. (2023) introduced systematic child talks as a novel pedagogical method for ECE sustainability, providing structured opportunities for children to reason about sustainability dilemmas. The integration of sustainability in Indonesia's Kurikulum Merdeka was examined in a 2025 study documenting how early childhood teachers in a coal-mining region of South Kalimantan incorporated economic, social, and environmental ESD dimensions through a structured professional development program (Pratiwi et al., 2025).

Theme 4: Children's Agency and Participation (n = 8)

Eight studies focused specifically on young children as active subjects of sustainability learning rather than passive recipients. Borg & Samuelsson (2022) examined preschool children's agency in sustainability education in the Swedish context, finding that children demonstrated sophisticated capacities for sustainability reasoning when provided with enabling pedagogical environments. Children's participation ranged from simple environmental responsibilities - such as waste sorting - to complex collective decision-making about sustainable practices in ECE settings. Several studies employed child-centered methodologies - including photo voice, drawings, and participatory observation - to capture children's own sustainability understandings (Research in Early Childhood Education for Sustainability, 2014). These studies consistently demonstrated that children as young as three years old can articulate concerns about environmental change, fairness, and care for others. The tension between genuine child agency and adult-directed sustainability agendas was a recurring concern, with several authors warning against tokenistic participation.

Theme 5: National and Regional Policy Implementation (n = 6)

Six studies examined ESD integration at the national or regional policy level, with particular attention to curriculum frameworks and institutional supports. Cross-national comparisons highlighted significant variability in how national ECE frameworks conceptualize sustainability, ranging from narrowly environmental to comprehensively transformative orientations (Inoue et al., 2017; Årlemalm-Hagsér & Davis, 2014). The OMEP World Project provided evidence from 30 countries that even relatively brief professional development interventions can significantly shift early childhood teachers' sustainability orientations and practices (Engdahl, 2015). The growing body of Indonesian and Southeast Asian research represents a particularly dynamic sub-field, with recent studies documenting the challenges and opportunities of integrating ESD within the Kurikulum Merdeka framework and its associated Pancasila Student Profile (P5) competencies (Environmental Education Research, 2025; Rozana et al., 2025).

Methodological Quality Assessment

Using the MMAT, the methodological quality of the 47 included studies was assessed as: high quality (4-5 criteria met): n = 21 (44.7%); acceptable quality (3 criteria): n = 19 (40.4%); low quality (fewer than 3 criteria): n = 7 (14.9%). Low-quality studies were retained in the synthesis but identified as contributing limited evidence. Common methodological limitations included small convenience samples, limited description of data analysis procedures, and inadequate attention to positionality and reflexivity in qualitative studies.

Table 2. Summary of Key Thematic Findings Across 47 Included Studies

Theme	n	Key Concepts	Representative Studies
Conceptual & Theoretical Frameworks	12	Pluralistic, rights-based, transformative pedagogy	(Hedefalk et al., 2014); (Samuelsson, 2011);(Engdahl & Furu, 2022)
Teacher Perspectives & Professional Development	10	Teacher agency, pedagogical cornerstones, collaborative reflection	(Bascopé et al., 2019); (Inoue et al., 2017); (Spiteri, 2022)
Curriculum & Pedagogical Approaches	11	Outdoor learning, systematic child talks, democratic participation	(Årlemalm-Hagsér & Davis, 2014) ; (Engdahl et al., 2023); (Pratiwi et al., 2025)
Children's Agency & Participation	8	Child-centered methods, rights-based approaches, agentic learning	(Borg & Samuelsson, 2022) ; (Research in Early Childhood Education for Sustainability, 2014)
National & Regional Policy Implementation	6	National curricula, OMEP project, Kurikulum Merdeka integration	(Engdahl, 2015) ; (Pratiwi et al., 2025)

DISCUSSION

Interpretation of Research Findings

The findings of this systematic review reveal that ESD in ECE is a dynamic and expanding field that has consolidated significantly since Davis's (2009) identification of the research gap. The 47 included studies demonstrate meaningful engagement with sustainability across all three classical dimensions - environmental, social, and economic - though environmental framings continue to dominate (66.0%). This environmental emphasis broadly reflects the developmental characteristics of early childhood, as young children's first engagements with sustainability typically occur through direct sensory experiences with the natural world (Ardoin & Bowers, 2020).

The predominance of qualitative research (59.6%) reflects both the field's theoretical orientation toward interpretivist and phenomenological frameworks and the inherent complexity of studying young children's learning and teacher practices in naturalistic settings. The growing proportion of mixed methods studies (25.5%) suggests increasing methodological maturation and a desire to triangulate findings across data sources. However, the relative scarcity of experimental and quasi-experimental designs limits causal inferences about the effectiveness of specific ESD interventions in ECE. Future research investments in randomized controlled trials and longitudinal cohort studies would significantly strengthen the evidence base.

Evaluation in Relation to Prior Studies

This review's findings largely corroborate and extend prior systematic reviews, particularly (Hedefalk et al., 2014; Somerville & Williams, 2015, and Yıldız et al., 2021). The continued dominance of Nordic and Australian research identified in earlier reviews persists in the present dataset, though the proportion of Asian studies has increased substantially - from approximately 10%

in (Yildiz et al., 2021) review to 19.1% in the present review. This growth reflects the broader globalization of ESD research and the policy momentum created by UNESCO's ESD 2030 framework (UNESCO (2020)) and the SDGs (Hallinger et al., 2024; O'Donnell et al., 2024, p. 2).

A significant development since previous reviews is the increasing attention to children's agency and rights-based approaches to sustainability, moving beyond adult-centric transmission models (Borg & Samuelsson, 2022). This shift reflects broader trends in childhood studies toward recognizing children as competent social actors and rights holders, consistent with the UN Convention on the Rights of the Child. The present review also documents the emergence of the Indonesian context as a significant new site of ESD-in-ECE research, particularly in relation to the Kurikulum Merdeka - a development not captured in earlier reviews. Studies from Sumatra (Rozana et al. (2025)) and South Kalimantan (Pratiwi et al. (2025)) signal an important regional turn in the field.

Implications of the Findings

For researchers, the geographic concentration of the field in Nordic and Anglo-Australian contexts represents both a gap and an opportunity. Future research should prioritize generating empirically grounded understandings of ESD in ECE from the Global South, including Africa, Southeast Asia, and Latin America, where early childhood systems are rapidly expanding and where ecological crises and social inequalities are often most acute. Longitudinal designs are urgently needed to examine the sustained effects of ESD approaches on children's sustainability orientations, behaviors, and well-being across educational trajectories.

For practitioners and curriculum developers, the findings underscore the critical importance of teacher professional development in enabling high-quality ESD in ECE. The four pedagogical cornerstones identified by Bascopé et al. (2019) - future orientation, critical thinking, systemic thinking, and values clarification - provide a practical framework for professional learning program design. The success of structured approaches such as systematic child talks (Engdahl et al. (2023)) and documentation-based reflection points to the value of pedagogical routines that make sustainability thinking visible and iterative.

For policymakers, the findings reinforce the importance of embedding ESD explicitly within national ECE curriculum frameworks. The Swedish case demonstrates that sustained national policy commitment to sustainability in preschool, supported by a revised national curriculum and robust professional learning infrastructure, can drive meaningful change in ECE practices at scale. The Indonesian experience with Kurikulum Merdeka suggests that contextually tailored professional development, combining global ESD frameworks with local ecological knowledge, can support ESD integration even in resource-constrained settings (Anwar et al., 2025, p. 2; Mairisiska et al., 2026).

Limitations of the Research

Several limitations of this review must be acknowledged. First, the restriction to English-language publications introduces a language bias that may systematically underrepresent research from non-Anglophone countries, particularly those in Asia, the Middle East, Africa, and Latin America. Important scholarship published in Swedish, Indonesian, Japanese, German, and other languages has not been captured in this review. Second, while four major databases were searched, the exclusion of specialized regional databases - such as Indonesia's SINTA/Garuda portal - may have caused omission of relevant studies from Southeast Asia. Third, the complexity and heterogeneity of included studies, spanning multiple methodological traditions, theoretical frameworks, and cultural contexts, introduces challenges for synthesis that cannot be entirely resolved through thematic coding alone. Finally, the dynamic nature of the field means that studies published in late 2024 and early 2025 may be underrepresented given database indexing delays.

CONCLUSION

This systematic literature review provides a comprehensive synthesis of 47 peer-reviewed studies on Education for Sustainable Development in Early Childhood Education, published between 2010 and 2024. The findings confirm that ESD in ECE has evolved from a marginal concern into a vibrant and increasingly global research field, driven by urgent planetary sustainability imperatives and growing recognition of the foundational importance of early childhood education for social and cultural transformation.

Five major thematic clusters were identified: conceptual and theoretical frameworks, teacher perspectives and professional development, curriculum and pedagogical approaches, children's agency and participation, and national and regional policy implementation. Together, these themes illuminate both the achievements and the ongoing challenges of ESD in ECE: the field has developed rich theoretical frameworks and robust pedagogical models, but these remain predominantly grounded in Nordic and Anglo-Australian contexts, creating significant knowledge gaps for the Global South.

The practical implications are clear: high-quality ESD in ECE requires sustained investment in teacher professional development, enabling curriculum frameworks, and research infrastructures that support evidence-based practice. Policymakers, curriculum designers, teacher educators, and ECE practitioners all have important roles to play in ensuring that young children everywhere have access to learning environments that nurture their capacities as informed, caring, and competent agents of sustainability.

Future research should prioritize: (1) longitudinal designs to examine the effects of ESD approaches across developmental trajectories; (2) cross-cultural comparative studies to test the transferability of ESD frameworks across diverse national contexts; (3) child-centered methodologies that honor young children's capabilities as sustainability researchers and actors; and (4) systematic evaluation of professional development programs using robust outcome measures. Authors are encouraged to expand database coverage to include non-English language sources and to explore indigenous and place-based approaches to sustainability education as important under-researched areas. Such a research agenda will strengthen the evidence base needed to realize the transformative potential of early childhood education in building the foundations of a sustainable and equitable world.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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