Australian Journal of Environmental Education (2026), **42**, 439–458
doi:10.1017/aee.2025.10093

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ARTICLE

Integrating Sustainable Development Within Physical Education Teacher Education Courses: A Professional Learning Project

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(Received 27 January 2025; revised 10 October 2025; accepted 29 October 2025; first published online 02 December 2025)

Abstract
The study explored physical education teacher educators' (PETE educators) perspectives on integrating sustainable development (SD) imperatives within PETE courses. Nine PETE educators participated in a nine-month professional learning project featuring six workshops and seminars promoting reflection, peer discussion and dialogic encounters. The PETE educators designed pedagogical interventions based on their teaching practices, selecting teaching units where SD perspectives could be integrated. Data included intervention papers, audio-recorded sessions and logbooks, analysed descriptively and thematically. The proposed interventions focused on inclusion, equality and lifelong physical activity, and typically included lectures, seminars, student-centred teaching, reflections and assignments. Challenges included contextualising SD in PETE, framing SD goals, integrating SD content and addressing its normative nature. The study offers insights into the potential of integrating SD perspectives in PETE, highlights associated challenges, and calls for further research to bridge theory and practice.

Keywords: Career development; collaborative learning; education for sustainable development; physical education; sustainable development

Introduction

Higher education plays a pivotal role in advancing sustainable development (SD). Research has explored higher education and SD from various perspectives. Studies highlight challenges in integrating SD into policies, curricula and practices within higher education institutions (e.g., Filho *et al.*, 2017, 2018). Teachers, positioned at the core of education, bear the responsibility of preparing future generations to address global challenges. This involves fostering awareness of the interconnections among the social, economic and environmental dimensions of SD and developing the necessary knowledge, skills, values and attitudes to address these issues effectively (Bürgener & Barth, 2018). To enable teachers to incorporate SD perspectives, initial teacher education serves as a relevant starting point. It may support the development of essential competencies for future teachers to address SD in compulsory and upper secondary education. Despite its importance, few studies have explored how teacher educators integrate SD perspectives into their teaching practices, not least within physical education (PE) teacher education (PETE).

Consequently, advancing the field of initial teacher education and SD requires an exploration of how teacher educators can incorporate SD, and the challenges they face in doing so. The present study addresses this knowledge gap by exploring teacher educators' perspectives on integrating SD

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https://doi.org/10.1017/aee.2025.10093 Published online by Cambridge University Press

imperatives within PETE. The research draws on data from a professional learning project (PLP) conducted among PETE educators.

Background

Sustainability and SD are broad concepts that can be defined in various ways (Ruggerio, 2021). The 1987 report *Our Common Future* provides one of the most widely recognised definitions of SD as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 16). In the context of SD, the United Nations' 2015 publication, *Transforming our world: The 2030 Agenda for Sustainable Development*, represents an action plan underpinned by a shared commitment from United Nations' member states to work collaboratively toward a sustainable future (United Nations, 2015). It acknowledges the interconnectedness of global challenges and emphasises the need for collective action to achieve positive change. The 2030 agenda includes 17 interconnected SD goals (SDGs) and 169 targets.

Quality education is essential not only because it supports progress across social, economic and environmental domains, but also because it represents a fundamental human right and a cornerstone of individual and collective development. Ensuring equitable access to meaningful and relevant learning opportunities is central to promoting inclusion, empowerment and sustainable societies. Education is also central to the 2030 agenda, with a dedicated SDG focused on quality education. Education is also acknowledged as an important driver for achieving the other 16 SDGs by informing learners about global challenges, fostering awareness of the interconnections between social, economic and environmental dimensions of SD, and developing the knowledge, skills, values and attitudes necessary to address complex issues and drive positive change (see e.g., Rieckmann *et al*., 2017). In this context, critical SD competencies may include systems thinking, anticipatory, strategic thinking, critical thinking, collaboration and integrated problem-solving, among others (Rieckmann *et al*., 2017).

According to UNESCO (2020), education for SD (EfSD) "empowers learners with knowledge, skills, values and attitudes to take informed decisions and make responsible actions for environmental integrity, economic viability and a just society empowering people of all genders, for present and future generations, while respecting cultural diversity" (p. 8). However, critics argue that EfSD risks greenwashing education or even reducing education to an instrument for producing individuals equipped to address SD challenges, potentially compromising educational values such as democracy, freedom, pluralism and creativity (see e.g., Álvarez-García & Sureda-Negre, 2023; Öhman & Östman, 2019; Poeck & Östman, 2020). This instrumental approach, often referred to as normative EfSD, focuses on predetermined outcomes such as fostering socially desirable behaviours and providing solutions to SD issues. However, this perspective assumes a linear relationship between knowledge and behaviour, overlooking the contextual and complex nature of human actions (Wals, 2011).

While normative EfSD has limitations, it also holds potential to support shared ethical commitments and collective responsibility. Poeck and Östman (2020) argue that it is possible to balance engagement with SD challenges and uphold democratic educational values. Instead of prescribing specific behaviours, an emancipatory approach to EfSD emphasises fostering SD competencies. This approach encourages students to engage with real-world problems in ways that promote freedom, pluralism and creativity (Poeck & Östman, 2020). From this perspective, SD can be framed as a dynamic concept, a socially constructed reality, an ideology, or a vision for innovation and change (Wals & Jickling, 2002). Emancipatory EfSD involves engaging students in decision-making processes, encouraging ethical reflections and drawing on interdisciplinary knowledge presented objectively and in balance (Öhman & Östman, 2019; Wals, 2011). In this context, it is important to note that normativity in EfSD need not be rejected entirely, but its application benefits from critical reflection. When EfSD is viewed as a space for dialogue,

https://doi.org/10.1017/aee.2025.10093 Published online by Cambridge University Press

pluralism and critical engagement rather than a vehicle for prescribing specific behaviours or worldviews, there is scope to challenge SD as a fixed, universally accepted, or beyond question' (see e.g., Poeck & Östman, 2020; Wals & Jickling, 2002; Wals, 2011). From this perspective, normativity becomes problematic when it limits democratic dialogue and ethical exploration. This understanding aligns with an emancipatory approach to EfSD that seeks to remain ethically grounded while open to contestation and multiple perspectives.

In higher education, SD competencies may be linked to specific pedagogical approaches. Lozano *et al.* (2017) found that no single teaching method covers all SD competencies, yet case studies and problem-based learning may address most of them. Lectures, though less effective on their own, remain a valuable component when combined with other methods. Nonetheless, effective sustainability education in higher education should foster the development of key competencies, such as futures thinking, values thinking, strategic thinking and integrated problem-solving, enabling students to critically engage with complex social, environmental and ethical issues (Brundiers *et al.*, 2021). Learning environments should support exploration, self-awareness and problem solving, while connecting sustainability to students' specific fields of study to ensure relevance and deepen disciplinary knowledge. By encouraging interdisciplinary thinking and involving students in real-world, systematic decision-making processes, educators can support the development of innovative and socially responsible solutions to sustainability challenges (Lundvall & Fröberg, 2022). Preparing teachers for the complex task of teaching SD perspectives requires attention in initial teacher education.

Initial teacher education plays an important role in equipping teacher education students with SD competencies (see e.g., Evans & Ferreira, 2020; Evans *et al.*, 2017; Pegalajar-Palomino *et al.*, 2021). To date, perspectives on SD and EfSD in initial teacher education are typically addressed in four ways (Evans *et al.*, 2017): (1) holistically across curricula, (2) as a component within compulsory subjects, (3) as a dedicated compulsory subject and (4) as a separate, non-compulsory subject. Overall, strategies to engage students in SD and EfSD often include peer discussions, fieldwork, critical reading and writing and problem-based learning (Algurén, 2021; Evans & Ferreira, 2020). Despite recognising the importance of SD and EfSD, teacher educators vary in their understanding of these concepts and often feel constrained by a lack of time and knowledge to address them effectively in their teaching (Goller & Rieckmann, 2022).

Given these challenges, professional learning is central to teacher educators' development, requiring both cognitive and emotional engagement and a willingness to reflect critically on existing beliefs and practices (Avalos, 2011). Various forms of professional learning are recognised, ranging from structured programmes to informal exchanges among peers, all aimed at developing educators' skills and knowledge (OECD, 2009). This is particularly essential in areas such as SD and EfSD, which require ongoing contextualisation and re-contextualisation due to their inherent complexity and ambiguity (Wals, 2020). Effective professional learning for SD should involve continuous reflection and action while encouraging innovation in curriculum and the development of new academic identities (Mulà *et al.*, 2017). Professional learning initiatives have shown their potential to transform teaching practices and address SD challenges effectively (Barth & Rieckmann, 2012; Collazo Expósito & Granados Sánchez, 2020). However, opportunities for professional learning in SD seem somewhat limited within Swedish higher education institutions (see e.g., Mulà *et al.*, 2015).

Context

This study situates SD within the context of PE and PETE. The potential of PE to contribute to SD through its unique focus on movement education, physical activity, sports, as well as health, and lifestyle topics has recently been highlighted (Baena-Morales & González-Víllora, 2022; Lundvall & Fröberg, 2022). PE can address social, environmental and economic dimensions of SD by promoting

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well-being, inclusive practices, active transportation, sustainable consumption, collaboration and innovation (Baena-Morales & González-Víllora, 2022). Previous literature has related PE to several SDGs, predominately good health and well-being (target 4: reduce premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being), quality education (target 5: eliminate gender disparities in education) and gender equality (target 1: end all forms of discrimination against all women and girls everywhere) (Baena-Morales & Ferriz-Valero, 2023). The use of well-established, PE practice-based pedagogical models, such as the Personal and Social Responsibility Model, Cooperative Learning, and Sport Education, can serve as effective tools for advancing perspectives on SD (Baena-Morales & González-Víllora, 2022). More specifically, a SD perspective in PE may involve fostering critical reflection, empowering students to explore their own experiences, and encouraging engagement with movement, physical activity, sports and health in relation to both personal and societal contexts. Through student-centred and authentic learning activities, PE can support lifelong learning, social awareness and the ability to navigate complex challenges, moving beyond the classroom to promote holistic and inclusive understandings of sustainable living (Lundvall & Fröberg, 2022).

PETE offers an opportunity to equip future PE teachers with the knowledge and skills to incorporate SD perspectives into their teaching practices (Fröberg & Lundvall, 2022). Despite this potential, little is known regarding the intersection of PETE and SD. Some studies have explored PETE students' perspectives on SD in PE. These studies suggest that PETE students somewhat emphasise the role of PE in promoting social development, while giving comparatively less attention to its potential contributions to economic and environmental development (Baena-Morales *et al.*, 2022; Merma-Molina *et al.*, 2023). In addition, limited professional development among teacher educators, insufficient resources and inflexible, overloaded PE curricula have been shown to hinder the preparation of PETE students to effectively promote SD (Merma-Molina *et al.*, 2023). However, limited attention has been paid to how PETE educators approach these topics. Existing studies have primarily focused on conceptual understandings of SD and EfSD rather than exploring practical integration (see e.g., Lohmann & Goller, 2023). Thus, further research is needed to explore how PETE educators might integrate SD perspectives within PETE.

Purpose and research questions

The overall purpose of the present study was to explore the perspectives of PETE educators regarding the integration of SD imperatives within PETE courses. The following two research questions were addressed:

- Research question 1: How might PETE educators integrate SD perspectives within PETE courses?
- Research question 2: What do PETE educators perceive to be challenges in relation to the integration of SD perspectives within PETE courses?

Methods and materials

The study is part of a larger research initiative (*Physical Education, Health, and Sustainability*) that was initiated in 2020. The research initiative aims to explore the potential and relevance of re-framing PE from the perspective of SD. As part of the research initiative, a PLP among PETE educators was designed and conducted.

The professional learning project

The purpose of the nine-month (October 2022 to June 2023) PLP was to explore PETE from SD perspectives.

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Theoretical framework

The PLP was grounded in socio-cultural learning theory and collaborative learning as an educational approach to teaching and learning. Here we drew on Vygotsky's work, which highlights social interaction and collaboration as central to learning (Vygotsky, 1978; 1986). This theory acknowledges that learning is culturally embedded, shaped by societal norms and values, aligning with social constructivism where knowledge is seen as actively constructed, not passively received (Martin, 2012; Säljö, 2005).

Socio-cultural theory emphasises how collaboration and social practices drive cognitive development, with interactions creating rich learning environments (Martin, 2012). This may inform professional learning, promoting reflection, peer discussions and problem-solving (Hämäläinen & Vähäsantanen, 2011; Van Lare & Brazer, 2013). In adult learning, socio-cultural approaches support meaningful discussions on socio-ecological issues, crucial for navigating the complexity of SD (Stevenson, 2022; Wals, 2020).

Guided by these principles, the PLP was designed to foster collaboration among PETE educators, encouraging reflection and innovation in integrating SD perspectives within PETE courses. PLP sessions were structured to encourage reflection, peer-discussions and dialogic encounters, allowing educators to learn from each other and explore alternative pathways for integrating SD perspectives into their teaching practices. Through collective sense-making and critical reflection, the PLP aimed to support transformative learning (i.e., shifts in assumptions, values and professional identities) and emancipatory learning, enabling participants to challenge norms and develop an agency to promote change (see e.g., Mezirow, 2000; Wals, 2020). In this way, the theoretical underpinnings not only supported knowledge sharing and collaboration but also created the conditions for questioning taken-for-granted practices and envisioning more sustainable approaches to education.

Pedagogical interventions

The PETE educators designed proposals for pedagogical interventions. They were encouraged to identify and choose a teaching unit within PETE, such as a course module, a sub-course, or a theme, where SD perspectives could be integrated (developed and/or strengthened). All PETE educators documented their interventions in written papers, where they: (1) articulated the central focus of the interventions, including a brief description of the chosen teaching unit, and (2) described the overall approach to integrate SD perspectives. The PETE educators independently chose SD perspectives, and how the interventions would be designed. Furthermore, the PETE educators were colleagues who (in different combinations) worked together within the same course modules and sub-courses. To allow for the PETE educators to discuss ideas and approaches to their interventions during the PLP, they were encouraged to form pairs or trios that worked together within the same teaching unit. While sharing this common context, each participant designed individual interventions with somewhat different focuses and SD perspectives. As part of this PLP, the pedagogical interventions were only designed and not implemented or evaluated in practice.

Sessions

The PLP comprised of six sessions of workshops and seminars as overviewed in Table 1. Each session lasted about 120–180 minutes (>90% participation-rate) and was designed to facilitate reflections, peer-discussions and dialogic encounters. It was anticipated that the process of designing the pedagogical interventions was to be fluid and open in a sense that reflections, peer-discussions and dialogic encounters would also occur both during and between the sessions.

The two authors assumed the role as PLP managers and coordinated the sessions since they believed that the collaboration process would benefit from being moderated by someone. Through

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Table 1. An overview of the sessions

Session	Purpose	Core content
1	To introduce the PLP and core concepts related to SD.	The PLP and the process of designing pedagogical interventions were introduced. PETE educators were encouraged to consider how to prioritise content or challenge the delivery and teaching methods, such as by rethinking learning perspectives and adopting a holistic and heuristic approach to the content of the chosen teaching unit. Thereafter, a literature seminar was held to identify challenges related to SD, both generally and specifically within PETE.
2	To discuss the contribution of PETE in relation to SD, and initiate the process of designing pedagogical interventions.	The first part involved identifying and discussing how teaching units within PETE contribute to the SDGs. The interactive SDG Impact Assessment Tool was used to assess how a selected teaching unit might impact the SDGs. Thereafter, a workshop was held to identify a teaching unit in which SD perspectives could be integrated.
3	To share insights and perspectives, and exchange of ideas in relation to previous literature that have explored SD perspectives in the context of PETE.	A literature seminar involving reading, reflecting on and discussing peer-reviewed papers.
4–6	To continue the process of designing pedagogical interventions.	Session four involved reading, reflecting on and discussing peer-reviewed papers related to the pedagogical interventions. The final two sessions involved evaluations of the interventions, where PETE educators acted as critical friends, providing peer feedback and feedforward.

CL = Collaborative learning; PETE = Physical education teacher education; SD = Sustainable development; SDG = Sustainable development goals; SE = Sustainable engagement. ***Note***: The *SDG Impact Assessment Tool* (Gothenburg Centre for Sustainable Development, n.d.) is freely available online from the following website: https://sdgimpactassessmenttool.org/en-gb.

dialogues with the PETE educators, however, the overall organisation of the PLP was negotiated. Throughout the PLP, all PETE educators (including the authors) acted as peers and critical friends that facilitated each other. However, as both PLP managers and peers/critical friends, the authors may have unintentionally influenced discussions or constrained participants' willingness to share openly, with some of them potentially feeling constrained in disagreeing with the authors' perspectives. To mitigate this, the PLP managers emphasised that SD involves inherently ambiguous and context-dependent elements, highlighting that all contributions were equally valuable and fostering a cooperative environment that encouraged open dialogue and the sharing of diverse perspectives.

Participants

A purposive sampling approach was used to recruit PETE educators from a single department at a higher education institution in Sweden. This sampling approach is well suited for qualitative research aiming to explore the perspectives of participants with direct and relevant experience of the phenomenon under exploration (Patton, 2015). Following an initial expression of interest, formal invitations were extended to 14 PETE educators (including the authors) who met the following criteria: (1) active involvement in the institution's initial teacher education programmes, (2) teaching at least one PETE course during the PLP time-period, and (3) willingness to participate in the PLP, which required both effort and time commitment. Nine PETE educators (including the authors) expressed interest and participated in the PLP.

The PETE educators represented diverse demographics (e.g., 5 males and 4 females, aged 39–65 years) and had different professional backgrounds, and academic positions. They taught a variety

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of areas and courses within PETE, encompassing social sciences, applied exercise sciences and didactical courses in ball games, dance, outdoor education etc. across initial teacher education programmes for primary (grades 4–6), secondary (grades 7–9) and upper-secondary (grades 10–12) schools. They had varying levels of prior knowledge and experience of SD. Two of the PETE educators (the authors) had research experience in the intersection of SD and PE. One had engaged with SD in teaching sport science but not within PETE, while the rest were familiar with the concept but lacked direct experience integrating it into teaching practices.

Data sources and analysis

To address the first research question (how PETE educators might integrate SD perspectives within PETE courses), the focus was on the proposed pedagogical interventions as examples of how to integrate SD perspectives within PETE courses. Each educator's intervention details were captured in written papers collected at the end of the PLP. Given that these papers outlined general approaches rather than detailed descriptions, a descriptive analysis and summary of how PETE educators integrated SD perspectives within PETE courses were conducted and structured according to goal and core content. To enhance trustworthiness, all proposed pedagogical interventions were also presented and discussed in a seminar with the PETE educators, which provided an opportunity to capture additional perspectives and cross-check the clarity of our interpretations in relation to the pedagogical interventions.

For the second research question (what PETE educators perceive to be challenges in relation to the integration of SD perspectives within PETE courses), audio recordings and participant logbooks were analysed to explore perceived challenges in integrating SD perspectives within PETE courses. Three sessions (1–3) were audio-recorded, capturing reflections, peer discussions and dialogic encounters. Relevant segments were transcribed for analysis, excluding administrative or introductory content. In the participant logbooks, the PETE educators logged expectations, reflections and thoughts throughout the PLP. These participant logbooks offered insights into challenges, opportunities, tensions and other relevant aspects. Using these data sources, the second research question was analysed using thematic analysis. Thematic analysis involves producing themes from data to address the research question (Braun & Clarke, 2006; Nowell *et al.*, 2017). In this context, "challenges" were broadly interpreted to include ambiguities, barriers, contradictions and tensions related to SD and PETE. The thematic analysis followed an inductive, data-driven approach, with codes reflecting both explicit and latent data features. The analysis process included familiarising ourselves with the data, coding similar content into sub-themes, and refining these into final themes (Braun & Clarke, 2006; Nowell *et al.*, 2017). This iterative process involved collaboration between the two authors to ensure thematic clarity. The final themes were labelled based on their core content, with an example provided in Table 2.

In qualitative research, researchers serve as instruments (e.g., Nowell *et al.*, 2017), and in this study, the PLP managers held dual roles as both researchers and participants. This dual role introduces potential biases, as the authors involved in the PLP may unintentionally favour interpretations aligned with their preconceived notions or overlook alternative perspectives. To mitigate these risks, the authors adopted a reflective approach, actively challenging assumptions to ensure nuanced data interpretation. For example, the authors maintained a reflexive stance by keeping dedicated individual research logbooks (where they logged reflections, and thoughts) and engaging in ongoing discussions about their positionality throughout the PLP. During the analysis process, the authors strived to critically examine their interpretations. To further enhance trustworthiness, parts of the preliminary interpretations were shared and discussed with the PETE educators. These collaborative discussions served as a form of participant validation, allowing the researchers to check the accuracy of their interpretations and ensure that the PETE educators' perspectives were adequately represented.

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Table 2. An example of the thematic analysis process

Quote	Code	Sub-theme	Theme
"It is quite comprehensive . . . so if you've narrowed down to something . . . it is a little easier to delve deeper and do something . . . "	Complexity, broadness and vagueness of SD	Making sense of SD in the context of PETE	Approaching SD in PETE
"It is very important that we collegially understand each other so we know what we are talking about when we talk about sustainable development and really make sustainable development concrete" "My expectation . . . is to obtain a definition and shared view of what we mean by sustainable development in physical education teacher education"	Shared conceptualisation and definition of SD		

PETE = Physical education teacher education; SD = Sustainable development.

Ethical considerations

The research reported in this study involves several ethical aspects that merit discussion. The study was conducted in accordance with established research ethics, including relevant laws, ethical frameworks and norms applicable to the PLP. The design and procedures followed the ethical guidelines set out by the Swedish Research Council (2017). After consultation with a representative from the institutional ethical committee, it was concluded that formal ethical approval was not required, as no sensitive personal data were collected.

Moreover, participation in the PLP was entirely voluntary. All participants received written and verbal information about the overall aim and structure of the PLP, and informed consent was obtained prior to participation. It was also clearly communicated that participants could withdraw at any time without the need to provide a reason. Furthermore, oral consent for audio recording the PLP sessions was obtained prior to each session. Participants were informed that the recordings would be used solely for research purposes. Confidentiality was ensured by de-identifying data and using pseudo-anonymised quotations when presenting the findings. Finally, the PLP was intentionally designed to promote critical reflection, peer dialogue and professional learning. The sessions aimed to provide a meaningful and enriching experience for participants. Project leaders also emphasised that all perspectives shared during the sessions were part of our collaborative work and would contribute to a deeper understanding of the PLP's focus area.

Findings

Integrate perspectives of sustainable development

The descriptive analysis and summary revealed that the proposed pedagogical interventions varied in goals, and core content, reflecting diverse approaches to integrating SD perspectives within PETE courses. An overview of the proposed interventions is provided in Table 3.

The proposed pedagogical interventions addressed five core content areas, with PETE educators working in pairs for four of these: ball games, physical activity in the immediate area, accessible swimming education, dance, movement and rhythm and outdoor education (Table 3). The core content was deemed important to PETE, focusing on inclusion, equality and lifelong physical activity participation. Seven interventions were structured as single teaching units within a sub-course, whereas two were designed to highlight SD perspectives across multiple teaching units, spanning over several courses. Eight interventions included a combination of lectures, seminars, student-centred teaching and assignments, while one was lecture-based only. Reflections, peer discussions and group work were consistent features of all interventions.

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Table 3. A descriptive analysis and summary of the proposed pedagogical interventions

Focus area	Pedagogical intervention	Goal	Core content
Ball games	1	To design inclusive ball games	Lectures and seminars aim to deepen understanding of challenges in ball games, inclusion, and SD, fostering ideas for more inclusive designs. Students propose and justify three inclusive ball games incorporating SD perspectives, implement them with peers, and evaluate the outcomes. A concluding seminar explores experiences and lessons from the unit.
	2	To design inclusive ball games where sustainability-oriented learning is visible	Students develop and justify three inclusive ball game proposals with a focus on sustainability-oriented learning. They implement and evaluate the games with peers, then reflect on the intellectual, emotional, and practical challenges they encountered.
Physical activity in the immediate area	3	To make SD perspectives visible across three courses by introducing the theme physical activity in the immediate area.	Students reflect on a nearby place where they feel well-being, considering any connection to specific activities. In groups, they visit the location, present their reflections, and discuss peer experiences (Course 1). Additionally, groups identify a local area and design exercise programmes for aerobic training, muscle strengthening, flexibility, agility, and coordination. They perform the programmes, share reflections, and engage in peer feedback (Courses 2 and 3).
	4	To make SD perspectives visible across three courses by introducing the theme physical activity in the immediate area.	Students explore local opportunities for physical activity, individually designing activities focused on health (Course 1) and integrating exercise principles, nature experiences, and ecological footprints (Courses 2 and 3). In groups, they implement the activities with peers, then present and discuss their experiences in a seminar, reflecting on the activities' relevance for PE.
Accessible swimming education	5	To illuminate inequalities in the ability to swim and provide students with arguments for the importance of having the ability to swim.	Lectures to address inequalities in the ability to swim across different groups in the society, and its implications for social exclusion and marginalisation. Furthermore, lectures to increase knowledge of the importance of acquiring the ability to swim, and the relation between having the ability to swim and the SDGs.
	6	To provide students with arguments for the importance of having the ability to swim.	Students observe how swimming lessons are organised at a municipality and school level, and what learning takes place. This is followed by a workshop where groups of students present insights and lessons learned, and peer-discussions about how swimming lessons can be developed.
Dance, rhythm and movement	7	To include SD perspectives in the context of dance, rhythm and movement	Students analyse learning materials (e.g., dance clips) to discuss stereotypical gender roles and attitudes. They perform dances and movements perceived as masculine or feminine, using various music and props (e.g., shawls, gymnastic

(*Continued*)

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Table 3. (*Continued*)

Focus area	Pedagogical intervention	Goal	Core content
			bands), reflecting on emotions, moods and the creative process. In groups, they research a location (country, region, or residence), learn cultural dance steps and reflect in logbooks on the social, environmental and economic dimensions of dance. They also consider how teachers can challenge stereotypical gender roles and attitudes.
	8	To include SD perspectives in the context running and qigong.	Equipped with heart-rate monitors, students walk, jog, or run for 15–20 minutes at a steady pace, individually or in pairs. They reflect on social aspects (e.g., pros and cons of running alone vs. in pairs), environmental factors (e.g., the environment's impact on the experience), and economic considerations (e.g., the link between aerobic fitness and sustainable living). They also participate in a qigong session, reflecting on social (e.g., emotional responses during qigong), environmental (e.g., the environment's role in mindfulness), and economic dimensions (e.g., the connection between qigong and sustainable living).
Outdoor education	9	To include and facilitate problem solving, collaboration and self-awareness competency among students in the context of outdoor education.	Students take responsibility for organising outdoor education activities, such as navigating excursions and selecting suitable tent sites. This aims to enhance problem-solving skills (e.g., creativity and action readiness), collaboration and self-awareness (e.g., responses to adversity). Students reflect on their experiences with peers.

PE = Physical education; SD = Sustainable development; SDG = Sustainable development goals.

Perceived challenges in relation to the integration of perspectives of sustainable development

Overall, the PETE educators expressed positive attitudes towards the potential integration of SD within PETE courses, recognising that PETE could contribute meaningfully to the SD agenda. Nonetheless, several challenges were also identified. The thematic analysis resulted in two main themes and four sub-themes (Figure 1).

Theme 1: Approaching sustainable development in physical education teacher education

As shown in Figure 1, the first theme constituted two sub-themes: *Making sense of sustainable development in the context of physical education teacher education* (sub-theme 1) and *Framing sustainable development goals in the context of physical education teacher education* (sub-theme 2).

Sub-theme 1

The PETE educators identified significant challenges in conceptualising and defining SD, perceiving the concept as complex, broad and vague. This complexity left some feeling overwhelmed, as exemplified by one participant who stated: "I get a little… I get a little suffocated. It feels like it's so broad… and that everyone must do everything. It's broad… and there will be a lot to carry." Moreover, while some expressed a desire for a shared conceptualisation and definition of SD within the PLP, they also acknowledged that achieving such a definition might not be feasible. They emphasised that any proposed definition should include a dynamic element, allowing for adaptation across varying contexts.

PETE educators also noted similar challenges when applying the concept of SD to PETE. A key difficulty was narrowing down the broad and vague concept to make it more practical at a school level. Some highlighted the importance of framing SD within the context of school and PE by interpreting the SDGs in alignment with the purpose, goals and content of PE. Establishing a shared conceptualisation of SD specific to these contexts was seen as important in making the concept more manageable and actionable.

Sub-theme 2

PETE educators identified challenges in aligning the SDGs with PETE. When introduced to the 17 SDGs during session two, many initially felt that PETE could relate to and contribute to multiple SDGs. However, deeper exploration of the specific targets within the SDGs led to the perception that PETE addressed only a limited portion of the content and descriptions provided for many targets. For example, good health and well-being (SDG #3) was initially seen as one of the most relevant goals for PETE. Yet, upon closer examination, PETE educators felt that only one target (3.4) had a clear connection to PETE. This raised difficulties in determining whether an SDG could be deemed relevant when only one or a few of its targets applied.

PETE educators suggested that it would be more practical for PETE to focus on a subset of the 17 SDGs, acknowledging that the 2030 agenda and the SDGs are broad and that it may be unrealistic for PETE to address all dimensions of SD. They also felt that the PE syllabus for compulsory and upper-secondary school should be able to serve as a guiding framework when selecting SDGs and dimensions of SD relevant to PETE. This discussion highlighted the need for a clearer, context-specific alignment between the SDGs and the goals and content of PE, ensuring that the contributions of PE and PETE to the SD agenda are both realistic and meaningful.

Theme 2: Teaching sustainable development in physical education teacher education

The second theme constituted of two sub-themes: *Integration and Focus* (sub-theme 1) and *Normativity, and lack of rights and wrongs* (sub-theme 2) (Figure 1).

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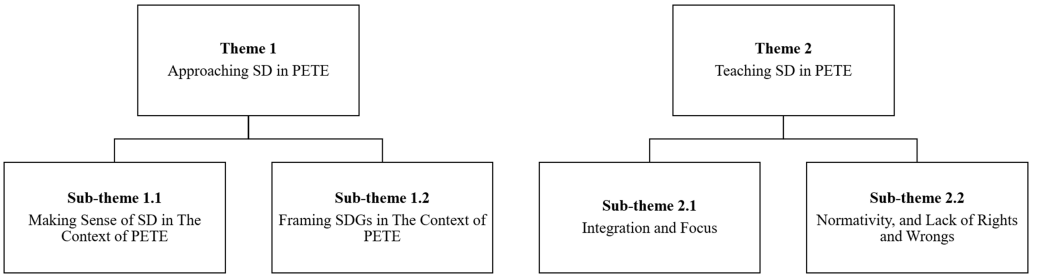


Figure 1. The two main themes and four sub-themes over perceived challenges in relation to the integration of SD perspectives within PETE. PETE = Physical education teacher education; SD = Sustainable development; SDG = Sustainable development goals.

Sub-theme 1

PETE educators were challenged with where SD perspectives should be integrated within PETE courses. One issue raised was whether SD should be incorporated across all initial teacher education programmes, or whether it should only be included within courses for higher grade levels (e.g., upper-secondary school). Another challenge concerned how SD perspectives should be integrated into the programme. Some argued that SD should ultimately be woven throughout all courses, becoming an overarching theme that permeates the entire programme. One participant compared this integration to how commonly recognised challenges in PETE, such as issues of inclusion, could be similarly embedded when discussing teaching approaches. However, others suggested that SD perspectives could be addressed in a single session within the introductory course, aiming to highlight the importance of SD at the outset. Additionally, PETE educators debated which specific aspects of SD should be emphasised and which courses would benefit most from the inclusion of SD perspectives. A related concern was ensuring that all dimensions of SD were adequately represented across the programme, especially since individual teachers might not always be aware of what colleagues are addressing in their respective courses.

Sub-theme 2

PETE educators faced challenges when planning for teaching in SD due to its normative nature and the absence of clear-cut right or wrong answers. Firstly, they recognised the difficulty of teaching SD because of its inherent normativity. They felt that SD always carries a normative dimension, making it complex to encourage students to, in a reflective way, examine their own attitudes, behaviours and similar aspects from an SD perspective. During discussions, one participant remarked: "... and there is also moral and ethical ... and critical ... when you must stand there and force someone to reflect on their own role ... some are prepared for this, while others are not. It is such a balancing act." Another participant echoed these concerns, saying: "... it sometimes feels like a lot of these questions ... there is a lot of guilt involved ... many feel it, many experience it."

Secondly, they anticipated that teaching SD would lead to situations where students might feel frustrated due to the lack of definitive answers. Some referred to their past experiences in teaching, both in compulsory and upper-secondary school, as well as higher education, where students generally seek clear right or wrong answers to problems, making this approach challenging in relation to SD. One participant shared the following:

I have worked quite a lot with upper-secondary school students. Many students can experience enormous frustration that there are no rights or wrongs ... that it becomes so vague to discuss. How can one create an understanding that the discussion in itself can be valuable, and that there may not need to be someone who has interpretive priority but that it can depend.

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Discussion

The overall purpose of the present study was to explore the perspectives of PETE educators regarding the integration of SD imperatives within PETE courses. The findings for the first research question (how PETE educators might integrate SD perspectives within PETE courses) indicated that the proposed pedagogical interventions varied in their goals and core content, leading to different approaches in integrating SD perspectives within PETE. The PETE educators focused on a range of activities, including transformative pedagogy and student-centred learning in ball games, physical activity in the immediate area, accessible swimming education, dance, movement and rhythm and aspects of equality as well as environmental factors when running, outdoor education, experimental learning and aspects of self-awareness. In the context of teaching SD, collaboration among students is a common feature in EfSD, and reflections, peer discussions and group work were consistent features of all interventions (Algurén, 2021; Evans *et al.*, 2017).

While the proposed pedagogical interventions may initially seem to have a limited contribution to the SD agenda, the combined effect of multiple small contributions can be significant. Achieving SD requires collective efforts across all societal sectors, and education plays an important role in advancing SD (Rieckmann *et al.*, 2017). From this perspective, PE may offer valuable contributions to SD, although we can see challenges with contextualisation and recontextualisation of course content when trying to integrate SD perspectives.

Criticism of PE worldwide includes the focus on sport- and performance-based activities, alongside an exclusionary environment that frames health from a biomedical perspective (see e.g., Mong & Standal, 2019; Nabaskues-Lasheras *et al.*, 2019). Similar critiques have been presented in relation to PE in Sweden (see e.g., Larsson & Nyberg, 2017). Integrating SD perspectives into PE could not only increase its relevance for students beyond the classroom but also support the development of knowledge, skills, values, and attitudes necessary to tackle complex issues and foster positive change (Lundvall & Fröberg, 2022). Although SD alone may not resolve these challenges, it represents an opportunity to reframe PE and PETE practices (Fröberg & Lundvall, 2022; Lundvall & Fröberg, 2022).

In higher education, there is both an opportunity and a need to connect PETE practices more explicitly to SD perspectives (Baena-Morales & González-Víllora, 2022). Connections can be made between the proposed pedagogical interventions and the 2030 agenda and the SDGs. For example, those focusing on inclusive ball games and accessible swimming education align with the SDGs good health and well-being (#3), quality education (#4), gender equality (#5) and reduced inequalities (#10). The focus on physical activity in the immediate area may connect to the SDGs quality education (#4) and sustainable cities and communities (e.g., ecological footprints) (#11).

Nevertheless, the relationship between the proposed pedagogical interventions and specific SDG targets is not always clear. For example, inclusive ball games and equal opportunities in swimming can promote physical activity in the short term and support ongoing participation in the long term, which is linked to SDG #3, target 4: reducing premature mortality from non-communicable diseases. Issues of inclusion and equality also tie to SDG #5 (gender equality) and SDG #10 (reduced inequalities), addressing specific targets such as ensuring women's participation in decision-making (SDG #5, target 5) and promoting social inclusion for all (SDG #10, target (2). It is recommended that PETE faculties undertake a comprehensive curriculum mapping exercise to systematically identify and align their educational objectives with specific SDGs and associated targets that their subject can effectively contribute to.

Furthermore, the second research question (what PETE educators perceive to be challenges in relation to the integration of SD perspectives within PETE courses) highlighted four main challenges in integrating SD perspectives within PETE courses. These challenges relate to how to approach and teach SD within the PETE programme. One challenge was the perception of SD as a complex, broad and vague concept. A previous study reported that PETE educators held a diverse set of subjective theories of EfSD and SD and described the two concepts in varied ways, differing

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in content, focus and depth (see e.g., Lohmann & Goller, 2023). In the present study, PETE educators expressed a need for a shared definition that was clear yet adaptable to different contexts. However, there is a risk that a simplified definition might lose its dynamic nature. PETE programmes could benefit from developing a shared working definition or framework for SD guided by existing definitions, such as the UNESCO's key competencies for SD (Rieckmann *et al.*, 2017). This could help align teaching efforts and promote a more coherent approach across the programme.

A second challenge involved determining the relevance of specific SDGs to PETE, especially when only one target within an SDG seemed relevant. Baena-Morales and González-Víllora (2022) argue that merely stating an SDG title may be too generic, and that the targets should be analysed to assess their relevance. In the present study, some PETE educators suggested that PETE should focus on specific SDGs, as the interconnectedness of the 17 SDGs can make the entire agenda overwhelming. Although more research is needed to identify which SDGs and targets should be prioritised within PETE, previous studies have related PE to 14 SDGs and 52 targets (Baena-Morales & González-Víllora, 2023). However, predominately were good health and well-being (target 4: reduce premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being), quality education (target 5: eliminate gender disparities in education) and gender equality (target 1: end all forms of discrimination against all women and girls everywhere) (Baena-Morales & González-Víllora, 2023).

Moreover, a third challenge revolved around where, when and how SD perspectives should be integrated into PETE courses. This question spans various levels, from the structure of the PETE programme to individual teaching activities. Previously, Evans *et al.* (2017) found that perspectives on SD and EfSD had typically been addressed in different ways within initial teacher education, ranging from holistic integration across the curriculum to inclusion as a dedicated compulsory subject or even as a separate, non-compulsory subject. PETE educators should consider undertaking a curriculum mapping exercise to identify where, when and how SD perspectives should be integrated into PETE courses.

Previous research has pointed out the uncertainty surrounding what teaching SD is meant to accomplish (Hofman, 2015), indicating the need for professional learning initiatives that foster exchange of ideas among PETE educators. The fourth challenge related to teaching SD within PETE was the normative and political nature of SD, as well as the lack of rights and wrongs. The challenge related to the normative and political nature of SD, and the tensions that may emerge in teaching practices, reflects findings reported in earlier initial teacher education research (Goller & Rieckmann, 2022). These issues have previously been addressed in the field of SD and require careful consideration when designing teaching activities (e.g., Poeck & Östman, 2020; Wals, 2010, 2011). Furthermore, the tension between concerns about normativity and PETE student frustration over the lack of clear answers reflects the complexity of teaching SD. The PETE educators described the normative nature of SD as emotionally and ethically charged, especially when encouraging students to reflect on their own values and behaviours. While PETE educators aim to avoid moralising, students may still experience discomfort or guilt yet also seek clearer guidance. This highlights a pedagogical balancing act that involves supporting critical reflection without imposing values, while simultaneously offering enough structure to support students in engaging meaningfully with complex, open-ended issues. In this context, professional learning initiatives may be needed to address how PETE teacher educators can handle the normative nature of SD, as well as the lack of rights and wrongs, as part of their teaching assignments. PETE educators could receive targeted training in facilitating discussions on controversial issues. Drawing on pedagogical strategies and principles from environmental education, such as deliberate debates, reflective journaling and other methods that support open-ended inquiry without definitive answers, may also offer valuable approaches for fostering critical engagement in these complex topics (e.g., Monroe *et al.*, 2019).

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Strengths and limitations

The strengths of the present study lie in the PLP and its collaborative learning approach, which facilitated reflections and discussions among PETE educators from diverse areas of expertise. Grounded in socio-cultural learning theory, the PLP provided a setting where PETE educators could learn with and from each other through shared dialogue and joint exploration of teaching practices. The PLP sessions – structured to encourage reflection, peer-discussions and dialogic encounters – may have functioned as mediating tools that supported the co-construction of understandings around SD perspectives in PETE. This collegial environment seemed to create space for more open discussions, including the expression of uncertainty or frustration (e.g., feeling "suffocated" by the breadth of SD), which may have been less likely in a top-down initiative. The collaborative format also appeared to support participants navigate the complexity and ambiguity of SD, suggesting that collective engagement can support deeper and more meaningful encounters with contested and abstract concepts.

Nevertheless, a limitation of this study is the relatively small sample size, which may have restricted the range of perspectives and experiences represented. It is possible that certain viewpoints or alternative interpretations of SD in PETE were not voiced, particularly given the exploratory and dialogic nature of the PLP. At the same time, however, the participants represented diverse demographics and brought different professional backgrounds, academic positions and teaching areas within PETE. This heterogeneity enriched the discussions by allowing for multiple interpretations of SD and its pedagogical implications to emerge.

Moreover, although the PETE educators acted as peers and critical friends that facilitated each other, one limitation may be that power dynamics could have been an issue during the peer-discussions. Such power dynamics could potentially inhibit some participants to freely express themselves without restrictions. With the intention to reduce power dynamics, the PLP managers emphasised that SD involves inherently ambiguous and context-dependent elements, which require critical reflection and peer discussion. Highlighting this ambiguity underscored that all contributions were equally valuable, encouraging participants to share their perspectives openly and reducing potential hierarchical or evaluative pressures.

As another limitation, the PLP was theoretical in nature and focused on designing proposals of pedagogical interventions. While the PETE educators collaboratively designed proposals for pedagogical interventions, these were not implemented or evaluated in practice. Consequently, the present study does not provide insights into how the proposed pedagogical interventions might function in authentic teaching contexts, how students might respond to them, or what practical challenges could arise during implementation. This limits the ability to assess the feasibility of the proposed pedagogical interventions. Nonetheless, theoretical focus allowed PETE educators to engage deeply with conceptual and pedagogical questions surrounding SD perspectives in PETE, without the immediate constraints of classroom realities. This process may have supported a more critical and reflective exploration of underlying assumptions and possibilities for future practice.

The PLP and its contextual uniqueness in a Swedish context may limit its generalisability. Although PE typically encompasses physical activity, sport, movement education and topics related to health and well-being, there are national and regional variations in curricular aims, time allocation and resources across the world (Hardman et al., 2014). These contextual differences mean that the organisation, content and pedagogical priorities of PE can vary considerably across countries and regions, which is important to consider when discussing the integration of SD perspectives in the subject. However, the insights gained may be transferable to similar higher education contexts, particularly in settings where PETE educators are seeking collaborative and reflective approaches to address complex educational challenges such as SD. Readers are invited to consider how the findings of the present study may be applicable or adapted to their own settings.

Moreover, the subjective nature of thematic analysis introduces potential bias, although the researcher aimed to mitigate this through a careful and transparent analysis process. As previously

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stated, however, the authors adopted a reflective approach, actively challenging assumptions to ensure nuanced data interpretation. As part of this, the authors maintained a reflexive stance by engaging in ongoing discussions about their positionality throughout the PLP. During the analysis process, the authors strived to critically examine their interpretations, and parts of the preliminary interpretations were shared and discussed with the PETE educators as a form of participant validation.

Directions for future research

This study offers suggestions on how to integrate SD perspectives within PETE courses and highlights important issues within PETE, such as inclusion, equality and the quest for lifelong engagement in physical activity and healthy lifestyle habits, in relation to the existing subject matter content. While the study adds to existing literature, more research is needed to explore SD perspectives within PETE.

Given that the PLP was theoretical in nature and focused on designing proposals of pedagogical interventions, future research should build on these theoretical proposals by implementing and evaluating selected pedagogical interventions in PETE settings to better understand their practical implications and outcomes. Studies could explore how to bridge theory and practice by not only design but also implement and evaluate pedagogical interventions with a focus on critical incidents and experiences among PETE educators and students. For example, future studies could select one or two of the proposed pedagogical interventions (e.g., the ball games unit or the outdoor education unit) and implement them together with PETE students, to evaluate outcomes (e.g., student learning) and gather valuable feedback from the learner's perspective.

Given the contextual uniqueness of the current PLP in a Swedish context, future research should replicate and extend this study across different geographical and institutional contexts. Such comparative work could provide a deeper understanding of how contextual factors, such as national PE curricula, institutional priorities and local educational cultures, influence the ways in which SD perspectives are interpreted and enacted within PETE and higher education more broadly. Replication in diverse settings would also allow for the identification of both shared and context-specific challenges, thereby contributing to a more nuanced understanding of how SD perspectives can be meaningfully integrated into PETE practices worldwide.

Furthermore, during the PLP, the PETE educators mostly engaged with the social dimensions of SD relevant to PETE, with less attention to economic and environmental dimensions of SD. Therefore, another suggestion is that future studies could explore how PETE educators may engage with economic and environmental dimensions of SD in PETE more directly.

Practical recommendations

Based on the identified challenges, some practical implications can be drawn for the development of PETE programmes seeking to integrate SD perspectives more systematically. Firstly, given the diversity of interpretations of SD, PETE programmes could initiate collaborative processes to establish a shared working definition or framework for SD within the PETE programme. This process could be guided by internationally recognised frameworks, such as UNESCO's key SD competencies (Rieckmann et al., 2017), but adapted to local and disciplinary contexts. Establishing a shared understanding could facilitate coherence across courses and strengthen collective pedagogical direction among PETE educators.

Secondly, PETE educators could conduct curriculum mapping to identify where, when and how SD perspectives are currently addressed and where integration could be strengthened in PETE. This may include embedding SD-related learning outcomes across existing PETE courses rather than introducing stand-alone modules. Integration can be supported through cross-disciplinary collaboration and by linking SD perspectives to PETE themes, such as health,

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inclusion, equality and movement culture. As part of this, focusing on specific SDG targets – rather than broad SDG labels – can make the relevance of SD within PETE more concrete and actionable.

Thirdly, given the challenges related to the normative and political character of SD, PETE programmes should provide educators with professional learning opportunities focused on handling controversial issues and supporting students' ethical reflection. Professional learning opportunities could include pedagogical approaches, such as structured debates, dialogic teaching and reflective journaling, which allow students to critically engage with complex SD dilemmas without imposing specific values. Such approaches can foster a balance between open inquiry and guided ethical reflection.

Fourthly, creating opportunities for PETE educators to exchange ideas and experiences is essential for building collective capacity to integrate SD perspectives within PETE. Collaborative professional learning can help reconcile differing interpretations of SD, enhance educators' confidence in addressing its multifaceted and contested nature, and support them in navigating its normative and value-laden dimensions. Such environments can foster the sharing of teaching strategies, promote critical reflection and address challenges related to when, where and how to integrate SD perspectives in PETE. Pedagogical approaches that encourage open-ended inquiry, critical thinking and dialogue (e.g., reflective journaling, deliberative discussions and experiential learning) may be particularly valuable. Future work should also prioritise the implementation and evaluation of pedagogical interventions, bridge theory and practice while exploring all three SD dimensions (social, environmental and economic) in PETE.

Finally, as previously mentioned, replication of similar studies in other geographical and institutional contexts would be valuable to examine how contextual factors, such as national PE curricula, institutional culture and available resources, shape the integration of SD perspectives within PETE. Comparative research could generate insights into both context-specific and transferable practices, supporting the development of more context-sensitive approaches to integrate SD perspectives in PETE.

Conclusion

In conclusion, the present study provides suggestions for the potential of integrating SD perspectives within PETE courses, addressing key challenges such as inclusion, equality and preparing PETE students for lifelong physical activity participation. The present study also identifies challenges in approaching and teaching SD within PETE courses and emphasises the need for further research, particularly in bridging theory and practice. PETE faculties are recommended to undertake a comprehensive curriculum mapping exercise to systematically identify and align their educational objectives with specific SDGs and associated targets that their subject can effectively contribute to.

Acknowledgements. The authors are grateful to the participants for their involvement, interest and commitment.

Financial support. The project has received funding from the Swedish Research Council for Sport Science.

Ethical standard. All procedures in the study were conducted in compliance with general ethical norms and with the ethical standards mandated by the Swedish Ethical Review Authority.

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https://doi.org/10.1017/aee.2025.10093 Published online by Cambridge University Press

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Cite this article: Fröberg, A., & Lundvall, S. (2026). Integrating Sustainable Development Within Physical Education Teacher Education Courses: A Professional Learning Project. *Australian Journal of Environmental Education* **42**, 439–458. https://doi.org/10.1017/aee.2025.10093

https://doi.org/10.1017/aee.2025.10093 Published online by Cambridge University Press