Physical Education and Sustainable Development: Educating Active Citizens for Social Transformation

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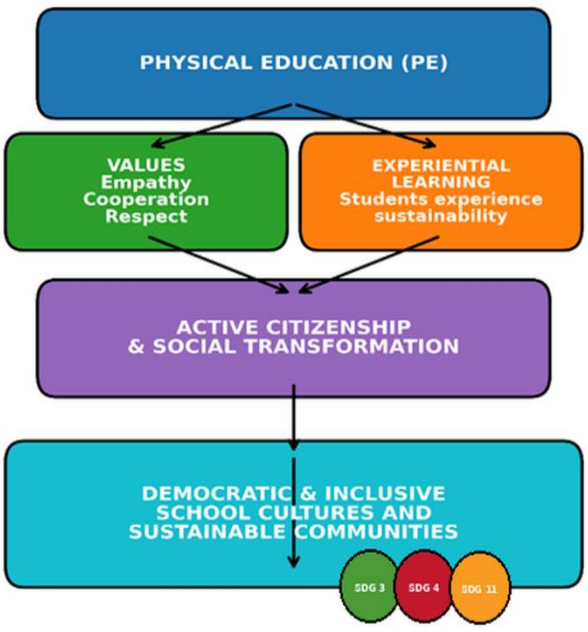

Abstract

This paper examines how Physical Education (PE) can function as a practical setting for Education for Sustainable Development (ESD) and the cultivation of future active citizens. Drawing on Agenda 2030 and UNESCO's ESD Roadmap, we argue that when PE is designed with explicit sustainability aims, it can foster socio-emotional and civic capacities (e.g., empathy, cooperation, responsibility, and collective action). We conducted a documented narrative synthesis of 37 sources (26 peer-reviewed empirical/review/theoretical contributions and 11 institutional/policy texts), following an explicit process of search, selection, and thematic analysis. Evidence was organized into four thematic axes: (1) pedagogical mechanisms and teaching models in PE focused on ESD, (2) sustainability competencies and active citizenship values/outcomes, (3) teacher professional development and implementation conditions, and (4) assessment and implementation tools. By mapping key evidence and tools (Table 1) and highlighting implementation requirements, this review clarifies the distinctive contribution of PE to the social dimension of sustainability and discusses implications for school practice, teacher education, and policy relevant to quality-of-life outcomes in local school communities.

Keywords: Physical Education (PE), Sustainable Development Goals (SDGs), Education for Sustainable Development (ESD), Active citizenship, Transformative learning, Experiential learning, School communities, Professional development of teachers.

1. Introduction

Over the last decade, Sustainable Development (SD) has emerged as a central global educational priority. The 2030 Agenda introduces the 17 Sustainable Development Goals (SDGs) as a single and indivisible framework, in which quality education is explicitly reflected as SDG 4 (United Nations General Assembly, 2015). Within this framework, Education for Sustainable Development (ESD)

aims at forms of learning that are not limited to the transmission of knowledge, but enhance participation, reflection, and the development of values related to more just and sustainable societies.

However, despite international commitments, the effective integration of sustainability into everyday school life remains a challenge. At the European level, learning for environmental sustainability is not yet a systemic feature of policy and practice. Curriculum coverage is often described as fragmented and concentrated in specific subjects, rather than embedded across disciplines (European Commission, 2022). Similar concerns have been noted in the Greek context, where environmental and climate education may remain difficult to integrate fully into the compulsory school framework (Moshou & Drinia, 2025).

1.1 Education for Sustainable Development

Within contemporary educational discourse, ESD goes beyond teaching environmental topics. It is often described as a holistic and transformative approach to learning. It integrates cognitive, socio-emotional, and behavioral dimensions, and aims to empower learners to contribute to more sustainable societies. Within the 2030 Agenda, ESD is embedded in SDG 4. Through target 4.7, it calls for education that supports sustainable lifestyles, human rights, equality, and active citizenship (United Nations General Assembly, 2015). UNESCO also presents ESD as a catalyst for progress across the SDGs, by fostering competencies, values, and attitudes that enable individual and social transformation (UNESCO, 2017, 2020).

1.2 Transformative learning and sustainability skills

Target 4.7 of Agenda 2030 highlights that learners should acquire knowledge and skills that support SD. This implies change not only in what students know, but also in how they interpret experience, question assumptions, and act (United Nations General Assembly, 2015). Transformative Learning Theory offers a useful foundation for this aim. Recent accounts emphasize that transformation involves shifts in meaning perspectives, supported through critical reflection and dialogue, and this can shape how people make sense of the world and act within it (Hoggan & Kloubert, 2020). In

sustainability education, transformative learning has also been linked to learners' capacity to engage with complex issues and to move beyond reflection towards action (Rodríguez Aboytes & Barth, 2020). This logic is consistent with ESD, which seeks to cultivate learners' capacity for responsible participation and transformative action.

1.3 Active citizenship, democratic participation, and Physical Education

Active citizenship in education refers to students' capacity to participate meaningfully in democratic life, to coexist in conditions of diversity, and to take collective action on issues of common interest. It is approached as a dynamic process linked to democracy, inclusion, and social justice within both school and community settings (Council of Europe, 2010; Osler & Starkey, 2005). A widely used framework is education for democratic citizenship, which aims to equip learners with knowledge, skills, and dispositions to exercise rights and responsibilities, appreciate diversity, and engage actively in democratic life (Council of Europe, 2010). The link with ESD is direct, because the social dimension of sustainability (justice, inclusion, cooperation, and collective action) depends on democratic culture and participatory learning experiences.

These aims can be operationalized in everyday school practice through Physical Education (PE), which offers an experiential context for cooperation and negotiated rules. In policy terms, quality PE is described as a planned, progressive, and inclusive learning experience that cultivates socially oriented skills, attitudes, and values (UNESCO, 2015a, 2015b). Pedagogical models used in PE can help translate these goals into everyday teaching by structuring participation, responsibility, and reflection (Hellison, 2011).

The purpose of this paper is therefore twofold: (a) to highlight, through the review of international literature, the pedagogical mechanisms through which PE can cultivate skills and values related to ESD, and (b) to interpret how these learning experiences can support the empowerment of students as active citizens, capable of responsible participation and collective action. In this state-of-the-art review, we bring together the PE–ESD literature through a clear active citizenship lens (e.g., participation, democratic culture, and collective action). We then organize the evidence into four

thematic axes and present an evidence map of representative sources and tools (Table 1), so that key implementation requirements for school practice, teacher education, and local policy contexts are easier to see.

2. Methodology

2.1 Design and approach

This paper adopts a narrative synthesis approach to interpret and connect a heterogeneous body of literature on PE, ESD, and active citizenship. The review focuses on identifying pedagogical mechanisms through which PE practices can cultivate sustainability-related values and skills. A narrative synthesis is suitable when evidence comes from diverse study designs, reviews, and policy or conceptual frameworks, and when the goal is conceptual mapping and interpretive synthesis rather than quantitative aggregation (Grant & Booth, 2009). To strengthen transparency, we followed an explicit and traceable process across search and selection, analysis, and reporting. The key methodological steps (search strategy, inclusion/exclusion criteria, and synthesis procedure) are presented so that readers can judge the trustworthiness of the review process (Snyder, 2019; Ferrari, 2015).

2.2 Search strategy and source categories

The search was conducted in international databases (Scopus, Web of Science, ERIC, and SPORTDiscus). It was complemented by a targeted Google Scholar search to identify relevant book chapters and policy reports. The initial search was completed on 25 November 2025. On 12 January 2026, we updated URLs and retrieval dates for institutional texts and online sources to ensure link accessibility at the time of submission; this update did not alter the inclusion criteria or the set of included sources.

Keyword combinations were applied using Boolean operators. An indicative search string was: “physical education” AND (“education for sustainable development” OR “ESD” OR “sustainability”) AND (“active citizenship” OR “democratic participation” OR “civic engagement”). Additional terms

were used to capture skills and pedagogical approaches (e.g., “sustainability competencies”, “transformative learning”, “TPSR”). For the purposes of synthesis, sources were grouped into three categories: (a) institutional and policy texts (e.g., United Nations/UNESCO), (b) empirical and review studies examining links between PE and sustainability/ESD, and (c) theoretical or pedagogical frameworks that inform learning mechanisms, values, and participation.

In total, 37 sources were included in the synthesis: 11 institutional/policy texts and 26 peer-reviewed academic sources (empirical studies, reviews, and conceptual/theoretical contributions). As a documented narrative synthesis, the review did not aim for exhaustive retrieval and did not apply a formal study-by-study quality appraisal but instead focused on transparent search/selection reporting and interpretive thematic mapping.

2.3 Inclusion and exclusion criteria and selection process

Inclusion criteria were: (a) publications from 2010 to 2025, (b) full text available in English, (c) an explicit link between PE and ESD/sustainability and/or active citizenship, and (d) a focus on educational settings (primary/secondary school and/or teacher education). Exclusion criteria included texts focused exclusively on competitive sport without an educational dimension, studies not related to PE, non-English full texts, and publications that did not provide sufficient methodological or contextual information to support interpretation.

Selection was conducted in successive stages: screening of titles and abstracts, full-text screening, and snowballing through reference lists of included sources.

2.4 Synthesis process, analysis and illustrative evidence

The analysis proceeded by organizing evidence into thematic axes and comparing patterns across sources. Themes were documented explicitly and linked to the study aims (Snyder, 2019). Interpretation followed principles of qualitative meaning-making and conceptual clarification (Pope & Mays, 2020). The main axes were: (1) pedagogical approaches and teaching models in PE that support ESD, (2) sustainability competencies, civic competence, and values, (3) teacher professional

development and implementation conditions, and (4) assessment and implementation tools. To enhance practical relevance, the Results section presents illustrative evidence mapped onto these axes, alongside targeted references to the Greek context as an applied example of implementation needs (Moshou & Drinia, 2025).

The narrative synthesis was intended to support conceptual mapping and interpretation rather than exhaustive coverage or quantitative comparison. For this reason, the credibility of the conclusion rests on a transparent account of the search and selection steps and on a clear description of how themes were derived and linked to the study aims (Ferrari, 2015; Snyder, 2019).

3. Results

3.1 Mapping the body of sources

The body of sources compiled in this study is heterogeneous, reflecting the multidimensional nature of ESD and the role of PE as a field of application. The sources fall into three broad categories. Initially, institutional and policy texts define SD and position education as a driver of change (United Nations General Assembly, 2015; UNESCO, 2020). These policy sources also portray education as a key lever for achieving the SDGs, by building cross-cutting competencies and enabling participation in social transformation (UNESCO, 2017).

Then, review and empirical studies document links between PE, sustainability and ESD and describe pedagogical mechanisms for implementation (e.g., Baena-Morales & González-Víllora, 2023; Royet et al., 2024). Lastly, implementation tools and frameworks support the documentation and evaluation of PE practices for ESD (e.g., Baena-Morales et al., 2024).

Despite the diversity of the sources, the review identified coherent patterns that converge on four key axes: (1) pedagogical practices and learning mechanisms in PE (including teaching models), (2) sustainability skills/competencies and active citizenship values/outcomes, (3) teacher professional development and implementation conditions, and (4) assessment and implementation tools.

The link between PE and citizenship in the international literature is documented both in institutional discourse, where quality PE is linked to the development of skills of socially responsible citizens (UNESCO, 2015b), as well as in research approaches that explicitly examine the cultivation of active citizenship through PE and sport (O'Donovan et al., 2010). For a brief overview of the evidence base, Table 1 maps representative sources and tools across the four thematic areas.

Table 1. Evidence map of key sources included in the narrative synthesis

Source (Author, Year)	Type	Axis*	Key contribution / outcomes (brief)
United Nations General Assembly (2015)	Policy	1-3	SDGs/Agenda 2030, SDG 4.7 framing for ESD & citizenship
UNESCO (2020)	Policy	1-3	ESD Roadmap, implementation directions and priorities
UNESCO (2017)	Policy	2-3	ESD learning objectives (cognitive/socio-emotional/behavioral)
European Commission (2022)	Policy	3	Environmental sustainability learning, cross-curricular integration issues
Baena-Morales et al. (2021)	Empirical/Conceptual	1	Practice-based models to map SDGs/ESD objectives in PE
Baena-Morales & González-Víllora (2023)	Review/Conceptual	1-3	PE contribution to SDGs, implementation reflections
Royet et al. (2024)	Review (scoping / evidence mapping)	1-4	Maps evidence across themes (including tools), highlights gaps and future directions
Thurm et al. (2024)	Review (systematic)	1-2	Sport/PE potential for sustainability education, mechanisms/outcomes
Hellison (2011)	Pedagogical model	1-2	TPSR model, responsibility, reflection, transfer beyond class
Legrain et al. (2021)	Empirical	1-3	Sustainable cooperative learning in PE, conditions for implementation
Jacobs et al. (2022)	Empirical	2	Students' perceptions of life skills via TPSR, socio-emotional outcomes
Aygun et al. (2024)	Review/meta-analysis	2	Socio-emotional outcomes of TPSR interventions
Lohmann et al. (2021)	Review (systematic)	3	Teachers' action competence for ESD in PE, competence needs
Fröberg et al. (2022)	Empirical (survey)	3	SD competencies in PE teachers; training needs
Baena-Morales et al. (2024)	Tool/Validation	4	PESD questionnaire, assessing sustainability-oriented PE practices
Tassi et al. (2025)	Tool development (pilot)	4	Pilot inventory assessing PE teachers' attitudes and self-reported teaching practices on SD

*Axis: (1) pedagogical mechanisms/models, (2) competencies/values & active citizenship outcomes, (3) teacher PD & implementation conditions, (4) assessment/tools.

3.2 Pedagogical mechanisms in PE that promote ESD

The reviewed sources suggest that PE can support ESD when lessons rely on experiential, embodied learning. In this case, the focus shifts from drills or fitness alone to values and social skills (UNESCO, 2015b; UNESCO, 2020). This approach fits well with ESD perspectives that emphasise participation, dialogue, and curriculum innovation (Tilbury, 2011).

A recurring message is that it helps to translate broad sustainability aims into concrete learning tasks. Practice-based PE models can support this translation by linking specific ESD objectives to explicit learning outcomes (Baena-Morales et al., 2021). In everyday lessons, cooperative games, negotiated rules, and structured group work can make participation feel real. They can also help students experience inclusion and responsibility in action. At the same time, cooperative approaches need consistency. They work best when roles are clear and reflection is planned, otherwise activities can become fragmented (Legrain et al., 2021).

Teaching models such as Teaching Personal and Social Responsibility (TPSR) provide a structured way to organise these processes. They use routines for goal-setting, choice, reflection, and transfer beyond the lesson (Hellison, 2011). This is often linked to positive socio-emotional outcomes and to students' perceptions that they develop life skills (Aygun et al., 2024; Jacobs et al., 2022). Finally, outdoor and environmental learning can also contribute to sustainability goals, but it needs clear pedagogical intent and meaningful action to have value (Royet et al., 2024; Thurm et al., 2024).

3.3 Sustainability competencies and active citizenship values cultivated through PE

Beyond pedagogical mechanisms, international literature highlights that PE can produce learning outcomes linked to sustainability and active citizenship when its design consciously targets values, attitudes and social skills. Values such as empathy, cooperation, respect, justice, social responsibility and a predisposition to engage in collective action within groups can be fostered, especially when collaborative games, group roles and structured reflection are used (Aygun et al., 2024; Hellison, 2011; Jacobs et al., 2022). These outcomes connect to competencies that are explicitly discussed in

the context of SDGs/ESD, such as responsible decision-making, collaborative problem solving, participation and action on issues of common interest (Baena-Morales & González-Víllora, 2023; Royet et al., 2024; UNESCO, 2017; UNESCO, 2020). In the broader ESD literature, these outcomes are often framed through sustainability competencies. For example, Rieckmann (2018) highlights key competencies needed to support social transformation towards sustainability. In higher education, Wiek et al. (2011) propose five widely used competencies, systems thinking, anticipatory, normative, strategic, and interpersonal competence, to describe what learners need in order to understand complex problems and design meaningful action. Studies examining the perceptions of teachers and future teachers also suggest that educational practices in PE can enhance environmental awareness and a sense of responsibility, but the extent and quality of these outcomes are influenced by how the teacher perceives sustainability and translates it into everyday teaching practice (Isgren Karlsson & Backman, 2023; Merma-Molina et al., 2023). For example, tasks that require negotiated rules, collective organization, and reflection on choices and consequences can translate sustainability values into lived experiences of participation and responsibility.

3.4 The role of the PE teacher, obstacles, needs and conditions for implementation

The teacher is central to whether ESD becomes a coherent pedagogical practice. Teachers do not only shape what students know. They also influence attitudes and the willingness to act in relation to socio-environmental challenges (Rieckmann, 2012; Wals, 2015). Although the literature recognises PE as a practical setting for ESD, implementation depends on everyday teaching decisions. It also depends on how teachers understand sustainability and on the support they receive within the school context (Lohmann et al., 2021).

A recurring barrier is the way sustainability is often framed. In many settings, it is reduced mainly to the environmental dimension and linked mostly to outdoor education. This narrow view can keep ESD outside systematic planning. It can also limit attention to social and civic dimensions that are highly relevant to active citizenship (Isgren Karlsson & Backman, 2023). Survey evidence suggests

231 that systematic teaching of sustainability issues in PE is still not widespread. At the same time, many
232 teachers report a clear need for training and for practical pedagogical tools (Fröberg et al., 2022).

233 Overall, the evidence points to a set of implementation conditions. These include targeted
234 professional development (knowledge, pedagogy, and assessment), access to concrete examples and
235 tools, and institutional support at both school and curriculum level (Lohmann et al., 2021). In the
236 Greek context, environmental education is often described as optional and fragmented. This
237 reinforces the need for clearer guidance and sustained teacher support (Moshou & Drinia, 2025).

238 **3.5 Assessment and implementation tools**

239 In the reviewed literature, a recurring theme is the need to document how ESD is implemented in PE
240 using appropriate assessment tools. Without clear indicators and reliable measures, ESD in PE may
241 remain an intention rather than a coherent teaching practice. This makes systematic monitoring and
242 improvement difficult (Royet et al., 2024). In this context, recent efforts have focused on developing
243 and validating instruments that assess whether PE teaching practices are aligned with sustainability
244 goals and dimensions of learning for ESD. One example is the Physical Education for Sustainable
245 Development (PESD) questionnaire, a validated instrument designed to capture teachers'
246 sustainability-oriented teaching interventions in PE (Baena-Morales et al., 2024). Complementary
247 work also targets PE teachers' attitudes and self-reported practices related to SD. For instance, Tassi
248 et al. (2025) presented the pilot development of an inventory that documents how teachers understand
249 SD and how they report integrating it into teaching. The study noted that such instruments can support
250 more systematic monitoring of implementation, while further refinement and validation are still
251 needed (Tassi et al., 2025). Despite relative progress, significant gaps remain, especially in assessing
252 values and attitudes (e.g., empathy, justice, social responsibility). Moreover, evaluating participation
253 and collective action is methodologically demanding and often relies on heterogeneous approaches,
254 which makes it difficult to compare findings across studies and contexts (Baena-Morales & González-
255 Víllora, 2023). Overall, sources agree that the further development of common indicators and

multimodal tools (e.g., observation, self-report, learning evidence) is a critical prerequisite for the maturation of the field.

3.6 Summary model of findings

Collectively, the findings point to a coherent framework in which PE can function as a field of application for ESD when it deliberately links experiential, embodied learning with collaborative and reflective pedagogical practices. Through these mechanisms, learning outcomes related to sustainability skills and active citizenship values (e.g., empathy, cooperation, social responsibility, and collective action) become more visible. However, the quality and consistency of implementation depend on conditions relating to the teacher (perceptions, training, pedagogical support) and on the ability to document practice with appropriate tools and evaluation indicators. Strengthening professional development and developing shared assessment frameworks therefore appear critical for moving from fragmented actions to a more coherent integration of ESD into PE.

4. Discussion

Overall, this synthesis indicates that PE can function as a practical field of application for ESD when lesson design combines experience-based learning, collaboration, and structured reflection. These elements help students move from participation to meaningful action. This interpretation is consistent with recent reviews, which argue that ESD-oriented work in PE is most visible through experiential and cooperative practices, as well as targeted pedagogical models. These approaches are often linked to socio-emotional outcomes and values connected to active citizenship (Baena-Morales & González-Víllora, 2023; Royet et al., 2024; Thurm et al., 2024). At the same time, the evidence indicates that implementation can remain fragile without sustained professional development and practical tools to document and monitor teaching. This fragility is especially evident for outcomes related to values and participation, which are harder to evidence and assess in consistent ways (Baena-Morales et al., 2024; Fröberg et al., 2022; Lohmann et al., 2021).

In teaching practice, the contribution of PE to ESD becomes more visible when learning moves beyond isolated skill exercises. When tasks are organized as scenarios, students collaborate, negotiate rules of fairness and respect, and reflect on choices and consequences. These learning conditions are closely linked to outcomes highlighted in this synthesis (e.g., empathy, cooperation, social responsibility, and willingness to engage in collective action), which are also central in sustainability-oriented learning (Royet et al., 2024; Thurm et al., 2024).

This interpretation supports the emphasis of SDG target 4.7 on developing knowledge and skills for sustainable lifestyles, human rights, equality, and active participation, in ways that connect values with action in everyday school life (United Nations General Assembly, 2015; UNESCO, 2017). In this context, structured pedagogical models can make sustainability more teachable and actionable in PE. Approaches such as cooperative learning and social responsibility models, including TPSR, offer roles, participation norms, and reflection routines that can support inclusion and responsible participation (Aygun et al., 2024; Hellison, 2011; Legrain et al., 2021).

There is also a practical risk: SDG mapping in PE can become superficial if it is used only as a label. Aligning ESD objectives with practice-based PE models can help (Baena-Morales et al., 2021). However, teachers still need to make learning intentions explicit and build in reflection. If there is no evidence of learning, sustainability may remain a slogan rather than a teachable outcome.

Despite these encouraging findings, a consistent implication is that moving from isolated good practices to the systematic integration of ESD into PE depends on the teacher and the supportive context. When sustainability is narrowly framed as an environmental issue and associated mainly with outdoor activities, implementation tends to remain limited or fragmented, without fully exploiting the social and civic dimensions of ESD (Isgren Karlsson & Backman, 2023). Survey data from a large sample of teachers also indicate that systematic teaching of sustainability issues in PE is not yet widespread and that there is a strong demand for training and practical pedagogical tools (Fröberg et al., 2022). This pattern points to the need to strengthen teachers' professional competence for ESD in PE (Lohmann et al., 2021). One implication is that the gap in knowledge and confidence

306 may not be limited to in-service training but could also reflect how consistently ESD is embedded in
307 initial Physical Education Teacher Education (PETE). Analyses of PETE curricula, for example,
308 show that SD perspectives are not always clearly reflected in expected learning outcomes. This lack
309 of clarity can make later implementation in school practice more difficult (Fröberg et al., 2022;
310 Fröberg & Lundvall, 2025).

311 Nevertheless, documenting implementation remains a methodological challenge: without commonly
312 accepted indicators and tools, it is difficult to evaluate outcomes related to values, attitudes and
313 participation, which in turn makes it difficult to compare studies and contexts (Baena-Morales &
314 González-Víllora, 2023). The development and validation of implementation and evaluation tools for
315 EE and ESD is therefore a critical step in the maturation of the field and in supporting educators in
316 practice (Baena-Morales et al., 2024). In Greece, environmental education is often described as
317 optional and fragmented, which reinforces the need for clearer guidance and professional
318 development to support more coherent implementation (Moshou & Drinia, 2025). In this direction,
319 the Greek Institute of Educational Policy (IEP) supports the "Active Citizen Actions" curriculum
320 program through a Scientific Unit for Education for Active Citizenship and Sustainability. The
321 initiative links civic actions to the 17 United Nations (UN) SDGs and promotes whole-school
322 participation, networking with external partners (e.g., universities, non-governmental organizations
323 (NGOs), local authorities), and the dissemination of good practices through seminars and events
324 (Institute of Educational Policy, 2024).

325 In line with the purpose of the study, this synthesis clarifies how PE can activate ESD through specific
326 pedagogical mechanisms, including experiential learning, collaboration, and reflection. It also shows
327 which learning outcomes appear most frequent and meaningful, particularly sustainability skills and
328 values linked to active citizenship. Importantly, the consistency and quality of these outcomes seem
329 to depend on key implementation conditions, such as teachers' professional readiness, institutional
330 support, and the availability of reliable documentation and assessment tools. The following

limitations do not invalidate the conclusions; rather, they set the boundaries of generalization and inform more targeted directions for future research and practice.

Across themes, the evidence base remains heterogeneous. Many contributions are conceptual or policy-oriented. Furthermore, a large portion of the empirical research is based on small-scale interventions and on outcomes reported by participants themselves. This limits confidence regarding real-world impact. The most consistent findings concern socio-emotional outcomes, which are clearer when structured pedagogical models are used. In contrast, outcomes related to values, political participation, and collective action are defined and measured with less consistency. Implementation can also be weak in practice. A common risk is superficial SDG "labelling". Another risk is isolated, one-off activities that are not connected to the curriculum. Transfer beyond the PE lesson is also limited when reflection and documentation are minimal. These limitations do not negate the potential of PE for ESD. Instead, they point to the need for clearer implementation guidance and more robust multi-method evaluation.

Limitations of the approach

This paper is based on a documented narrative synthesis. This approach supports the interpretation of diverse sources and the identification of conceptual patterns, but it also has limitations. First, because the search was not exhaustive and no formal quality appraisal was conducted for each study, some relevant publications may have been missing, and certain geographical or educational contexts may be underrepresented. Second, variation across studies (designs, samples, age groups, and pedagogical interventions) limits direct comparisons and generalization, particularly for outcomes related to values, attitudes, and participation. Third, much of the evidence relies on teachers' self-reports or program descriptions, which may be affected by social desirability and make it harder to judge real-world impact. Finally, the absence of shared indicators and comparable assessment tools limits how confidently findings can be compared across studies and contexts. Taken together, these limitations temper the conclusions and point to the need for more systematic, multi-method research designs.

5. Conclusions and implications

Taken together, the findings point to PE as a promising setting for ESD when lesson design deliberately connects experiential learning with collaboration, reflection, and civic values. Under these conditions, PE supports not only physical development but also the cultivation of sustainability-related skills and active citizenship values, such as empathy, cooperation, respect, social responsibility, and readiness to engage in collective action. However, implementation appears vulnerable when sustainability is treated mainly as a narrow environmental topic, when systematic pedagogical support is limited, or when tools for documenting outcomes are lacking.

Implications for educational practice and teacher development. At the level of educational practice, integrating ESD into PE requires clear learning intentions and structured teaching routines. These include purposeful group work, defined roles, agreed rules for participation, and planned time for reflection. It also requires activities that allow students to test values and attitudes in practice, not only to discuss them. Professional development is a key prerequisite. It supports teachers not only in understanding ESD, but also in translating it into classroom practices that are feasible and assessable.

Implications for school community, curriculum and policy (cities/regions perspective). At the level of the school community, ESD is likely to be strengthened when it is embedded in a broader culture that encourages cooperation, participation, and shared action. Cross-curricular projects, the purposeful use of outdoor spaces, and collaboration with other disciplines can reinforce coherence and add meaning to learning experiences. From a cities-and-regions perspective, these conditions are strengthened when schools build partnerships with local authorities, community organisations, universities, and place-based initiatives that connect learning with local sustainability priorities and quality-of-life goals. From a policy perspective, including within initial teacher education (PETE), the findings reinforce the need for ESD to be integrated more systematically into curricula and teacher preparation, supported by clear learning outcomes and practical resources. Finally, the development of shared indicators and multimodal assessment tools (e.g., observation, self-report, learning

evidence) remains important for documenting implementation and supporting comparisons across contexts.

Research agenda. Research should now move beyond predominantly conceptual accounts and small-scale self-report evidence by using multi-method designs, clearer operationalization of active citizenship outcomes, and longer-term follow-up. Further validation and practical testing of assessment tools across contexts would also strengthen the evidence base.

Contribution of this review. By bringing together PE-based ESD work through an explicit active citizenship lens and mapping representative sources and tools (Table 1), this synthesis makes the evidence easier to navigate and the implementation requirements easier to act on. When deliberately designed, PE can make sustainability and democratic participation more visible as lived experiences in everyday school life.

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