EDUCATION FOR SUSTAINABLE DEVELOPMENT AND PHYSICAL EDUCATION: A REVIEW

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ABSTRACT
This literature review explores the intersection of physical education and education for sustainable development in primary education settings. Grounded in the 2030 Agenda and the Sustainable Development Goals, it emphasizes the importance of integrating sustainability principles into physical education to foster holistic, inclusive, and transformative learning. The review is structured around three thematic pillars: (1) the conceptual and institutional framework of sustainable development, (2) the implementation of education for sustainable development in primary schools – including opportunities, challenges, and teacher perceptions, and (3) the pedagogical potential of physical education to advance sustainability through experiential learning and values-based education. Research indicates that physical education has the capacity to make a significant contribution to the Sustainable Development Goals concerning health, inclusion, environmental awareness, and sustainable lifestyles. Physical education's emphasis on cooperation, empathy, and self-care aligns with the core principles of sustainability. Recent empirical findings suggest that while educators recognize the importance of education for sustainable development, many physical education teachers report limited confidence and training in applying it. This review highlights the importance of targeted professional development that integrates sustainability theory with subject-specific pedagogical strategies. The evaluation of teachers' beliefs and practices is further emphasized to inform the design and the effectiveness of similar programs. To conclude, it can be highlighted that physical education has the capacity to play a significant role in the development of sustainability competencies and the empowerment of young learners to become informed and responsible citizens who are able to address future global challenges.

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INTRODUCTION

In recent decades, the concept of sustainable development (SD) has emerged as a critical global priority, addressing interconnected challenges such as climate change, environmental degradation, and social inequality (United Nations, 2015). Education is increasingly seen as a key catalyst for achieving sustainability by fostering critical thinking, responsible citizenship, and transformative action (UNESCO, 2020; Rieckmann, 2012). Within this framework, education for sustainable development (ESD) promotes a holistic, value-driven, and interdisciplinary learning approach that equips learners with the knowledge, attitudes, and skills needed to navigate complex socio-environmental realities (Tilbury, 2011).

Physical education (PE), although traditionally associated with physical fitness and health promotion, holds significant potential to contribute to the goals of SD. Through embodied learning, cooperation, empathy, and engagement with natural and social environments, PE can foster sustainability competencies and promote social inclusion, environmental awareness, and well-being (Backman et al., 2024; Baena-Morales & González-Víllora, 2022; Hellison, 2011). These attributes align with key Sustainable Development Goals (SDGs) such as Good Health and Well-being (SDG 3), Quality Education (SDG 4), Gender Equality (SDG 5), and Reduced Inequalities (SDG 10). Despite the increasing attention to ESD in policy and research, its integration in PE curricula remains limited and often fragmented (Baena-Morales et al., 2021; UNESCO & Education International, 2021). Many PE teachers express uncertainty about how to apply sustainability principles in practice, citing a lack of training, resources, and institutional support (Kougias et al., 2023).

This review aims to critically examine the theoretical and pedagogical foundations linking PE and SD in primary education. It highlights current challenges, explores promising practices, and emphasizes the role of teacher training in fostering sustainability-oriented educational environments. The contribution of this review lies in synthesizing recent evidence and proposing a coherent conceptual framework for enhancing the transformative potential of PE through ESD.

Aim and Objectives

The primary aim of this review is to examine the educational potential of PE as a platform for promoting ESD in primary schools. This includes exploring the theoretical foundations, pedagogical implications, and opportunities for integrating sustainability into PE curricula.

The specific objectives are to:

- Define the key concepts and frameworks related to SD and ESD in education.
- Identify pedagogical opportunities and barriers for implementing ESD in primary PE.
- Highlight the values and competencies that PE can promote to support sustainability.

METHODOLOGY

This article presents a *narrative literature review organized thematically* to explore the theoretical and pedagogical connections between ESD and PE in primary school settings. The review also aims to examine empirical studies and good practices that demonstrate the transformative potential of PE in promoting ESD. Furthermore, particular attention is given to the role of teacher education and professional development in supporting the integration of sustainability into PE curricula.

Sources were identified through targeted searches in academic databases such as Scopus, Web of Science, ERIC, and Google Scholar. Keyword combinations included terms like "sustainable development," "education for sustainable development," "physical education," "primary schools," "experiential learning," and "teacher training." The initial pool of literature was screened based on relevance to the review's core themes and alignment with primary education settings.

The inclusion criteria focused on peer-reviewed journal articles, academic books, and policy documents published between 2010 and 2024, written in English. Studies were selected for their relevance to three core areas: (1) theoretical and institutional foundations of sustainable development, (2) ESD implementation in primary schools, and (3) the role of PE in advancing sustainability. Studies that did not connect PE with ESD, or that focused solely on secondary/higher education or non-educational contexts, were excluded.

Approximately 45 sources were reviewed in total. As this was a narrative rather than a systematic review, no formal appraisal tool was applied. Nonetheless, care was taken to include studies with diverse perspectives and methodological approaches. The goal of this approach is to provide a critically informed, integrative understanding of how PE can function as a transformative platform for advancing ESD in schools. While this review does not follow systematic review protocols such as PRISMA, it adheres to principles of transparency and thematic consistency appropriate for narrative synthesis.

RESULTS

Conceptual and institutional foundations

Sustainable development (*SD*) has been internationally recognized as a multidimensional process that seeks to balance *economic growth, social inclusion, and environmental protection* (United Nations, 2015). This tripartite structure forms the foundation of the 2030 Agenda, which articulates 17 SDGs aimed at transforming societies towards more equitable and resilient futures. Within this framework, education is not only a standalone goal (SDG 4: Quality Education) but also a crucial enabler for achieving all other SDGs.

Education for Sustainable Development (ESD), as promoted by UNESCO and the United Nations, refers to a transformative learning process that empowers individuals to act responsibly for the present and future. It emphasizes knowledge, skills, values, and attitudes that support environmental integrity, economic viability, and social justice (UNESCO, 2014). This educational approach further promotes holistic and interdisciplinary methods, active, participatory learning, and the development of sustainability competencies, including critical thinking, empathy, and collaborative problem-solving.

In the context of school education, ESD aims to embed sustainability throughout curricula and pedagogy, rather than limiting it to isolated subjects. It promotes learning experiences that are situated, experiential, and value-oriented, engaging students as active participants in their communities (UNESCO, 2017; Tilbury, 2011). A key element of this vision is the integration of ESD not only in educational content but also in the ethos, governance, and culture of schools. However, its implementation in national curricula remains uneven, particularly at the primary level. Despite increasing recognition in policy documents and international strategies (UNESCO, 2020), ESD is often reduced to environmental education or siloed within specific disciplines, lacking the *holistic orientation* and *transformative intent* originally envisioned (Kioupi & Voulvoulis, 2019). This highlights the need for stronger alignment between institutional frameworks, pedagogical practice, and teacher preparation.

Opportunities and challenges in primary education

The integration of ESD in primary education represents both a growing opportunity and an ongoing challenge. On the one hand, several international and national educational strategies have recognized the importance of sustainability-related learning at the early stages of schooling (UNESCO, 2017; UNESCO, 2020). Policy frameworks such as the 2030 Agenda have highlighted the role of schools in promoting sustainable values, democratic participation, and active citizenship (United Nations, 2015). In many countries, national curricula explicitly refer to sustainability or include cross-thematic objectives related to environmental and social responsibility.

Nevertheless, the actual implementation of ESD in primary schools remains inconsistent and limited. Studies indicate that sustainability is often marginalized in formal curricula or relegated to isolated projects and short-term activities. Furthermore, time constraints, curriculum overload, and a lack of institutional support often prevent teachers from integrating ESD meaningfully into their teaching practice (UNESCO & Education International, 2021).

Teachers themselves play a crucial role in the implementation of ESD. However, many primary educators report uncertainty or lack of confidence regarding how to translate sustainability principles into classroom activities. Physical education teachers, in particular, face an additional challenge: the perception that their subject is disconnected from broader socio-environmental issues. As a result, *many feel unprepared or unsupported* in contributing to sustainability education (Kougias et al., 2023).

At the same time, there is a growing body of research suggesting that primary schools can serve as fertile environments for cultivating sustainability values and competencies when teachers are empowered and pedagogical approaches are adapted (Baena-Morales et al., 2024; Lozano et al., 2017; Wiek et al., 2011). Whole school approaches and interdisciplinary projects have been shown to enhance student engagement and promote environmental awareness, particularly when supported by targeted professional development (Baena-Morales et al., 2023; Lozano et al., 2017).

Ultimately, the successful integration of ESD in primary education requires a combination of structural support, pedagogical innovation, and teacher training. Schools must move beyond symbolic or occasional references to sustainability and adopt a deeper, systemic perspective that is reflected across curricula, teaching methods, and school culture.

Pedagogical potential of physical education

Physical education (PE) is uniquely positioned to ESD through its embodied, participatory, and values-based nature. Unlike many "core" subjects (e.g., Math, Physics, Language, etc.), PE creates learning opportunities that integrate physical, emotional, and social dimensions, fostering the holistic development that ESD promotes (Baena-Morales & González-Víllora, 2022). Through cooperative games, outdoor activities, and reflection, students develop empathy, responsibility, respect, and care for others-values that are central to sustainability (Hellison, 2011).

Experiential learning is a key pedagogical tool in ESD, and PE provides an ideal setting for such approaches. Movement-based experiences can enhance students' awareness of their own bodies, relationships, and environments. Outdoor PE, for instance, has been shown to cultivate environmental responsibility and promote active lifestyles connected to sustainable living (UNESCO, 2015; Backman et al., 2024). Similarly, integrating social issues-such as gender equality, inclusion, and cooperation within PE lessons aligns the subject with the social pillar of sustainability (Royet et al., 2024).

A range of empirical studies provides concrete evidence of how PE can support ESD in primary school contexts. For example, Karlsson and Backman (2023) highlighted how school gardening activities in PE foster children's contact with nature and responsibility towards nutrition and the environment. Merma-Molina et al. (2023) explored the perceptions of pre-service and in-service PE teachers, stressing the importance of professional development for critical and systemic thinking. Other studies have examined pedagogical models such as *Holistic Health and PE* (Baena-Morales & González-Víllora, 2022). A recent intervention study by Baena-Morales et al. (2024) introduced the *Physical Education Sustainable Development Intervention Model (PESDIM)*, demonstrating how structured PE lessons can promote sustainability-oriented values, prosocial behaviors, and environmental responsibility among primary students. These approaches, coupled with interdisciplinary and project-based learning strategies (Boned-Gómez et al., 2024), illustrate how PE can serve as a powerful medium for transformative sustainability education. Research has also highlighted the lack of explicit SDGs integration in national PE curricula, and the need for coordinated institutional guidance and cross-subject collaboration (Karlsson & Backman, 2023; Boned-Gómez et al., 2024). Systematic and conceptual reviews by Thurm et al. (2024) and Osborne (2012) emphasize the potential of PE to cultivate sustainability competencies through embodied learning and ethically oriented pedagogies. These studies also call for broader structural reforms in teacher training and curriculum design to support the integration of ESD in PE.

In sum, PE offers fertile ground for advancing sustainability through its focus on bodily experience, social interaction, and personal growth. When intentionally designed and supported, PE lessons can foster the kinds of values, attitudes, and skills that ESD seeks to cultivate, contributing to the development of responsible and empowered learners.

DISCUSSION

This review confirms that PE holds unique potential for advancing ESD in primary schools. While the integration of sustainability is increasingly recognized as an educational priority, translating this vision into meaningful pedagogical practice - especially in subject-specific contexts like PE - remains a challenge. This tension invites deeper reflection on how the conceptual, institutional, and pedagogical dimensions explored in this review intersect either to support or hinder the advancement of ESD.

The foundational principles of ESD - holistic, interdisciplinary, and value-based learning - conceptually align with many of the pedagogical goals of PE. Qualities such as empathy, collaboration, and self-awareness have long been central to quality PE practice (Hellison, 2011; UNESCO, 2017). However, conceptual alignment alone is insufficient. Without clear frameworks and teacher preparation, these shared values risk remaining abstract rather than becoming embedded in day-to-day teaching. As Thurm et al. (2024) point out, the experiential and embodied nature of PE offers opportunities for deep engagement with sustainability, but only when intentionally designed within a broader educational vision.

Despite growing international recognition of the importance of ESD, its integration into PE curricula remains limited by both structural and pedagogical constraints. As UNESCO (2017) has emphasized, policy commitments alone do not guarantee meaningful educational change. In practice, sustainability education is often fragmented, inconsistently applied, and marginal within the school culture. Many teachers, and particularly PE educators, report a lack of training, resources, and confidence to effectively embed sustainability principles in their teaching. This points to a deeper disconnect between high-level policy intentions and the everyday realities of classroom practice.

Intentional lesson design in PE, using approaches such as *cooperative learning*, *outdoor education*, and *service-learning*, has the potential to foster *environmental awareness*, *critical thinking*, and *collective responsibility* among learners. However, such pedagogical transformation depends largely on teacher capacity. The role of teacher education emerges as a key lever for change. Embedding ESD principles in both pre-service and in-service training can provide educators with the conceptual tools and strategies they need to enact transformative teaching. Furthermore, adopting a whole-school approach to sustainability can reinforce the efforts of PE teachers and promote interdisciplinary collaboration (UNESCO & Education International, 2021).

Taken all together, these insights reveal not only the current limitations in educational practice but also the untapped pedagogical richness of PE. This synthesis can inform curriculum reform and professional development strategies, particularly in systems where ESD is still marginal. Recognizing PE as a potentially transformative discipline means challenging long-standing perceptions that treat it as peripheral. For this potential to be realized, structural reforms, interdisciplinary collaboration, and conceptual clarity are all required.

Future research could explore how teacher training interventions grounded in sustainability frameworks influence the pedagogical practices of PE teachers across diverse educational contexts. In addition, participatory action research, co-designed interventions, and longitudinal approaches could provide deeper insights into how ESD-oriented PE programs affect student learning, behavior, and values over time. Investigating student perspectives and lived experiences would further enrich our understanding of ESD's classroom impact.

Finally, comparative and policy-focused research could help identify structural enablers and barriers to embedding sustainability in PE across different educational systems.

CONCLUSION

This review highlights the potential of PE to advance ESD in primary schools, particularly through its embodied, relational, and values-based pedagogy. When intentionally designed, PE lessons can foster core sustainability competencies such as empathy, collaboration, and critical thinking. To support this, policymakers should embed sustainability more explicitly in national PE curricula and invest in interdisciplinary teacher education. Schools should also adopt whole-school approaches that empower PE to contribute meaningfully to institutional sustainability goals. For PE teachers, professional development should focus on integrating ESD principles through experiential and cooperative learning strategies, adapted to real-world issues. This alignment between policy, training, and pedagogy is essential for cultivating active, responsible citizens prepared to address sustainability challenges.

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