

Trends and Challenges in Environmental Education for Young Children: A Systematic Literature Review

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Abstract: Trends and Challenges in Environmental Education for Young Children: A Systematic Literature Review. Objectives: This study aims to systematically review and synthesize research on environmental education for young children with a focus on identifying global trends, pedagogical approaches, implementation challenges, and future directions. The objective is to provide a comprehensive overview that informs future research and practice promoting sustainability education for young children. **Methods:** A systematic literature review was conducted using international databases (Scopus) to collect and analyze peer-reviewed articles published over the past decade. Inclusion criteria covered studies focusing on environmental education in early childhood, addressing both pedagogical practices and conceptual frameworks. The selected articles were analyzed thematically to identify prevailing trends, strategies, barriers, and recommendations. **Findings:** The analysis reveals a growing interest in early childhood environmental education, marked by a significant increase in publications after 2020. The study is dominated by the participation of developed countries rather than developing countries. Four main pedagogical approaches have been set: experiential-based learning, garden-based learning, storytelling with an ecological project theme, as well as project-based learning. Regardless of the profit, several challenges persist, including limited access to the green room, inadequate educator training, and an inconsistent framework for measuring ecoliteracy. This finding also highlights the scarcity of longitudinal studies, which limits our understanding of short-term effects. **Conclusion:** Early childhood environmental education plays a crucial role in promoting ecoliteracy, social-emotional development, and pro-environmental attitudes. However, this sector still confronts a conceptual gap, methodological, as well as significant geographic. Tightening the educator training, integrating sustainability in the curriculum, and carrying out more fundamental, inclusive, long-term studies to work on environmental education in early childhood effectiveness.

Keywords: environmental education, sustainability, young children.

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■ INTRODUCTION

Environmental education for young children has become increasingly relevant in the context of climate change and ecological degradation. Early childhood is considered the critical development phase where the foundation of values, attitudes, and behaviors is built. The research indicates that children exposed to

environmental issues from an early age are more likely to develop empathy for nature, exhibit pro-environmental behavior, and demonstrate social collaboration abilities (Barrable, 2019; Wilson, 2018). Since the Tbilisi Declaration in 1997, UNESCO has stressed life environmental education must be started from an early age as an integral part of sustainable development.

Global agenda for Education for Sustainable Development (ESD) further strengthens this urgency, spotlighting the importance of equipping children with knowledge, skills, and values that enable them to contribute to sustainable solutions (UNESCO, 2020). This global mandate positions the education of young children as a crucial entry point for transitions.

Life environmental education for early children not only fosters ecological awareness but also supports holistic development. Direct interaction with nature has proven to raise cognitive skill, creativity, emotional regulation, and physical health (Markevych et al., 2017; Otto & Pensini, 2017). Furthermore, early experiences in nature foster an emotional connection to the environment, which is a strong predictor of later pro-environmental behavior (Chawla, 2015; Otto & Pensini, 2017). Besides individual profits, early childhood environmental education can foster creative ecological responsibility. Study displays that when the children establish empathy and connectedness with nature, this disposition extends toward family and community practice, tightening sustainable lifestyle in the wider social level (Cutter-Mackenzie-Knowles et al., 2020). This highlights the importance of embedding ecological learning from an early age.

Global trends show that pedagogic approaches in life environmental education for early children are increasingly diverse. The prominent strategies include experience-based learning, outdoor education, garden-based learning, storytelling with an ecology theme, and project-based learning (Ärlemalm Hagsér & Elliott, 2017; Ernst & Burcak, 2019). These approaches are designed to provide an authentic learning experience that fosters critical thinking, while also promoting social responsibility and environmental awareness among children.

The integration of environmental education into early childhood curricula has become a major focus in many countries. Studies show that

programs with a focus on sustainability in early childhood education not only enhance environmental literacy but also increase social ability, empathy, and collaboration (Davis & Elliott, 2014). That integration is in line with Sustainable Development Goal 4.7, which announces the value of education with a strong stress on sustainability. In Nordic tradition, sustainability is framed as a part of children's prosperity (Hagglund & Johansson, 2019), while in another context, the perspective of cultural society presses the intergenerational place-based learning. (Nxumalo & Ross, 2019)

Despite these obvious profits, the application of environmental education for young children confronts challenges continuously. The challenges that are always reported include limited access to outdoor spaces, inadequate facilities, insufficient time due to academic pressure, and inadequate training in environmental education (Ernst, 2014; Malone & Waite, 2016). These challenges particularly occur in the city, where access to green spaces is often limited (Jennings et al., 2016; Wells & Evans, 2003). Another challenge is the diversity of definitions and indicators used to measure early children's environmental literacy. Some researchers stress ecoliteracy as the systematic knowledge (Capra, 2007), while others focus more on behavior and practice skills (McBride et al., 2013). The less of this conceptual consistency makes it difficult to compare the findings in several studies and contexts. Besides that, most of the available research only analyzes short-term findings. Longitudinal studies are still rare, making it difficult to evaluate how early environmental education shapes ecological identity and pro-environmental behavior in the long term. (G. Evans et al., 2018)

The latest report highlights that, despite the recognition of environmental education for early children as crucial, its implementation remains limited in certain areas. For instance, the global survey reveals that fewer than 40% of early

childhood programs actively incorporate structured ecology learning activities, resulting in a significant gap in promoting sustainable values from an early age (UNESCO, 2022). This leaves a significant gap in promoting sustainability values at an early age.

Empirical evidence shows that nature-based learning experiences, when designed effectively, can enhance children's ecological knowledge and foster emotional regulation, social collaboration, and problem-solving skills (Gray et al., 2023). Outdoor class activities and direct practice are also connected with cognitive competence, motor skills, and more effective collaboration. However, the adoption of this systematic approach remains inconsistent across various contexts. Outdoor class activities and direct practice are also connected with cognitive competence, motor skills, and more effective collaboration (Jiang & Hussain, 2023).

Even though the benefits of Early childhood environmental education have been acknowledged, its practice is still imbalanced in some contexts. The newest study highlights several challenges, including teacher training, which remains limited in environmental pedagogy, access limitations to nature, and inadequate teaching practices (Hungerford & Volk, 2020; Sandseter & Seland, 2020). Moreover, the program's inconsistent approach to interpreting and measuring environmental literacy in early children, particularly in terms of pressure on behavior, attitude, or knowledge, complicates the evaluation of effectiveness (Hungerford & Volk, 2020). Evidence also indicates that even though the nature-based learning activity can foster ecology awareness, pro-environment behavior in children, some programs for early children still do not integrate that approach systematically (Danks, 2020; Ebbeck & Yim, 2021). The continuity gap highlights the importance of comprehensive synthesis from available research to identify effective pedagogic strategies and

inform program design for early childhood education.

This gap shows the need for a comprehensive synthesis of recent evidence. As stated by Snyder (2019), a systematic review not only organizes fragmented findings but also reveals future directions for research and practice. Therefore, conducting a systematic literature review is crucial for mapping global pedagogical trends, identifying the main challenges in implementation, and highlighting recommendations to advance early childhood environmental education.

Unlike previous narrative reviews that often addressed environmental education more broadly or were limited to specific regional contexts, this study adopts a systematic literature review with a particular emphasis on early childhood education. For instance, Barrable (2019) reviewed the role of children's connection with nature, offering valuable theoretical insights but focusing mainly on conceptual discussions rather than a systematic synthesis of empirical findings. Similarly, Boyd (2021) provided a narrative reflection on participatory practices in early childhood education for sustainability, emphasizing children's agency but drawing primarily from selective case-based examples. While both works contribute important perspectives, they are descriptive in nature and limited in scope. In contrast, the present study applies a systematic methodology (Snyder, 2019) to synthesize international evidence published between 2016 and 2025, thereby providing an updated and comprehensive overview of global research trends, pedagogical strategies, and persistent challenges in early childhood environmental education. Accordingly, this study is guided by four research questions:

RQ1. What are the prevailing research trends in environmental education for young children over the past decade?

- RQ2. What pedagogical approaches and strategies are most frequently applied in early childhood environmental education?
- RQ3. What challenges and barriers are reported in implementing environmental education for young children?
- RQ4. What recommendations and future directions are proposed to enhance the effectiveness of environmental education for young children?

The result of this review is expected to contribute both theoretically by clarifying the state of the art and gaps in the literature practically by informing teachers, curriculum developers, and policymakers on strategies to strengthen environmental education for the earliest years of life.

■ METHOD

Research Design

This study employed a Systematic Literature Review (SLR) as the research design to generate a comprehensive synthesis of studies on environmental education for young children. SLR was selected because research in this field is often fragmented across disciplines such as education, psychology, and environmental studies, and therefore requires a structured and transparent approach to consolidate knowledge. The review process followed the PRISMA 2020 guidelines (Page et al, 2021), which provide a rigorous framework for identifying, screening, and selecting studies in a reproducible manner. SLR applies explicit procedures that allow for a systematic mapping of research trends, pedagogical approaches, and implementation challenges. At the same time, this design facilitates

a critical synthesis of findings, enabling the identification of conceptual gaps and the development of recommendations that can inform future research, policy, and practice in early childhood environmental education. (Donthu et al., 2021; Snyder, 2019)

Search Strategy

Data for this review were collected exclusively from the Scopus database. Scopus is selected due to its reputation as one of the most multidisciplinary databases, encompassing journals in education, psychology, environmental studies, and related fields directly relevant to the study. In addition to its wide scope, Scopus offers consistent metadata quality and export functions that support scientometric analyses, ensuring transparency and reproducibility in the review process (Falagas et al., 2008). Other major databases such as Web of Science, PubMed, ERIC, and Google Scholar were considered. However, Scopus was deemed a relevant and methodologically suitable source for systematically identifying and analyzing literature in this study.

Searching carried out toward publication between 2016 and 2025, by focusing on the latest development in the education of early children life environmental after the SDGs launching in 2015. Only published articles written in English which is considered, as this context ensures the accessibility and the consistency in analysis, even though this has the limitation of excluding non-English literature. The search strategy employed a combination of keywords and Boolean operators to capture a broad yet precise set of studies. The primary search string was:

Table 1. Data sources and search strategy

Databased	Scopus
Search Period	2016-2025
Keyword	“environmental education”, “Education for sustainability”, “Sustainability”, “young children”, “Early childhood education”

Keyword Combination	TITLE-ABS-KEY ("Education for sustainability" OR "environmental education" OR "sustainability" AND "early childhood" OR "young children") AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SUBJAREA , "ENVI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (EXACTKEYWORD , "Environmental Education"))
Data retrieval date: August 11 th , 2025	

The search strategy and selection process were conducted systematically to ensure transparency and replicability. After applying the predefined search string and screening criteria, records were progressively filtered through identification, duplicate removal, title and abstract screening, and full-text eligibility assessment. The number of records at each stage, along with reasons for exclusion, is presented in the

PRISMA flow diagram. To ensure transparency in study selection, this review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The Prisma Flow Diagram (Figure 1) illustrates the process of identifying, filtering, and measuring study eligibility, which was then incorporated into the synthesis.

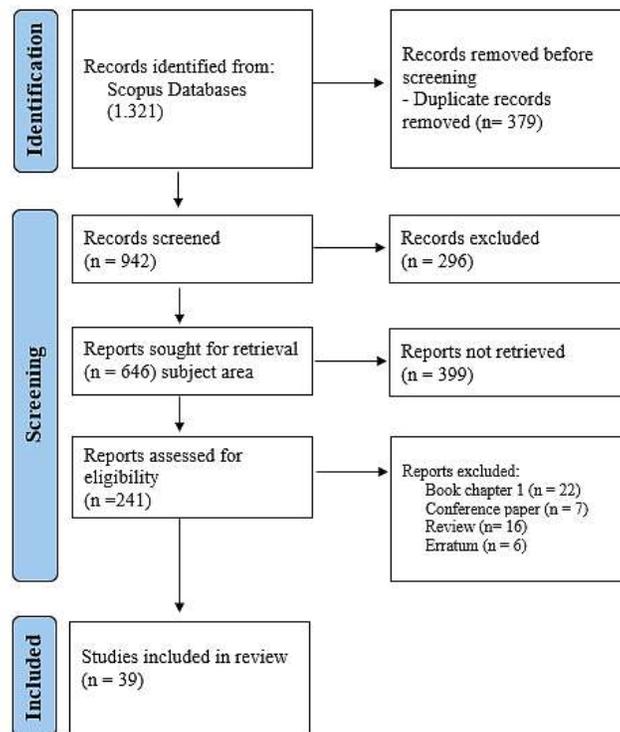


Figure 1. PRISMA flow diagram for the study selection process

The database search initially identified 1.321 from Scopus. After removing 379 duplicates, a total of 942 records were screened

at the title and abstract level. In this stage, 296 records were excluded because they were unrelated to early childhood or not focused on

environmental or ecological themes. The remaining 646 records underwent full-text assessment, from which 399 were excluded based on subject-area filtering. A total of 241 full-text articles were assessed for eligibility. Among these, 51 records were excluded for the following reasons: book chapters (n=22), conference papers (n=7), review papers (n=16), and errata (n=6). Ultimately, 39 studies satisfied all inclusion criteria and were included in the final synthesis (Figure 1).

Inclusion and Exclusion Criteria

To ensure transparency and reproducibility, clear inclusion and exclusion criteria were established before the screening process. As Petticrew and Roberts (2006) emphasize, the use of explicit criteria is fundamental in systematic reviews to reduce bias and define the scope of evidence considered. In this review, the criteria were designed to focus specifically on early childhood environmental education.

Table 2. Inclusion and exclusion criteria

Databased	Inclusion	Exclusion
Publication type	Peer-reviewed journal article	Conference proceedings, non-peer-reviewed works, grey literature
Timeframe	Published between 2016-2025	Published outside the specified period
Topic relevance	Articles explicitly addressing environmental education, education in early childhood contexts	Studies mentioning environmental issues only peripherally, without making them the main focus
Type of study	Empirical (qualitative, quantitative, mixed-methods) and conceptual studies are directly related to the research questions.	Editorials, opinion papers, book reviews, reports, or works lacking an empirical basis.
Methodological detail	Studies providing a sufficient methodological description for evaluation	Studies lacking methodological clarity or detail
Language	Written in English	Written in languages other than English

Data Analysis

The analysis combined thematic synthesis and bibliometric mapping to ensure both depth and breadth in interpreting the selected studies. According to Thomas & Harden (2008), thematic synthesis is an appropriate method for identifying recurring patterns across qualitative literature through coding, categorization, and theme development. This approach allows the transformation of both qualitative insights findings into descriptive statements that can be integrated into broader thematic categories (Barnett-Page & Thomas, 2009). Thematic synthesis offers the flexibility to capture contextual, experiential, and

pedagogical dimensions, making it particularly suitable for synthesizing the multifaceted evidence base of early childhood environmental education.

In this study, the approach was applied to systematically code the articles, construct descriptive categories, and generate analytical themes that directly addressed the four research questions guiding the review. Facilitating consistence, the data extraction matrix was made to catch the key information, including the writer, publication year, country, research model, participant characteristics, pedagogical strategy, reported challenges, as well as the major findings. This procedure mirrors the analysis principles that

incorporate qualitative elements, which are used to organize the extensive evidence into a balanced category. (Elo & Kyngeäs, 2008)

Complimenting thematic synthesis and bibliometric mapping was employed to identify wider patterns in the field. Trends in publication output, keyword co-occurrence, and geographic distribution were analyzed to provide insights into the evolution of environmental education for early childhood. As pressed by Snyder (2019), mixing bibliometric indicators with qualitative synthetic increases the literature completeness, particularly in interdisciplinary domains. The integration of these approaches enabled this review to gain depth and optimal breadth. By organizing the data based on four research questions, trend, pedagogical strategy, challenge, and recommendation, this study not only reviews the available knowledge, but also spotlights the conceptual gap and the research future direction, practice, and regulation development.

■ RESULT AND DISCUSSION

RQ1. What are the Prevailing Research Trends in Environmental Education for Young Children Over the Past Decade?

The analysis of publication trends between 2016-2025 reveals a fluctuating but gradually

increasing research trajectory in the field of environmental education for young children. In 2016, six articles were published, establishing a baseline for scholarly activity in this area. However, between 2017 and 2020, the number of publications decreased to 3 articles per year, mirroring a temporary stagnancy period. After 2020, the research activity shows the resurrection signals by recording five publications in 2020 and 2021, followed by the moderate fluctuation in 2022 and 2023. The most significant growth occurred in 2025, with seven documents published, marking the highest output at that time. This trend aligns with the growing global focus on sustainability in education, particularly in the context of the Sustainable Development Goals (SDGs) era post-2015, which emphasizes education for sustainable development (Mukhlis et al., 2024; Samuelsson & Park, 2017). As shown in Figure 2, the upward momentum in scholarly output reflects the growing recognition of young children as critical agents in sustainability education.

Keyword co-occurrence analysis provides deep knowledge concerning the intellectual structure of the sector. The central term of “Environmental education” is strictly related to “early children”, “sustainability”, and “Prosperity”,

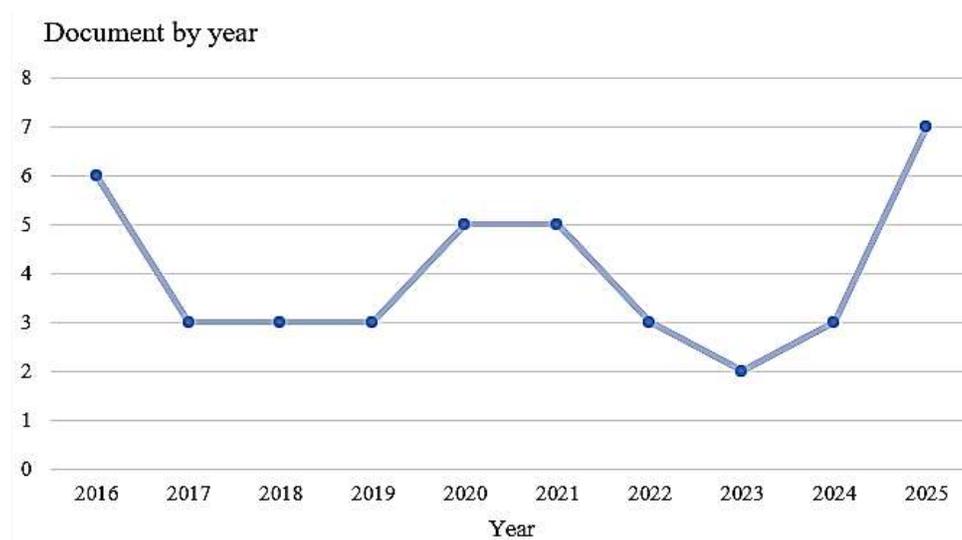


Figure 2. Annual publication trends on environmental education for early children (2016-2025)

the cluster analysis creates three main thematic categories: one focusing on education-based concept and sustainability, another stresses the health and prosperity, and the third related to management as well as environmental protection. This aligns with the research by Hagglund & Johansson (2019), who emphasize the Nordic Tradition's integration of sustainability and prosperity in early childhood education, and

Rowe & Humphries (2022), who highlight the interdisciplinary connection between sustainability and physical development. Picture 3 illustrates these clusters, which highlight the shift from pure cognitive results to holistic prosperity and attitude-oriented practice.

Research productivity in this field is driven by small academic communities and institutions, indicating that the foundation of environmental

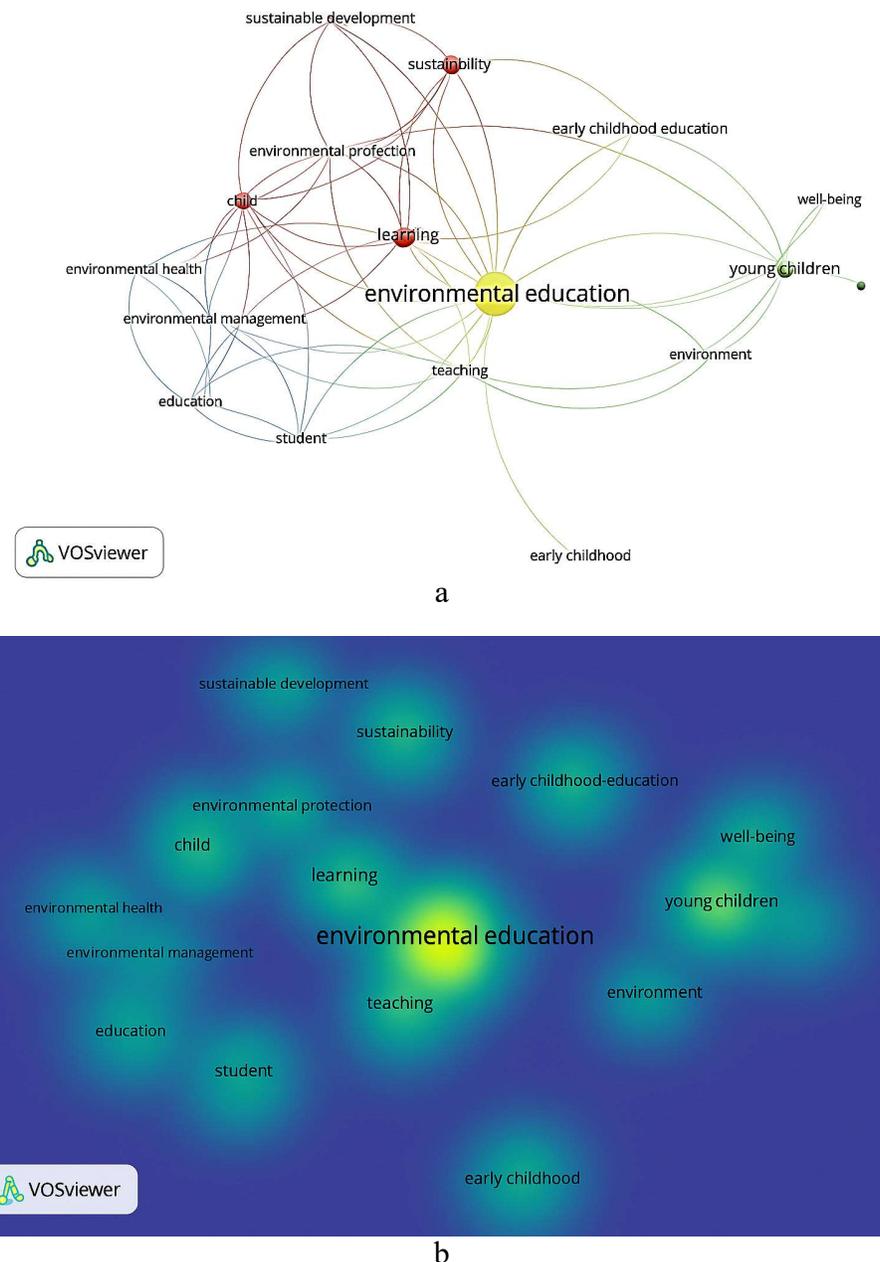


Figure 3. a) Keyword co-occurrence clusters in environmental education research for young children, b) density visualization map

education for young children remains concentrated. Spiteri appears as the most productive writer, with three publications, followed by Beasley, Hesterman, & Lee-Hammond, with each having two publications. This indicates that the sector was formed significantly by permanent contributors, whose creation continuously influenced scientific discourse. In the case of institutional affiliation,

L-Università ta' Malta stands out as the leading contributor, with three publications, followed by some Australian universities, such as Southern Cross University, Murdoch University, as well as Australian Catholic University. The additional contribution also comes from the institution in the United States, involving Pennsylvania State University dan the University of Texas di Austin.

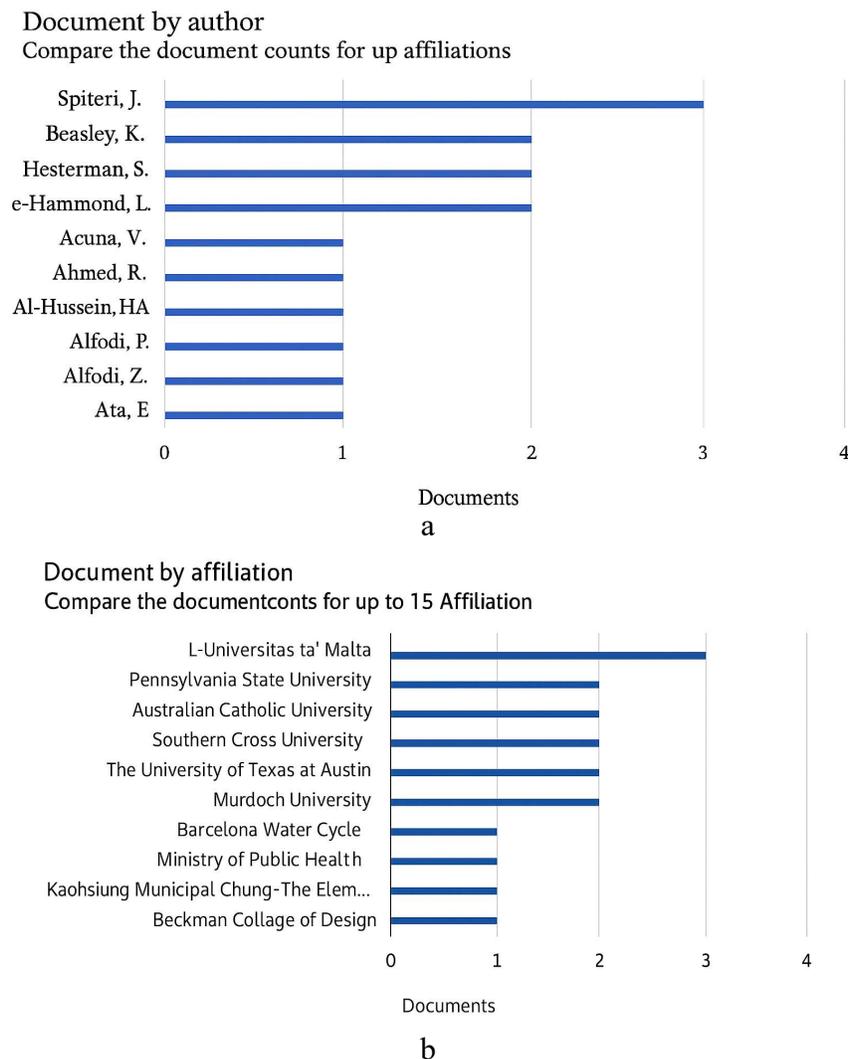


Figure 4. a) Most prolific authors in environmental education research for young children (2016–2025) b) most prolific institutional affiliations in environmental education research for young children (2016–2025)

Geographically, the majority of publications are from North Global countries, especially the United States (12 Documents) and Australia (7),

with additional contributions from Canada, Malta, and Great Britain (each 13). Studies from the Global South are still rare, with isolated

publications from Brazil, Argentina, Chile, and China. Picture 5 illustrates this unbalanced geographical distribution, which underlines the need for greater inclusivity in this sector. This unbalance strengthens the prior analysis in literature, where the study of early children's environmental education is often dominated by

Western perspectives (Ärlemalm Hagsér & Elliott, 2017). That trend spotlights the importance of fostering the voice and practice from underrepresented areas, especially the Global South, to catch the social-culture context and various ecology in sustainability education (Davis, 2020)

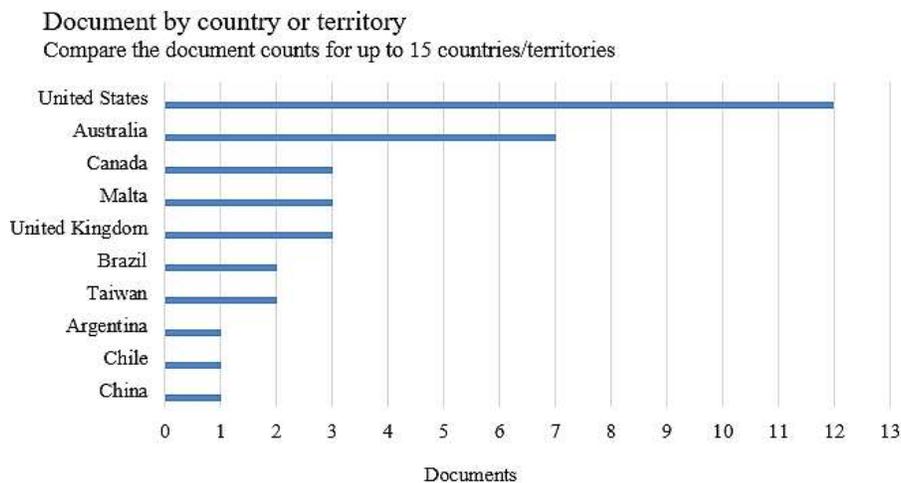


Figure 5. Geographical distribution of publications on environmental education for young children

The field study analysis mirrors the interdisciplinary orientation of this research. Around 43.2% of publications were classified in social science, followed by 23% in environmental science, and 13.5% in psychology. This work highlights the relationship between pedagogy,

ecology, and developmental psychology in shaping this field. As shown in Figure 6, this disciplinary distribution confirms that environmental education for young children is increasingly approached from multiple perspectives.

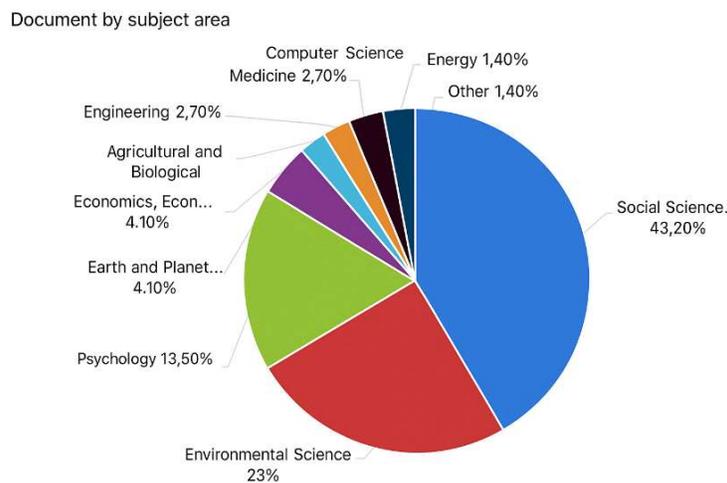


Figure 6. Subject area distribution of research in environmental education for young children

A critical reflection on these findings suggests that while the growing number of publications indicates heightened academic interest, the concentration of research in the Global North raises concerns about the representation and contextual diversity. As Davis (2020) notes, sustainability education must account for local socio-cultural realities, which are often underrepresented in international literature. Addressing this imbalance is crucial, as culturally responsive approaches may better capture children's lived experiences with their immediate environments (Berthelsen, 2021). Therefore, the observed trends not only highlight academic progress but also point to critical gaps that require more geographically and culturally inclusive scholarship in the future.

In addition, the increasing research momentum after 2015 may also be explained by the stronger international policy frameworks that positioned education as central to sustainability transitions. For instance, the UNESCO Global Action Program on ESD (2015–2019) explicitly emphasized the inclusion of early childhood education, which likely stimulated scholarly attention (UNESCO, 2017). However, despite this growth, most studies remain descriptive or small-scale case studies, with limited longitudinal or comparative research designs. As Boyd (2021) highlights, a lack of longitudinal evidence makes it difficult to assess whether early interventions foster enduring pro-environmental identities. Likewise, comparative analyses across education systems are still scarce, although cross-national perspectives could illuminate how policy,

culture, and resources shape program effectiveness (N. Evans & Ferreira, 2020). This indicates that while the field is expanding, there remains significant scope for methodological innovation and deeper global collaboration to advance both theory and practice in early childhood environmental education.

This steady increase in research output (RQ1) appears to be accompanied by diversification in pedagogical approaches (RQ2). As the number of publications grew, researchers began to explore more varied methods such as experiential learning, storytelling, and nature-based approaches, reflecting a shift from descriptive studies toward more practice-oriented designs.

RQ2: What Pedagogical Approaches and Strategies are Most Frequently Applied in Environmental Education for Young Children?

The reviewed studies demonstrate that pedagogical strategies in environmental education for young children are diverse, reflecting both traditional and innovative approaches. These strategies span storytelling through picture books, experiential and outdoor-based learning, play and game-based methods, intergenerational learning, arts-based practices, and culturally responsive pedagogies. Such variety indicates a growing recognition that environmental education in early childhood must be holistic, developmentally appropriate, and sensitive to children's cultural and ecological contexts. Table 3 summarizes the pedagogical approaches and strategies identified across the 39 studies reviewed.

Table 3. Pedagogical strategies in environmental education for young children (2016–2025)

No.	Author(s), Year	Pedagogical Strategy	Main Findings
1	(Ishiguro, 2016)	Social learning during meal times	Children learn environmental-related routines through guided participation in a social context.
2	(Hsiao & Shih, 2016)	Picture books (storytelling)	Picture books effectively convey environmental protection concepts.
3	(Edwards et al., 2016)	Funds of knowledge approach	Integrating children's everyday knowledge with sustainability

			supports holistic environmental learning.
4	(Zimmerman & McClain, 2016)	Nature walks, family participation	Guided family participation on nature walks fosters inquiry and shared meaning-making.
5	(Mostowfi et al., 2016)	Educational board game	Game-based learning enhances knowledge of recycling and waste separation.
6	(Green et al., 2016)	Environmental identity framework	Environmental identity development model highlight role of psychosocial development.
7	(Barnes & Scoffham, 2017)	Humanities integration	The curriculum links the environment with the humanities, although it faces challenges in schools.
8	(Muthukrishnan & Kelley, 2017)	Children's books	Children's literature depicts sustainability but with mixed accuracy.
9	Madden & Liang (2017)	Classroom dialogue	Children express ideas about environment shaped by teacher scaffolding.
10	Madden & Liang (2017)	Experiential river exploration	Direct interaction builds empathy and ecological identity.
11	(Chabanet et al., 2018)	Teaching toolbox	Tools for reef education improve children's coral reef representations.
12	(Ata, 2018)	Social learning theory	Peer and adult modeling influence children's environmental attitudes.
13	(Alföldi & Alfoldi, 2019)	Attitude surveys (indirect)	No explicit pedagogy, but reveals need for experiential EE.
14	(Kraftl et al., 2019)	Nexus (water–energy–food) inquiry	Young people connect sustainability issues in community-based learning.
15	(Nxumalo & Ross, 2019)	Culturally responsive pedagogy	Black children's experiences reframe environmental education spaces.
16	(Burton, 2020)	Eco-pedagogy in urban settings	Practitioners use puddle play to foster urban eco-learning.
17	(Cudworth, 2020)	Forest school pedagogy	Forest schools promote emotional connection to nature.
18	(Thor & Karlsudd, 2020)	Action-oriented EE	Curriculum design for active awareness and planning.
19	Derrien et al (2020).	Civic science (bio-indicator project)	Children measure air pollution, linking science with justice.
20	(Spiteri, 2021)	Daily child/water/dirt relations	Informal environmental learning embedded in daily interactions.
21	(Spiteri, 2021)	Children's drawings	Drawings used to elicit perceptions of environmental issues.
22	(Pollitt et al., 2021)	Dance improvisation	Arts-based pedagogy explores climate change and environment.
23	(Beasley et al., 2021)	Botanical Literacies Framework	Structured pedagogy for early botany learning.
24	(Hartley et al., 2021)	Intergenerational learning	Children influence adults in marine debris solutions.

25	(Scoarize et al., 2022)	Interdisciplinary project (water issues)	Problem-based learning with aquatic themes in Brazil.
26	(Turner & Wilks, 2022)	Indigenous knowledge integration	Children learn climate change via local/Indigenous perspectives.
27	(Spiteri, 2022)	Children's drawings (sustainability perceptions)	Drawings reveal children's sense of sustainability.
28	(Spiteri, 2023)	Intergenerational, spontaneous encounters	Environmental learning in families and classrooms.
29	(Beasley et al., 2023)	Teachers' botanical journey	Professional learning approach to revive botany.
30	(Novikova et al., 2024)	Childcare context study	Focus more on immigrant family choices rather than EE.
31	(Sekula et al., 2024)	Professional training (Growing Up WILD)	Training shifts teachers' outdoor pedagogy.
32	(Crighton et al., 2024)	Survey of reproductive-aged women	Adult focus; limited EE strategy.
33	(Cheberli et al., 2025)	Indoor air quality awareness	Environmental health in childcare centers.
34	(Lin & Liu, 2025)	Eco-museum design curriculum	Local heritage integrated into EE curriculum.
35	(Al-Hussein & Jihad, 2025)	Survey on orientation & concern	School-age focus, limited pedagogy.
36	(Garcia et al., 2025)	Serious game (urban water cycle)	Game-based pedagogy engages children in water systems.
37	(Yfantidou et al., 2025)	Movement & physical education	PE as context for EE awareness in tourism.
38	(Wang et al., 2025)	RCT on energy conservation	Children influence household energy behaviors.
39	(Elwell et al., 2025)	Children's agency in sustainability	Framework for strengthening child-led action.

The synthesis of findings presented in Table 3 reveals a gradual pedagogical shift in early childhood environmental education from knowledge-transmission approaches toward more participatory practices grounded in experience, play, the arts, and community engagement. Earlier studies in the decade emphasized conceptual understanding through tools such as picture books (Hsiao & Shih, 2016) or the integration of environmental themes in children's literature (Muthukrishnan & Kelley, 2017). While these strategies proved effective in raising awareness, most were short-term in design and measured only immediate cognitive outcomes. This raises concerns about the extent to which learning transfers into sustainable ecological behavior beyond the classroom (Garcia et al., 2025). This observation is

consistent with Hedefalk et al. (2015) argue that many interventions in early childhood sustainability education stop at fostering knowledge or attitudes without building children's agency for sustained environmental action.

Experiential and outdoor learning approaches reveal broader and more enduring outcomes, particularly in fostering ecological empathy, curiosity, and identity formation (Cudworth, 2020; Humphreys & Blenkinsop, 2018; Zimmerman & McClain, 2016) Practices such as forest schools and field activities related to aquatic ecosystems (Scoarize et al., 2022) illustrate how direct engagement with nature deepens children's ecological understanding. Nevertheless, issues of equity in access remain a significant barrier. Urban schools with limited green spaces and teachers' varying levels of

preparedness often lead to incidental rather than systematic implementation. Conceptual frameworks, such as nature pedagogy and child behavior, demonstrate that unstructured exploration should evolve into a structured curriculum. This curriculum enables children to analyze, negotiate, and decide on actions toward real environmental issues within their daily life context. (Edwards et al., 2016)

An art-based strategy also appears to be an effective way to enhance the contribution of affective elements to the environment. Research using the improvisation dance (Pollitt et al., 2021), children's pictures (Spiteri, 2022), and botanical literacy, which is embedded in curriculum design (Beasley et al., 2021, 2023), shows art can bridge cognitive fields and emotional learning. The strength of this approach lies in its ability to integrate creative planning with ecological sensitivity. Nevertheless, most research remains limited to analyzing symbolic expressions without connecting them to actual behavioral outcomes, such as reductions in trash or household energy consumption. This gap spotlights the need for a combination method design that can capture the expressive representation and measurable ecological practice in children's daily lives.

Learning strategies that span generations and are community-based offer another promising direction. Hartley et al. (2021) demonstrate how an intergenerational project addressing sea trash can foster environmental awareness among younger generations. Meanwhile, Spiteri (2023) highlights that spontaneous interactions between children, parents, and teachers provide opportunities for ecological learning within families. In line with community-based practices in Brazil (Scoarize et al., 2022) and eco-museum initiatives in Taiwan (Lin & Liu, 2025), the potential pedagogical value of a place-based approach is evident in its ability to relate children's learning to local ecology.

The latest research has also explored the approach with science and technology-based

methods. Derrien et al. (2020) involved children in societal science through air pollution monitoring using moss as a bioindicator; meanwhile, Garcia et al. (2025) identified the effectiveness of serious games in teaching the urban water cycle. Wang et al. (2025) conducted a randomized controlled trial demonstrating that school-based interventions empower children to become key agents in household energy conservation, with measurable spillover effects on family practices. These findings provide compelling evidence for the potential of action-oriented pedagogies to extend beyond classrooms, though similar evidence in domains such as biodiversity conservation and water management remains limited.

Cultural and social justice dimensions emerge as critical differentiators in the literature. Approaches integrating Indigenous and local knowledge, as well as affirming children's identities (Turner & Wilks, 2022; Wang et al., 2025), hold strong potential for meaningful engagement and sustainable practice, yet remain underrepresented in a body of research largely dominated by Global North contexts. Contemporary early childhood scholarship underscores the importance of place-responsive pedagogy, linking environmental issues with the ecologies of children's everyday lives as a means to foster resilience and community engagement (Crinall & Somerville, 2020). Moving forward, further research is needed to diversify socio-cultural contexts, connect child-centered approaches with longitudinal assessments, and strengthen teacher training to support interdisciplinary, action-oriented pedagogies (Beasley et al., 2021; Cutter-Mackenzie-Knowles et al., 2020; Lin & Liu, 2025). This will be essential to ensure that environmental learning in early childhood does not stop at knowledge acquisition but translates into sustained ecological habits at both household and community levels.

Although these pedagogical strategies (RQ2) demonstrate strong potential to foster

children's environmental awareness, their effectiveness is often constrained by systemic and institutional barriers (RQ3). For instance, while nature-based learning is widely acknowledged as impactful, teachers frequently report challenges related to training, resources, and curricular alignment, which limit broader implementation.

RQ3. What Challenges and Barriers are Reported in Implementing Environmental Education for Young Children?

Environmental education for young children is widely recognized as a foundation for fostering

ecological awareness and sustainable behaviors from an early age. The reviewed literature reveals a range of challenges that constrain the effectiveness of interventions, ranging from structural and curricular limitations, readiness, socio-cultural inequalities, and difficulties in sustaining behavioral change. To provide a comprehensive overview, Table 4 synthesizes evidence from 40 empirical and conceptual studies published between 2016–2025, highlighting the most frequently reported obstacles in the implementation of environmental education for young children across diverse global contexts.

Table 4. Challenges and barriers in implementing environmental education for young children

No.	Author(s), Year	Pedagogical Strategy	Main Findings
1	(Ishiguro, 2016)	Longitudinal case study, Japanese daycare	Environmental education not explicitly integrated into curriculum; daily routines take precedence; teachers lack structured environmental pedagogy.
2	(Ishiguro, 2016)	Experimental, picture book intervention	Short-term design, emphasis on knowledge acquisition rather than behavior change, and limited scalability.
3	(Edwards et al., 2016)	Early years classrooms, Australia	Teachers struggle to connect well-being and sustainability concepts; lack of professional training in EE.
4	(Zimmerman & McClain, 2016)	Family-based nature walks, U.S.	Dependence on parental involvement, unequal access to natural spaces, contextual variability in participation.
5	(Mostowfi et al., 2016)	Educational board game, Iran	Playful methods are effective, but their effectiveness is limited by classroom time, resources, and a lack of teacher familiarity with game-based learning.
6	(Green et al., 2016)	Conceptual framework of environmental identity	Theoretical, limited empirical validation; challenge in operationalizing "environmental identity" in young children.
7	(Barnes & Scoffham, 2017)	Primary schools, UK	Marginalization of humanities reduces integrative EE approaches; curricular constraints.

8	(Muthukrishnan & Kelley, 2017)	Children's literature analysis	Sustainability is poorly represented, with limited resources of high-quality books, and cultural stereotypes persist.
9	(Madden & Liang, 2017)	Comparative study in 3 ECE settings	Children's ideas are shaped by teachers' emphasis, a lack of consistent curriculum, and variability across settings.
10	(Humphreys & Blenkinsop, 2018)	Experiential river exploration, Canada	Access to safe outdoor sites is limited, relying on teachers' ecological knowledge and involving time-intensive activities.
11	(Chabanet et al., 2018)	Teaching toolbox on coral reefs, France	Campaign impact is limited; children's knowledge gains do not always translate into long-term behavior.
12	(Ata, 2018)	Survey, Turkey	Environmental awareness depends on adult modeling, but it lacks systemic integration in the curriculum.
13	(Alföldi & Alföldi, 2019)	Hungarian students, survey	Positive attitudes exist, but there is an absence of structured EE policies and weak continuity from primary to early years.
14	(Kraftl et al., 2019)	Brazil, youth and nexus study	Structural inequalities (urban poor); EE often disconnected from local socio-economic contexts.
15	(Nxumalo & Ross, 2019)	Critical ethnography, U.S.	Black children's perspectives marginalized; dominant frameworks neglect racialized experiences.
16	(Burton, 2020)	Urban eco-pedagogies, UK	Lack of green spaces; neoliberal educational pressures hinder experiential EE.
17	(Cudworth, 2020)	Forest schools, UK	EE faces challenges, including performative metrics, limited teacher autonomy, and inequitable access to forest schools.
18	(Thor & Karlsudd, 2020)	Action-oriented EE design, Sweden	Difficulty in sustaining action beyond the classroom due to resource limitations for practical projects.
19	(Derrien et al., 2020)	Civic science, U.S.	Reliance on external funding constrains children's participation due to adult-driven protocols.
20	(Crinall & Somerville, 2020)	Informal learning (child-water-dirt relations), Australia	Informal EE lacks institutional recognition and is undervalued compared to the formal curriculum.

21	(Spiteri, 2021)	Children's perceptions of environmental issues, Malta	Children articulate concerns but lack the agency to take concrete action; there is limited pedagogical follow-up.
22	(Pollitt et al., 2021)	Dance improvisation in EE, Australia	Innovative but difficult to integrate into mainstream curriculum; assessment challenges.
23	(Beasley et al., 2021)	Botanical literacies, Australia	The teacher's limited botanical knowledge results in plants being marginalized in the curriculum.
24	(Hartley et al., 2021)	Intergenerational Learning on Marine Debris, U.S.	It requires extensive coordination across age groups, which makes it difficult to scale.
25	(Scoarize et al., 2022)	Aquatic issues, Brazil	Lack of teacher training; interdisciplinary content difficult to implement in rigid curriculum.
26	(Turner & Wilks, 2022)	Indigenous/local knowledge, Australia	Children's voices undervalued; Indigenous knowledge marginalized within dominant frameworks.
27	(Spiteri, 2022)	Children's drawings on sustainability, Malta	Representation rich but limited in behavioral follow-up; drawings not directly linked to actions.
28	(Spiteri, 2023)	Intergenerational encounters, Malta	Opportunities depend on family engagement, which is unequal across socio-economic groups.
29	(Beasley et al., 2023)	Botany in curriculum, Australia	Teachers struggle with disciplinary integration; resource constraints.
30	(Novikova et al., 2024)	Russian immigrant families in U.S. childcare	Environmental concerns are secondary to childcare priorities and cultural adaptation challenges.
31	(Sekula et al., 2024)	Outdoor education training (Growing Up WILD), U.S.	Teacher beliefs improved, but implementation barriers included time constraints and accountability issues.
32	(Crighton et al., 2024)	National survey, Canada	Gaps in EE preferences vs. actual provision; lack of women's perspectives in curriculum design.
33	(Cheberli et al., 2025)	Air quality in childcare, Tunisia	Health risks noted, but EE not institutionalized; weak infrastructure for EE practices.
34	(Lin & Liu, 2025)	Eco-museum-based curriculum, Taiwan	Curriculum innovation is promising, but it has limited scalability and requires strong local partnerships.
35	(Al-Hussein & Jihad, 2025)	Environmental orientation of schoolchildren, Iraq	General awareness is present, but the in-depth understanding is

			weak, and there are limited pedagogical approaches.
36	(Garcia et al., 2025)	Serious game on water cycle, Spain	Engagement is high, but long-term retention remains untested, mainly due to a reliance on digital access.
37	(Yfantidou et al., 2025)	Tourism & movement, Greece	Physical education link innovative, but curricular marginalization of EE persists.
38	(Wang et al., 2025)	RCT on energy conservation, China	Positive spillovers were observed, albeit limited to the energy domain, and scalability challenges were noted.
39	(Elwell et al., 2025)	Children's agency & sustainability, Chile/Global South	Children's agency is recognized, but global sustainability agendas remain adult-centric, perpetuating structural inequities.

The synthesis of evidence presented in Table 4 demonstrates that challenges in implementing environmental education for young children are multidimensional. One major barrier concerns curricular and pedagogical design. Many interventions remain short-term in scope, focusing primarily on immediate cognitive gains rather than long-term behavioral transformation (Hsiao & Shih, 2016). In several cases, environmental content is positioned as an optional or supplementary theme instead of being embedded systematically into early childhood curricula, which results in fragmented and inconsistent practices. (Beasley et al., 2021; Thor & Karlsudd, 2020)

Another set of obstacles relates to teacher preparedness and institutional resources. Studies highlight limitations in educators' ecological knowledge, confidence, and professional training opportunities, which in turn constrain their ability to deliver interdisciplinary and experiential learning (Beasley et al., 2021; Sekula et al., 2024). Structural indicators such as the cost limitation, heavy workload, and the pressure of accountability increasingly limit the teacher's capacity to design and defend meaningful environmental education programs (Burton, 2020; Sekula et al., 2024)

Contextual differences and equity of access present another difficulty. Due to the lack of green spaces, children in urban schools often have few possibilities for outdoor learning (Humphreys & Blenkinsop, 2018; Zimmerman & McClain, 2016). Due to conflicting educational needs, wider socioeconomic disparities, and inadequate policy integration, environmental education is commonly sidelined in the Global South (Elwell et al., 2025; Krafl et al., 2019). These disparities reinforce uneven learning opportunities across regions and highlight the importance of an equity-driven framework.

Sociocultural and justice aspects are also mentioned in the literature as important determinants of environmental education's efficacy. A Global North viewpoint is frequently reflected in dominant pedagogical frameworks, which frequently ignore local ecologies, indigenous knowledge systems, and the lived realities of oppressed groups (Elwell et al., 2025; Turner & Wilks, 2022). The importance of more place-responsive and culturally sustaining pedagogies is highlighted by this imbalance, which restricts contextual relevance and runs the risk of strengthening cultural hierarchies.

Overall, these findings display that the obstacles in the implementation of environmental

education in early childhood are systematic. Those challenges include the weakness of curriculum integration, the limitation of teacher preparation, the lack of attention to cultural diversity, and the gap in developing teacher training. Fair access to resources and culturally responsive pedagogy remain crucial if environmental education is to realize its full potential. A responsive pedagogic approach to culture remains crucial for environmental education to realize its transformative potential in shaping values and sustainable behavior from an early age.

These challenges (RQ3) also reflect broader disparities in the field (RQ1). Studies from high-income contexts highlight curriculum integration as a central issue, whereas those from lower-resource settings emphasize infrastructural and material constraints. Moreover, such barriers directly shape the feasibility of implementing pedagogical innovations (RQ2), suggesting that context strongly mediates the outcomes of educational strategies.

RQ4. What Recommendations and Future Directions are Proposed to Enhance the Effectiveness of Environmental Education for Young Children?

According to the synthesis of findings, systemic integration, teacher empowerment, equitable practices, and research invites are necessary to advance environmental education for young children. Academics stress that environmental education must be methodically incorporated into all areas of early childhood curricula rather than being viewed as an elective or supplemental issue. Interdisciplinary approaches that incorporate sustainability issues, the arts, science, and literacy provide children with real-world, developmentally appropriate experiences with ecological principles (Beasley et al., 2021; Thor & Karlsudd, 2020). Additional, by ensuring continuity between early life and

primary school, such integration helps to avoid fragmented or transient interventions.

Professional development and teacher preparation are another crucial area. Numerous studies demonstrate that educators frequently lack the ecological knowledge and self-assurance necessary to create successful practices, which restricts the extent of implementation (Beasley et al., 2023; Sekula et al., 2024). Support at the institutional and policy levels is needed to guarantee that educators have the tools and freedom to try out novel and context-sensitive teaching strategies.

In addition, equity and cultural inclusion are critical concerns. Persistent discrepancies are shown by research, especially in metropolitan areas with little access to natural space (Humphreys & Blenkinsop, 2018), especially in the Global South, where socioeconomic disparities frequently place restrictions on environmental education (Elwell et al., 2025). Place-based and low-cost pedagogical models can become effective solutions by adapting learning to local ecologies and available resources. Moreover, incorporating indigenous and community knowledge systems has been shown to enrich children's environmental learning while affirming cultural identity (Turner & Wilks, 2022). These approaches highlight the importance of designing pedagogies that are both socially just and environmentally responsive.

The literature also emphasizes the need to strengthen children's agency and participation. While young children frequently demonstrate empathy for nature, opportunities to translate this awareness into sustained action remain limited (Spiteri, 2021). Linking classroom learning with household practices, intergenerational projects, and community engagement has been found to generate a positive spillover effect on families and broader communities (Hartley et al., 2021; Wang et al., 2025). Future programs should therefore be designed not only to build awareness but also

to enable children to act as meaningful contributors to sustainability practices in their everyday lives.

Finally, scholars call for a more diverse and rigorous methodological approach. Current research is dominated by small-scale qualitative case studies, while valuable, limit the generalizability of findings. Longitudinal designs are particularly scarce, making it difficult to evaluate whether early interventions cultivate enduring ecological contexts that are also needed to capture global diversity (Evans & Ferreira, 2020). Expanding research in underrepresented regions of the Global South will be vital to balance the dominance of Global North perspectives and ensure more contextually relevant recommendations (Ärlemalm Hagsér & Elliott, 2017; Elwell et al., 2025).

Building on these findings, scholars caution against the uncritical transfer of pedagogical models developed in the Global North to the Global South contexts. Many of these approaches, such as forest kindergarten models or extensive outdoor learning programs, presuppose access to abundant green spaces and resources that are often unavailable in urban or low-resource communities. Without adaptation, such models risk reinforcing inequalities and marginalizing schools that lack these conditions. As N. Evans & Ferreira (2020) note, the global field of early childhood education for sustainability remains dominated by perspectives from the Global North, limiting the relevance of its recommendations to diverse socio-ecological realities. Similarly, Ärlemalm Hagsér & Elliott (2017) highlight the need for research and practice that critically engages with local cultural and ecological knowledge systems. This underscores the importance of contextualizing pedagogical models to avoid epistemic dominance and ensure that approaches to environmental education are both socially just and ecologically responsive.

Taken together, these recommendations suggest that the future of environmental education

for young children lies in comprehensive curriculum integration, well-prepared educators, equity-driven and culturally sustaining practices, the empowerment of children's ecological agency, and more robust global research designs. Advancing these directions requires multi-stakeholder collaboration among educators, policymakers, researchers, and communities to ensure that early childhood education contributes meaningfully to sustainable development.

In addition to reporting findings for each research question separately, this study also performed a cross-analysis across RQ1-RQ4 to provide a more integrated understanding of publication trends, pedagogical strategies, challenges, and recommendations. Beyond the findings of each research question considered individually, a cross-analysis was conducted to obtain a more integrated understanding of the field. The result indicated that the increase in publication trends after 2015 (RQ1) was accompanied by diversification of pedagogical approach (RQ2), particularly the growing use of experiential learning and storytelling methods in early childhood environmental education. This suggests that global policy frameworks, such as the Sustainable Development Goals (SDGs), may have stimulated not only the quantity of research but also its pedagogical scope, as scholars sought approaches aligned with broader sustainability agendas.

The cross-analysis also reveals that each pedagogical approach (RQ2) is associated with distinct implementation challenges (RQ3). For example, experiential and outdoor learning strategies frequently encountered barriers such as limited access to green spaces and insufficient teacher preparation. In contrast, storytelling-based interventions more often struggled with parental involvement and sustaining environmental values in the home. These patterns show that pedagogical design choices are not neutral but carry specific contextual demands, underscoring the importance of aligning teaching strategies with available resources and cultural settings.

Moreover, the recommendations identified in the literature (RQ4) were closely linked to these challenges, highlighting an adaptive cycle between practice and scholarship. Studies reporting teacher capacity limitations consistently proposed professional development initiatives, while those emphasizing family-related barriers recommended stronger school-home collaboration. This alignment demonstrates that recommendations are often grounded in the practical constraints faced during implementation, rather than being abstract or generic.

■ LIMITATION

This study has some limitations that must be admitted. The review scope is limited in the article, which can be accessed through the chosen database and written in the English Language, which may exclude relevant content that was published in other languages or local media. That limitation decreases the extent to which findings reflect diverse perspectives, particularly those emerging from local or Indigenous contexts, often documented in non-English literature.

The other limitation related to the imbalance of geographical representation in the study analysed. Most of the research is from the northern hemisphere, namely the United States, Australia, and parts of Europe; meanwhile, the contributions from the southern hemisphere are still limited. This imbalanced distribution makes it challenging to achieve diversity in the social-culture context and ecology, particularly in early childhood environmental education settings. The methodology profile of this research also has the challenge. Most of the literature contains cases that are small, descriptive, or qualitative, with a small longitudinal design, experimental, or mixed methods. That kind of concentration limits the capability to evaluate long-term results and generalize the findings in various contexts.

Besides that, in the most systematic review, the selection process and study interpretation contain a bias possibility. Even though systematic criteria have been used, some relevant information

may be missed due to the scope of the data basis, publication accessibility, or variations in keyword use. This limitation suggests that future research should expand its scope to include a data basis and more diverse languages, thereby increasing representation from underexplored areas and adopting a more varied range of methodological approaches. This initiative will provide a more balanced and comprehensive understanding of environmental education for early children within the global context.

The impact of these limitations is that the findings of this review should be interpreted with caution. The exclusion of non-English and regionally specific studies may limit the inclusivity of perspectives, while the dominance of Global North research reduces applicability to diverse sociocultural and ecological settings. Likewise, the prevalence of small-scale and descriptive studies restricts the ability to assess long-term outcomes or generalize across contexts. These factors suggest that the conclusions presented here represent valuable indicative trends, but they cannot be regarded as fully comprehensive or universally applicable. For this reason, policymakers and practitioners should interpret the results as provisional insights rather than prescriptive solutions. At the same time, future research is encouraged to strengthen the evidence base with broader and more diverse contributions.

■ CONCLUSION

This review highlights that environmental education for early children is a rapidly growing field, characterized by diverse pedagogic innovations, persistent challenges, and opportunities for future development. The latest study synthesis indicates that early childhood is a critical period for developing ecological awareness, empathy, and sustainable habits; however, its implementation remains unevenly distributed across global contexts. This trend research indicates an increase in academic attention, primarily in developing countries,

alongside a shift in pedagogical approaches toward more participative, experiential, and culturally responsive practices. At the same time, obstacles such as the limitation of teacher preparation, the limitation of access to the green room, and an imbalance in representation across all areas continuously hinder its effectiveness.

By addressing this gap, this study contributes to advancing life environmental education for sustainable development. These findings also highlight the urgency of fostering children's agency and ensuring that early interventions lead to identity formation and sustainable ecological practices. For future research, extending geographical representation, implementing longitudinal designs, and conducting more rigorous comparative studies, along with diversifying methodological approaches, will be essential to deepen the evidence and inform policy and practice.

Nevertheless, the review also has inherent limitations. Its scope was restricted to English-language studies accessible in selected databases, and the majority of the analyzed research originated from the Global North. These limitations may narrow the diversity of perspectives and reduce the generalizability of findings, particularly for underrepresented socio-cultural and ecological contexts. This review consistently emphasizes that early childhood life education encompasses not only the development of endurance, responsibility, and sustainability values but also fosters a lasting orientation toward the Environment. Reinforcing this agenda requires collaboration among educators, researchers, policymakers, and communities to ensure that young children are empowered as active contributors in developing a sustainable future.

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