Australian Journal of Environmental Education (2025), 1–19
doi:10.1017/aee.2025.6

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Research at the Nexus Between Physical Education and Environmental Education: A Narrative Integrative Review Through a Physical Literacy Lens

Johannes Carl[1], Kathryn Riley[2], Jacqui Peters[3] and Peta J. White[3]

[1]Institute for Physical Activity and Nutrition, School of Health and Social Development, Deakin University, Geelong, Victoria, Australia, [2]Faculty of Education, University of Manitoba, Winnipeg, MB, Canada and [3]School of Education, Centre for Regenerating Futures, Deakin University, Burwood, Victoria, Australia
Corresponding author: Johannes Carl; Email: j.carl@deakin.edu.au

(Received 24 October 2024; revised 11 February 2025; accepted 13 February 2025)

Abstract
Following inter-/transdisciplinary ideas, environmental education inherently collaborates with other subjects, including physical education. As the work with other subjects might be jeopardised by differing worldviews and paradigms, it is worth illuminating compatible and incompatible positions for inter-/transdisciplinary work. In physical education, the concept of physical literacy (PL) has recently gained considerable attention and adopts a student-centred perspective on human existence and learning. Therefore, the goal of the present narrative integrative review was to review the existing literature at the nexus between physical education and environmental education through a PL lens (five pre-defined concept assumptions). After screening for eligibility, a total of 129 articles were assigned to five different thematic categories: (a) conceptual discussion/argumentative patterns, (b) curricular discussion and international comparisons, (c) programming/intervention content, (d) teacher and enabler perspectives and (e) student outcomes/perspectives. The synthesis revealed that PL can harmonise with the educative work when respecting the disciplinary interests of both physical education and environmental education. However, few intervention studies translate the holistic PL claims into interventions. Accordingly, evaluations with teachers or students less frequently integrated holistic learning experiences in line with PL. In summary, previous research at the nexus has not yet exhausted its full inter-/transdisciplinary potential.

Keywords: Environmental education; health; interdisciplinary; learning; physical education; physical literacy; students

Introduction

The nexus of physical education and environmental education

Acknowledging that human existence is inherently interwoven with worldly ecologies (Braidotti, 2019; Riley et al., 2024), the field of environmental education has, over time, turned into a subject/practice with its own paradigmatic assumptions, methodological approaches, organisational structures and practical solutions (Hart, 2022). In responding to different socio-ecological crises (Casas et al., 2021; Stickney & Skilbeck, 2020), environmental education has undergone a remarkable historical journey and, as a field, undertakes intense reflections about its development, progress and trends (Carter & Simmons, 2010; Gough, 2013, 2024; Palmer, 2002). This dynamic development also finds its expression in the *Australian Journal of Environmental Education* as a 40-year-old academic journal promoting exchange in the scientific sphere of environmental

education since its inception in 1984. One immanent feature of environmental education is its strong inter-/transdisciplinary focus, integrating teaching and learning across different fields including biology, geography, chemistry, geology, physics, economics, sociology, natural resources management, law, politics, arts-based practices and outdoor education (Adsit-Morris, 2017; Raven et al., 2008). As these connections provide the opportunity to work together with other disciplines and share knowledge mutually (Carlin, 2016; Leahey et al., 2017), it is indicated to reflect on potential synergies but also tensions in relation to other scientific fields. Despite inter/transdisciplinary openness, it is important that curricular and pedagogical enactments in environmental education remain integral to the overarching aims and purposes of the field (Vincent & Focht, 2011). While integration or the synthesis of knowledge is the stated goal, all disciplines are not equal but exist in a hierarchy. For example, formal knowledge is privileged over lived stories or local knowledges, and pure sciences are more highly valued than the social sciences, humanities and fine arts. Thus, careful attention is needed to ensure that inter/transdisciplinary approaches work to enrich environmental education, rather than jeopardise, or delegitimise, the field.

One scientific field that is mentioned less frequently when explicitly discussing disciplinary and practical 'points of contact' of environmental education is research on physical education. Human movement can be observed from different angles (Balagué et al., 2017) – the adopted perspectives can, for instance, be medical, sociological, biomechanical, psychological, or historical – and physical education emphasises the learning that can and does occur for individuals when they have opportunities to move (Johnson & Turner, 2016); accordingly, the perspective of physical education on human movement is pedagogical in nature. As human movement, in accordance with existentialist assumptions, always occurs in an environmental space (Whitehead, 2007), it is worth reflecting about corresponding points of contact between physical education and environmental education. Indeed, when exploratorily combining the search terms "physical education" and "environmental education" (conditional link through the Boolean operator "AND") and chronologically mapping the corresponding search hits from the database *google scholar*, it turns out that the number of scientific contributions at this disciplinary "nexus" (Riley & Proctor, 2022) has increased exponentially within the last four decades (see Figure 1). Targeting these 'points of contact' between environmental education and physical education, it is obvious that analyses about these synergies and conflicts are identified within the pedagogical sphere.

Physical literacy

Interestingly, researchers of both environmental education and physical education have intensively discussed different forms of 'literacy' (Bailey, 2022; Carl, Barratt, Töpfer, Cairney & Pfeifer 2022; Carter et al., 2010; Maurer & Bogner, 2020; McBride et al., 2013) that enable and empower individuals to master essential demands in their domain. A bibliometric analysis has recently modelled the growing number of annual studies for the field of environmental literacy (Vijaykumar & Naseema, 2021). Two studies have also identified an exponential increase in studies on physical literacy (PL) (Bailey, 2022; Carl et al., 2022) as the respective conceptualisation for the corporeal sphere. Among the available pedagogical models, such as cooperative learning, sport education and teaching games for understanding, PL embodies different assumptions as a result of a hybridisation (Fernandez-Rio & Iglesias, 2024). One asset of PL can be identified in the narrative that the concept detaches from a mere orientation on physical aspects by also encompassing cognitive (e.g., knowledge and understanding), affective (e.g., enjoyment, motivation and confidence) and social aspects (e.g., communication skills, sense of belonging) when describing movement (Barnett et al., 2023; Keegan et al. 2019). The scientific field has yielded many definitions (Bailey, 2022), amongst which the Australian framework understands PL as the "integrated physical, psychological, social and cognitive capabilities to support health promoting and fulfilling movement and physical activity – relative to their situation and context –

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

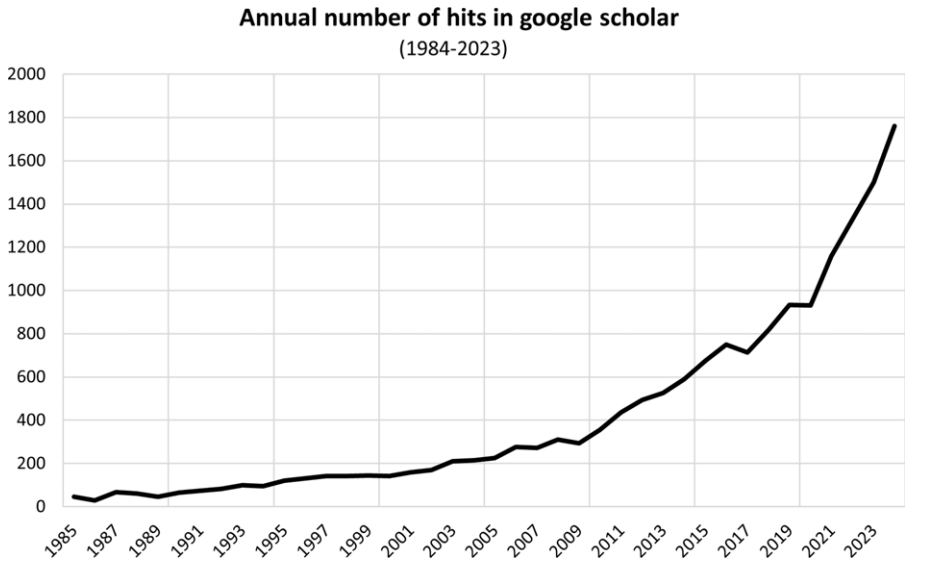

Figure 1. Development of the annual hits with the terms "physical education" and "environmental education" in the *google scholar* database in the last 40 years.

throughout the lifespan" (Keegan et al., 2019). This definition also informed the subsequent analysis (see the methodology section).

PL takes a holistic, person-centred view and conceptualises a lifelong, personal "journey" for individuals' physical activity (Holler et al. 2019; Santos, Newman, Aytur & Farias 2022). PL is based is on profound philosophic assumptions (Whitehead, 2007). Under a monist umbrella, PL assumes that the physical, cognitive, affective and social aspects mentioned above are deeply intertwined and form one integral unit. Under an existentialist umbrella, PL assumes that human behaviour cannot be separated from the social and physical environment. Under a phenomenological umbrella, PL assumes that individual perspectives are unique and require idiosyncratic observations (Whitehead, 2007). Although the term "physical literacy" first emerged in 1884 in a description of the physicality of an Indigenous culture (Cairney et al., 2019), the term has gained more attention since the 2000s and, in the meantime, spread into different spheres, including physical education (Dudley et al., 2017). Nowadays, PL finds political and strategic support on the global level through its inclusion in important documents of UNESCO (e.g., Quality Physical Education Guidelines for Policymakers; see UNESCO, 2015). Given that research and policy in physical education has more strongly adopted a PL lens recently, the goal of the present study was to examine how the scholarly work at the nexus between physical education and environmental education stands in compatibility with PL. Encouraged by the fact that single PL articles in the recent past already delved into ecological aspects (Carl et al., 2024; Lyngstad & Saether, 2021; Riley et al., 2023), we systematically mapped the inter-/transdisciplinary field from a meta perspective by theoretically looking through this "literacy" lens with its holistic, empowering perspective. In this regard, the current article follows the question: which PL aspects are discussed at the nexus, when physical education experiences an environmental nuance or when environmental education becomes 'physical'?

Methodology

Among the various review types suggested in the academic literature (Sutton et al., 2019), we have applied an integrative review methodology which allows for the combination of different study

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

designs (e.g., experimental and non-experimental research) and data formats for synthesis (Whittemore & Knafl, 2005). Compared to other review methods, the integrative review does not exclusively concentrate on quantitative studies (e.g., extracting effects for meta-analyses) or qualitative studies (e.g., student experiences for qualitative meta-synthesis) but is both paradigmatically and methodologically open for integration on a higher level. This explicit breadth was required, as we anticipated a large spectrum of goals and approaches among the primary articles. We adhered to the following steps: (a) problem identification (see introduction), (b) literature search, (c) data evaluation, (d) data analysis and (e) presentation (Whittemore & Knafl, 2005).

Literature search and eligibility criteria

After several search trials, we decided to use the following term combination adhering to Boolean notation: ("environmental education" OR "outdoor education") AND ("physical activity" OR "physical education"). We have added "outdoor education" to the "environmental education" term and "physical activity" to the "physical education" term to ensure that we have also covered relevant articles from neighbouring academic fields. In this regard, we proactively acknowledged outdoor education to be a distinct field that is more defined by the "where" rather than the "what" involving teaching, learning and experiencing in an outdoor and/or out-of-school environment (Becker et al., 2017). We ran this combination in a total of 16 databases via the meta-database EBSCOhost (for details, see Supplementary File 1). In the first step, the first author (JC; postdoctoral researcher) screened titles and abstracts of the search hits. We formulated the following inclusion criteria: (a) full article format (i.e., not only conference contribution); (b) English language; (c) research at the intersection of physical education and environmental education; (d) educational claim (i.e., not only physical activity in the outdoor context); (e) publication in year 2000 or later (due to the dynamic development of the environmental education field: Palmer, 2002). Accordingly, we excluded, for instance, (a) editor notes, (b) Spanish full texts, (c) outdoor physical activity concepts with a restorative wellbeing function (e.g., clinical) or virtual reality studies, (d) adventure sports without explicit pedagogical note and (e) articles that were older than 25 years. Afterwards, JC generated a first categorisation suggestion based on the broad goals of the articles. In the second step, the same person checked all full-text articles and assigned the articles to the inductively derived categories (double coding permitted) to handle different purposes and functions of the articles separately. JC read all full-text articles for eligibility and extracted the most essential information from a PL perspective (for the theoretical assumptions, see next section). Across the entire eligibility and extraction process, reassignment, double-coding and removal of any article was permitted. It was assumed that extractable aspects overlapped between the different categories.

Analysis

The data extraction contained: (a) author and year information; (b) study design and findings section; and (c) a PL interpretations section. The first author analysed all articles per inductive category, attempting to identify commonalities (maximisation of homogeneity) and differences (maximisation of heterogeneity) across the primary studies. The derivation of findings followed an inductive approach, working with the primary material/summary without pre-defined synthetic endeavours. The PL field has spawned many assumptions about the concept since its "academic birth" at the turn of the 21st century (Edwards, Bryant, Keegan, Morgan & Jones 2017; Young, O'Connor & Alfrey 2020). Considering it is impossible to concentrate on all assumptions characterising the "idealist" (Edwards et al. 2018; Young, O'Connor & Alfrey 2023) core of the concept, we focused on the following assumptions for analysing and interpreting research at the nexus: (a) PL incorporates a holistic understanding of learning encompassing physical, cognitive,

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

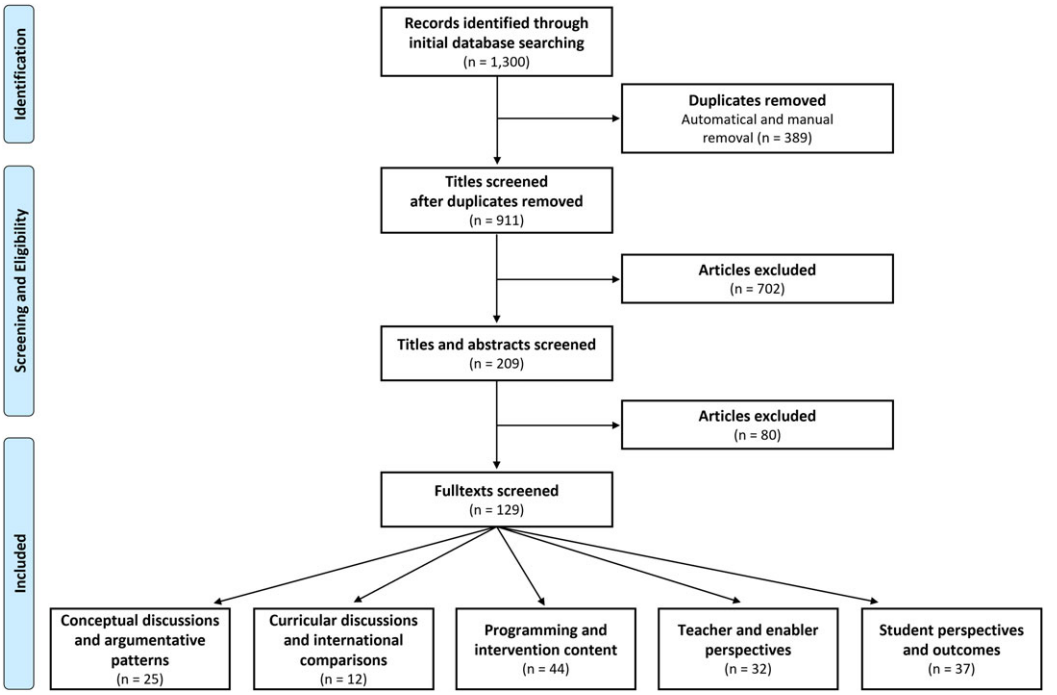

Figure 2. Flow chart of the review process. *Note*: full-text screened articles could be double categorised (for details, see Supplementary Table 2).

affective and sometimes even social domains for physical activity (Carl et al., 2022; Keegan et al., 2019); (b) these learning domains are linked and interwoven (i.e., also embodied); (c) PL is a never-ending journey, advocating for lifelong learning (Young et al., 2020); (c) PL is linked to the environment with its opportunities and affordances (see existentialism: Whitehead, 2007); (d) PL questions the value of mere competitive orientations and holds inclusive premises; (e) PL places the individual in the focus of pedagogical attention and, therefore, favours student-centred (instead of norm- or criterion-centred) approaches (Santos et al., 2022).

Results

Search process and overview

The search yielded exactly 1300 initial hits. The removal of duplicates resulted in 911 articles entering title and abstract screening. Among these, a total of 209 articles still underwent the integrative full-text screening and, if deemed eligible, data extraction (Figure 2). We finally assigned 129 articles to five different categories. These categories were inductively derived to structure the results and accounted for the fact that the articles approached the nexus between physical education and environmental education with different functions and purposes, thus requiring separate reporting. More specifically, $n = 25$ articles contained "conceptual discussions and argumentative patterns," $n = 12$ articles contained "curricular discussions and international comparisons," $n = 44$ articles contained "programming and intervention content," $n = 32$ articles contained "teacher and enabler perspectives," and $n = 37$ articles contained "student perspectives and outcomes." Information about double coding can be retrieved from Supplementary Table 2. The following sections considered the number of assigned articles to appropriately guide the length of the respective category reports.

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

Conceptual discussions and argumentative patterns

The discussion at the disciplinary nexus between physical education and environmental education is hallmarked by different terms and concepts, including, for instance, eco-motricity (Pazos-Couto, Arevalo, Middleton & Kawada 2021), outdoor physical education (Attali & Saint-Martin, 2017), wilderness education (Fleishack, 2012), nature-based physical activity (Gruno & Gibbons, 2020), "friluftsliv" (Beery, 2013; Lyngstad & Saether, 2021; Sjödin, Quennerstedt & Öhman 2023), or outdoor adventure education (Stratton, 2022; Williams & Wainwright, 2016a). Therefore, attention was warranted to not further blur the terminological boundaries and not attribute disproportionate claims to certain concepts (Martin & McCullagh, 2011). While most articles argued through a physical education lens to stress the inspiring or enriching potential of certain outdoor elements (Frühauf et al., 2023; González, 2001; Rose, 2001; Stratton, 2022), Riley and Proctor (2022) underscored the value of an authentic transdisciplinary endeavour to effectively nourish this interface or nexus. In summary, we recognised parallels and overlaps with discussions on PL. For instance, many researchers highlighted holistic (e.g., bio-psycho-social) health potentials or multidimensional (e.g., physical, cognitive, affective, social) learning outcomes (Bortolotti, 2021; Gruno & Gibbons, 2020; Martin & McCullagh, 2011; Pignato, Patania, Manzo & Coppola 2021; Stratton, 2022; Williams & Wainwright, 2016a). There was also an interesting parallel drawing on the pedagogical metaphor of a "journey" (Fleishack, 2012; Quay, 2002; Williams & Wainwright, 2016b), denoting experiential and developmental processes (Green et al., 2018; Taplin, 2019). Moreover, conceptual articles strongly underlined human-nature bonds (Beery, 2013; Gruno & Gibbons, 2020; Luthe et al., 2007; Lyngstad & Saether, 2021; Pignato et al., 2021; Quay, 2002), thus directly or indirectly corroborating existentialist descriptions of PL about interactions with the physical (and social) environment (Durden-Myers et al., 2021; Riley & Proctor, 2023; Whitehead, 2007). Similarly, researchers underlined that nature basically provides opportunities to be physically active without competitive aspirations (Beery, 2013; Rose, 2001; Sjödin et al., 2023). Both the outdoor education and the PL literature shared a narrative that portrayed a development away from objective and normative standards (e.g., competencies that have to be mastered) toward individual experiences and responsibilities (Cosgriff, 2008; Sjödin et al., 2023; Williams & Wainwright, 2016a). Some scholars, however, criticised this human-centered view, as the modern era also emphasises person-(ego)centred acting and requests a shift towards sustainability, environmental awareness and connections with Earth (Martin & McCullagh, 2011; Mikaels, 2018; Pazos-Couto et al., 2021; Sjödin et al., 2023). In this regard, there is risk that the academic discussions of both subjects — physical education and environmental education — might go into diverging directions in the future. If the diverse voices of physical education tend to more strongly stress student-centred acting with rejecting external orientations, whereas environmental education increasingly focuses goals external to humans' experiences (e.g., along with increasing pressure from climate change), both subjects might develop in opposite directions. As a result, incompatibilities might arise and the nexus, with its potential applications, might reduce. Thus, caution must be warranted when cultivating an overly positive standpoint for the future nexus.

Curricular discussions and international comparisons

On the curricular level, Tortella et al. (2021) generated a multinational position statement that emphasised the role of outdoor movement education in fostering holistic experiences by promoting "not only motor skills and competence but also the cognitive, social, relational and affective development of the child" (p. 452). Accordingly, curricular frameworks should encapsulate a wide range of pedagogical skills and holistic student outcomes (Atencio & Tan, 2016). Regarding the "domains" to be addressed, there appeared to be a strong parallel to, and compatibility with, the corresponding curricular debates on PL (Brown & Whittle, 2021;

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

Wainwright et al., 2016). The Scandinavian concept 'friluftsliv' with its plea for outdoor experiences and outdoor life was conceptualised to transport values of democracy and equity (Backman, 2011a). While the equity claim is, for instance, explicitly reflected in inclusive potential of PL (Arbour-Nicitopoulos et al., 2018; Pushkarenko, Causgrove Dunn & Wohlers 2021), there were few explicit conceptual connections of PL to democracy (Land & Vidotto, 2021; Lyngstad & Saether, 2021; Santos et al., 2022). Apart from these few thematic overlaps, only parallels in the narratives for curricular discussions could be drawn. For instance, similar to PL, researchers criticised 'old-fashioned' versus 'contemporary' conceptualisations of education. Curricular concepts in outdoor education have moved from military and mental toughness functions to adventurous approaches as well as more lifestyle-oriented, progressive and ultimately critical understandings (Atencio & Tan, 2016; Rodrigues & Payne, 2017). Another parallel to PL was the finding that outdoor education criticised the dominance of curricular performance codes (Backman, 2008, 2011a), conceptual ambiguities (Boyes, 2000) and the lack of transfer of the curriculum into practice (Backman, 2008, 2011b; Sutherland & Legge, 2016). Fröberg et al. (2023) broadly analysed the Swedish curriculum from a sustainability perspective and found many aspects that were also voiced by PL literature, such as the inclusion of health promoting behaviours into daily routines, the planning of activities, ethical aspects, empowerment, planning of activities (knowledge), moving in different contexts and testing of different activity forms.

Combined, this nexus category was strongly informed by insights from outdoor education. The discussions share certain narratives about the developments of outdoor education and physical education over the last decades. Commonalities through the applied PL lens largely refer to more overarching aspects of education (e.g., the multidimensional nature of learning goals, democracy) instead of permeating to tangible ideas on how to specifically design education. A large portion of articles from this category stemmed from the Scandinavian or the Pacific region, which limits the current debate to single geographical regions and challenges the generalisability of potential conclusions.

Programming and intervention content

In the two previous sections, we discovered a variety of different concepts studied; this heterogeneity was also recognised when examining the intervention content through the lens of PL. Concrete goals or postulated outcomes in the context of a programme were often structured in line with multidimensional (often physical, cognitive, affective and social) goals in the activity context. For instance, Finn, Yan and McInnis (2018) targeted physical growth, provided information about healthy living, aimed to develop students' self-accomplishment and fostered team building. Similarly, Schwab and Dustin (2014) separately listed technical skill building, critical thinking, enjoyment, and social interaction. A total of six additional articles formulated content relatable to all four PL domains (physical, cognitive, affective, social) and met the claim of a "complete" list (Casado-Robles, Viciana, Guijarro-Romero & Mayorga-Vega 2022; Clocksin, 2006; Cook, Boyan, Mendelsohn, Green & Woolvett 2007; Floresca, 2019; Hall, Robinson, Bradford & Costa 2022; Philippi & Mulhearn, 2023). Interestingly, the outdoor education programme by Nguyen (2015) was split into different sessions and consequently defined distinct psychomotor, cognitive and affective goals for each day. The adventure education programme for physical education teachers by Kurtzman, Beddoes and Gaudreault (2023) clearly prioritised affective and social domains. From a methodological perspective, we identified strong compatibility with PL when favouring non-linear over linear/directive teaching styles (Colella & D'Arando, 2021), student-centred over teacher-centred approaches (Hall et al., 2022; Lamoneda, González-Víllora, Evangelio & Fernandez-Rio 2024; Nguyen, 2015) and meaningful activity experiences over performance orientation (González, 2001; Gruno & Gibbons, 2021; Lamoneda et al., 2024). Many researchers in that space have employed approaches of experiential learning (Bentsen et al., 2022; Finn et al., 2018; Lamoneda et al., 2024; McNamee & Timken, 2017),

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

offering student exploration and PL-compatible identification of activity preferences. However, many scholarly endeavours at the nexus outlined the potential to enrich existing physical education through a series of outdoor activities (Chen, 2016; Clocksin, 2006; Cook et al., 2007; Finn et al., 2018; Gagnon, 2024; Gruno & Gibbons, 2020; Kurtzman et al., 2023). Albeit probably not explicitly intended, the corresponding presentation logically tended to follow an activity-centred rather than student- or learning-centred reporting, implying that an important tenet of PL-enriched pedagogy would be violated when prioritising a task or activity orientation (Young et al., 2020). In line with this activity-centred reporting, it was not always easy to interpret intervention content through the theoretical PL lens, as the concept is not a programme per se and rather has the potential to dictate the 'stance' or 'atmosphere' in the background. Although many researchers stressed the importance of autonomous learning elements (Casado-Robles et al., 2022; Colella & D'Arando, 2021; Lamoneda et al., 2024) and opportunities for students to "self-select activities that match their abilities and interests" (Menear et al., 2006, p. 23), not many articles provided explicit didactical differentiations.

In summary, for this section on "programming and intervention content," we identified considerable differences between outdoor education and environmental education. Articles adopting an outdoor education perspective predominantly maintained a physical activity or physical education focus and were, therefore, inherently interested in fostering individuals' familiarisation process towards an active lifestyle. Some articles even embodied an explicit lifetime orientation for their programme (Gagnon, 2024; McNamee & Timken, 2017; Nguyen, 2015; Schwab & Dustin, 2014), which harmonised with the PL aspiration for "engagement in physical activities for life" (International Physical Literacy Association, 2017, front page). In turn, an environmental education perspective within the nexus emphasised sustainability aspects, in which physical activities served as a means toward environmental goals, such as environmental knowledge, attitudes, or behaviours (Gómez Quintana et al., 2023; Gruno & Gibbons, 2020; Li, 2022; Mischenko et al., 2023; Santos-Pastor, Ruiz-Montero, Chiva-Bartoll, Baena-Extremera & Martínez-Muñoz 2022). These extrinsic functions may be negatively called an 'instrumentalisation' of physical education or physical activities and do partially conflict with the person-centred and idealist PL orientations toward individual's PA.

Teacher and enabler perspectives

Teachers are central actors for educational processes, with studies providing insights on their experiences at the nexus. Indeed, several studies have revealed that teachers aim to promote holistic development, learning and outcomes (Becker, Grist, Caudle & Watson 2018; Blakey, 2018; Cooley et al., 2015; Gilkes, Wintle & Reed 2024; Timken & McNamee, 2012). However, although elements from different learning domains could be identified (e.g., cognitive, social, affective), most reports did not specify these multidimensional descriptions in the physical activity context directly serving to promote active lifestyles. Instead, the majority of these articles extracted generalised goals independent from the physical education sphere (e.g., personality aspects or transferable skills). Dahl, Standal and Moe (2019) conducted focus groups with more experienced teachers who encountered decreasing physical abilities (physical domain of PL) and regressing interest, abilities and experiences regarding outdoor activities (friluftsliv) among the student cohorts over time. Interestingly, several studies independently found that teachers were aware of the particular role of affective and emotional experiences in students (Braga et al., 2017; Gilkes et al., 2024; Legge, 2022), with educators having the responsibility to orchestrate pupils' emotions (Thomas, 2015). Teachers were also cognisant of the relevance to create affordable and outdoor education-friendly environments (Dyment & Bell, 2007, 2008; Jidovtseff, Kohnen, Belboom, Dispa & Vidal 2021) to let interactions of students with places and nature "thrive." Moreover, teachers were interested in also creating a fair and inclusive environment (Dahl et al., 2019; Fröberg et al., 2022), which aligned with the claims of PL to promote human flourishing based on experiential

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

and embodied engagement with movement from one's situated context (Pushkarenko et al., 2021). Admittedly, many screened studies did not allow us to draw any interpretations through, or implications for, PL. In these studies, the scholarly focus was not placed on students (e.g., professional teacher development) or the research questions referred to aspects of environmental education or sustainability concurrently exhibiting loose links to PA. Nevertheless, teachers welcomed the outdoors as an opportunity to repress traditional sport and competition in favour of cooperation and positive social interactions (Gilkes et al., 2024; McNamee & Timken, 2017). Furthermore, the facilitators themselves expressed the hope that corresponding activities should contribute to enhancing lifetime physical activity and healthy habits (McNamee & Timken, 2017; Osborne, 2012; Timken & McNamee, 2012). Despite these positive aspects voiced by teachers, the screening of the literature also uncovered some negative aspects related to outdoor education. For instance, teachers often levelled concerns regarding their didactical ability to provide outdoor education (Atencio et al., 2015; Dyment, 2005; Mañanas-Iglesias et al., 2023; Richards et al., 2018) and faced considerable challenges when intending to organise educational activities at the nexus (Ayotte-Beaudet et al., 2024; Jidovtseff et al., 2021; McNamee & Timken, 2017). Taken together, teachers voiced openness and interest regarding educational activities at the nexus. Across the articles screened, physical education more frequently served as a starting point than environmental education. Although the alignment of education with PL appeared realistic through the lens of teachers, most dominant challenges referred to teacher skills and organisational barriers. Studies are lacking with other relevant enabler or stakeholder groups, such as school administrators or parents (Becker et al., 2018; Dyment & Bell, 2008).

Student outcomes and perspectives

As the PL concept inherently embodies a student-centred understanding (Santos et al., 2022), the category of 'student outcomes and perspectives' was of particular importance. Many studies have integrated an assessment of students' PA, whilst often even employing objective measurement devices (e.g., accelerometers). Almost all studies — irrespective of whether the programme referred to geocaching (Battista & West, 2018), loose parts (Engelen et al., 2018), nature preschools (Ernst et al., 2021; Fyfe-Johnson et al., 2019), outdoor concepts (Casado-Robles et al., 2022; Hernawan et al., 2024; Mygind, 2007; Peacock et al., 2021), or orienteering (Mandrillon, Desplanques & Gottsmann 2024) — registered higher values of children's physical activity levels compared to a baseline or a regular programme. In line with this operationalisation priority, many studies at the nexus assessed the final outcome of PL (i.e., the actual activity engagement). When analysing student outcomes pertaining to the domains of PL lens, only few articles adopted a holistic perspective on learning outcomes. Floresca (2019) directly quantified the learning portion of a nature walk programme for physical education and localised 50% of individuals' learning effects on the affective, 27% on the cognitive, 9% on the social and 14% on the physical level. Interestingly, several programmes emphasised affective variables (Armour & Sandford, 2013; Bonavolonta et al., 2021; Brewer & Sparkes, 2011; Gatzemann et al., 2008; Samsudin et al., 2021) and indirectly corroborated this quantification. Cotterill and Brown (2018) evaluated the effects of a dinghy sailing programme with a qualitative design and extracted a myriad of positive outcomes across the different PL domains. Likewise, the students in the mixed-methods study by Mandrillon et al. (2024) verbalised many positive lessons learned from orienteering activities that could be clustered to the different PL domains. Adopting a self-critical perspective, Finn et al. (2018) admonished future studies to complement existing outcome categories with operationalisation such as well-being, attitudes, or learning. Two studies harmonised well with PL for other reasons than the learning domains: a practical epistemology analysed students' meaning making of being outdoors and their connection to place with illustrative existentialist descriptions whilst yielding intensive feelings, elaborate reflections, social statements and embodied experiences (Lundvall & Maivorsdotter, 2021); Sanderud et al. (2020) described the continuous

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

transformations of children in interaction with winter landscapes resulting in competence gains in the dynamic environment and embodiment manifestations between existential knowledge and skills. In summary, however, several articles did not hold any implications or interpretations for PL. Studies cultivating an environmental education claim logically concentrated more on environmental learning outcomes (Cuenca-Soto et al., 2023; Fang WeiTa et al., 2017; Huang & Reynoso, 2018; Lavie Alon, 2015; Mischenko et al., 2023; Santos-Pastor et al., 2022).

Discussion

This article intended to examine how PL stands in compatibility with the scholarly work at the nexus between physical education and environmental education. To achieve this, we globally summarised research at the nexus between physical education and environmental education using an integrative review methodology. Finally, we inductively extracted five categories spanning "conceptual discussions and argumentative patterns," "curricular discussions and international comparisons," "programming and intervention content," "teacher and enabler perspectives," and "student outcomes and perspectives" from the identified articles. Depending on the disciplinary access of the concerning authors, articles approached the nexus more with either an environmental education or a physical education interest, but rarely from an authentic inter-/transdisciplinary perspective. To avoid conflation or co-option between disciplines, it is essential to retain important disciplinary differentiations, such as environmental education, adventure-based education, or outdoor education (Williams & Wainwright, 2016a, 2016b; yet also acknowledge their deep interconnections and pedagogical and curricular alignments across practices. The present article with its pragmatic and balanced search terms revealed that relatively more articles initially set a physical activity or physical education scenery to introduce their topic. This finding might reflect that physical education — in some countries the subject designation is connected with a "health" attribute (Annerstedt, 2008; Macdonald, 2013) — still has a stronger curricular support (e.g., separate school subject) at the formal level worldwide as compared to environmental education. For instance, there is a discrete learning area "Health and Physical Education" in Australia whilst environmental education may be woven into "Science," "Geography," or "Humanities and Social Sciences." Given the opportunity, or maybe even necessity, of environmental education to cultivate inter-transdisciplinary connections, the adoption of a PL lens is worth considering to connect the moving body with earthly ecologies, as the concept has gained increasing attention in academic discussions and in practices worldwide (Bailey, 2022; Carl et al., 2023). Specifically for environmental education, PL in its idealist sense (Edwards et al., 2018; Young et al., 2023) offers to describe students who sensitise strong connections to their body during movement, with flow states allowing the individual to also connect to the world and benefiting learning during educational practices (Boniface, 2000). Teachers are invited to acknowledge that an authentic involvement of the body might promote quality education across subjects by meeting goals from several subjects that were previously considered as subjectively incompatible.

From a thematic standpoint, the synthesis regarding the first two categories (i.e., the conceptual and curricular discussions at the nexus) has basically endorsed the opportunity to realise teaching and learning in compatibility with PL. It is didactically possible to coalesce physical, social, cognitive and effective learning goals for lifelong engagement in lifelong physical activity whilst prompting students for environmental knowledge, ecological awareness and sustainable practices (Thomas et al., 2019). Importantly, PL philosophically assumes that physical activities cannot be separated from their physical and social environment (Elsborg et al., 2024; Land & Vidotto, 2021; Riley & Proctor, 2023; Whitehead, 2007), and indeed being with nature holds promise to broaden the spectrum of human activity locations. Simultaneously, this review demonstrated that the corresponding literature has yielded few best practice examples on how to transform the

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

conceptually compatible ideas into pedagogical practices. Relatedly, most evaluations of teacher and student outcomes assigned less priority to holistic experiences with physical activities. In summary, we identified a contrast between the theoretical opportunities as expressed in the first two categories (conceptual aspects and argumentative patterns, curricular aspects and international comparisons) and the more applied and empirical findings in the last three categories (programming and intervention content, teacher and enabler perspectives, student outcomes and perspectives). Two major implications arise from this situation. First, the PL literature itself should further explore and discuss applications at the nexus (e.g., outdoor activities, environmental education, education for sustainable development, adventure-based learning) to overcome the theory-practice disconnect. Similar to other research activities related to PL, the stakeholders should prevent "un-couplings" from idealist PL conceptions (Young et al., 2020). Second, researchers can benefit from escaping their silos (O'Connor & Jess, 2020) to intensify debates at the nexus under authentic inter-/transdisciplinary perspectives (Riley & Proctor, 2022) with an explication of inclusive, student-centred, embodied and multidimensional learning goals for PA. The different academics, however, should be clear of their expertise and scientific positionality along with the potential advantages and risks arising from such a collaboration.

With its focus on education in, about and for the outdoors usually enacting some form of movement (Priest, 1986), outdoor education is positioned as an important interlocutor between physical education and environmental education. Thus, outdoor education is a crucial inter-/transdisciplinary area of inquiry that has the potential to promote both ecological and physical literacy for a more ecologically attuned and motivated mover (Riley & Proctor, 2023). Wattchow and Brown (2011) claimed that traditional teaching and learning practices of adventure and challenge in the outdoors are not necessarily commensurate with environmental ethics in outdoor education, especially when outdoor education is disciplined and constrained by dominant discourses in physical education that relegates the outdoors to a 'gymnasium' through an over-emphasis on fitness pursuits and the objectification of bodies and the Earth. Therefore, PL with its similar narrative rejecting objectifications might serve as an appropriate theoretical lens to nourish and operationalise the nexus. However, although PL is a popular concept that can inform physical education practices and inspire inter-/transdisciplinary work (Riley & Proctor, 2022), the present study has also shown that research at the nexus between physical education and environmental education has hesitantly adopted the idealist aspects of PL. From an environmental education perspective, there may also be good reasons for this finding. PL congruently assumes person-centredness (Holler et al., 2019; Santos et al., 2022), while environmental education inherently requests a stronger focus on the environment (Vincent & Focht, 2011). Remaining vigilant to the various hierarchies that proliferate through disciplines, physical education may be positioned as the more dominant subject of inquiry. To grapple with this tension, it is crucial that practitioners working at the nexus between physical education and environmental education pay close attention to disciplinary nuance and the distinctions and differences that uphold the integrity of each field of inquiry; while also activating possibilities for ecologically attuned movers and individual/collective and social/ecological wellbeing within relational entanglements of physical education and environmental education.

Limitations

Although this review has taken an inter-/transdisciplinary perspective and has permitted different study designs (both qualitative and quantitative) entering the synthesis, the present study exhibited the following limitations. First, we used a narrative approach for reporting the primary studies. Although we applied a standardised term combination (Supplementary File 1) and the algorithm was balanced to ensure fair representation between physical education and environmental education, the search was purposeful and not systematic (e.g., not drawing on

https://doi.org/10.1017/aee.2025.6 Published online by Cambridge University Press

the PRISMA guidelines: Page et al., 2021). As the present study already included 129 documents, it would not have been manageable to achieve a complete and exhaustive search. Similarly, only one person submitted the included studies to review and synthesis. Second, we did not systematically assess study quality. Of course, we indirectly considered study quality in informing the evidence of the categories (e.g., via different study designs) but the synthesis might have benefited from a rigorous assessment. Third, the PL lens made it necessary to analyse the included studies at a meta level. Although we pre-defined PL assumptions, our five selected criteria could not logically cover "all" conceptual discussions (see already the number of PL aspects seven years ago: Edwards et al., 2017). Another interesting approach for future research could be to lead conversations with some of the research groups whose literature was included in this review to inquire about their perspective on the concept.

Conclusion

This narrative integrative review has broadly illuminated the inter-/transdisciplinary nexus between physical education and environmental education. We inductively retrieved five categories from this integrative synthesis to have a differentiated view on where compatibility was given between the nexus and PL, spanning theoretical, curricular, interventional and evaluative aspects. The field is characterised by multifaceted heterogeneity, from disciplinary perspectives and theoretical assumptions to research goals, study designs and methodological approaches. Truly holistic analyses only mark a small part of the nexus, which undermines the simultaneous achievement of physical, cognitive, affective and social learning goals. Theoretical studies more strongly harmonised with PL assumptions than empirical and applied studies, uncovering a theory-practice disconnect on how educational work is operationalised through a person-centred lens to promote more ecologically attuned and motivated movers. The literature can benefit considerably from the identification of solutions balancing environmental and movement-related goals. Although PL as gained considerable popularity in recent educational discussion and demonstrates potential to inspire work at the nexus, also caution is warranted that environmental education is not jeopardised in its paradigmatic character and goals.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/aee.2025.6.

Acknowledgements. We want to thank all researchers who have contributed to the literature of the field, thus enabling the completion of such a comprehensive review.

Financial support. The present study has not been funded by external bodies.

Competing interests. The authors would like to disclose that Dr Kathryn Riley and Associate Professor Peta White are in the Editorial Executive of The Australian Journal of Environmental Education (AJEE). In accordance with AJEE protocols, neither were involved in the editorial process or decision making regarding this manuscript.

Ethical standard. Nothing to note.

References

Adsit-Morris, C. (2017). *Restorying environmental education: Figurations, fictions, and feral subjectivities*. Palgrave Macmillan Cham.

Annerstedt, C. (2008). Physical education in Scandinavia with a focus on Sweden: A comparative perspective. *Physical Education and Sport Pedagogy*, *13*(4), 303–318. DOI: 10.1080/17408980802353347

Arbour-Nicitopoulos, K.P., Boross-Harmer, A., Leo, J., Allison, A., Bremner, R., Taverna, F., Sora, D., Wright, F.V. (2018). Igniting Fitness Possibilities: A case study of an inclusive community-based physical literacy program for children and youth. *Leisure/Loisir*, *42*(1), 69–92. DOI: 10.1080/14927713.2017.1414627.

Armour, K., & Sandford, R. (2013). Positive youth development through an outdoor physical activity programme: Evidence from a four-year evaluation. *Educational Review*, *65*(1), 85–108. DOI: 10.1080/00131911.2011.648169.

Atencio, M., & Tan, Y.S.M. (2016). Teacher deliberation within the context of Singaporean curricular change: Pre- and in-service PE teachers' perceptions of outdoor education. *Curriculum Journal*, *27*(3), 368–386. DOI: 10.1080/09585176.2015.1127843.

Atencio, M., Tan, Y.S.M., Ho, S., & Ching, C.T. (2015). The strawberry generation . . . they are too pampered. *European Physical Education Review*, *21*(1), 31–50. DOI: 10.1177/1356336X14550939

Attali, M., & Saint-Martin, J. (2017). Outdoor physical education in French schools during the twentieth century. *Journal of Adventure Education & Outdoor Learning*, *17*(2), 148–160. DOI: 10.1080/14729679.2016.1242082.

Ayotte-Beaudet, J.-P., Berrigan, F., Deschamps, A., L'Heureux, K., Beaudry, M.C., & Turcotte, S. (2024). K-11 teachers' school-based outdoor education practices in the Province of Québec, Canada: From local initiatives to a grassroots movement. *Journal of Adventure Education and Outdoor Learning*, *24*(2), 334–347. DOI: 10.1080/14729679.2022.2164787.

Backman, E. (2008). What is valued in friluftsliv within PE teacher education? - Swedish PE teacher educators' thoughts about friluftsliv analysed through the perspective of Pierre Bourdieu. *Sport, Education & Society*, *13*(1), 61–76. DOI: 10.1080/13573320701780522.

Backman, E. (2011a). 'Friluftsliv': A contribution to equity and democracy in Swedish physical education? An analysis of codes in Swedish physical education curricula. *Journal of Curriculum Studies*, *43*(2), 269–288. DOI: 10.1080/00220272.2010.500680.

Backman, E. (2011b). What controls the teaching of 'Friluftsliv'? Analysing a pedagogic discourse within Swedish physical education. *Journal of Adventure Education and Outdoor Learning*, *11*(1), 51–65. DOI: 10.1080/14729679.2010.532988.

Bailey, R. (2022). Defining physical literacy: Making sense of a promiscuous concept. *Sport in Society*, *25*(1), 163–180. DOI: 10.1080/17430437.2020.1777104.

Balagué, N., Torrents, C., Hristovski, R., & Kelso, J. (2017). Sport science integration: An evolutionary synthesis. *European Journal of Sport Science*, *17*(1), 51–62. DOI: 10.1080/17461391.2016.1198422

Barnett, L.M., Jerebine, A., Keegan, R., Watson-Mackie, K., Arundell, L., Ridgers, N.D., Salmon, J., Dudley, D. (2023). Validity, reliability, and feasibility of physical literacy assessments designed for school children: A systematic review. *Sports Medicine*, *53*(10), 1905–1929. DOI: 10.1007/s40279-023-01867-4.

Battista, R.A., & West, S.T. (2018). The use of geocaching as a form of physical activity in youth. *American Journal of Health Education*, *49*(3), 125–132. DOI: 10.1080/19325037.2018.1428700.

Becker, C., Lauterbach, G., Spengler, S., Dettweiler, U., & Mess, F. (2017). Effects of regular classes in outdoor education settings: A systematic review on students' learning, social and health dimensions. *International Journal of Environmental Research and Public Health*, *14*(5), 485. DOI: 10.3390/ijerph14050485

Becker, D.R., Grist, C.L., Caudle, L.A., & Watson, M.K. (2018). Complex physical activity, outdoor play, and school readiness among preschoolers. *Global Education Review*, *5*(2), 110–122.

Beery, T. (2013). Nordic in nature: Friluftsliv and environmental connectedness. *Environmental Education Research*, *19*(1), 94–117. DOI: 10.1080/13504622.2012.688799.

Bentsen, P., Mygind, L., Elsborg, P., Nielsen, G., & Mygind, E. (2022). Education outside the classroom as upstream school health promotion: 'adding-in' physical activity into children's everyday life and settings. *Scandinavian Journal of Public Health*, *50*(3), 303–311. DOI: 10.1177/1403494821993715.

Blakey, B. (2018). Staff and caregiver perspectives on the role of nature and physical activity at camp: An ecopsychological study. *Pathways: The Ontario Journal of Outdoor Education*, *30*(3), 25–34.

Bonavolonta, V., Cataldi, S., & Fischetti, F. (2021). Changes in body image perception after an outdoor physical education program. *Journal of Physical Education & Sport*, *21*(1), 632–637. DOI: 10.7752/jpes.2021.s1074.

Boniface, M.R. (2000). Towards an understanding of flow and other positive experience phenomena within outdoor and adventurous activities. *Journal of Adventure Education & Outdoor Learning*, *1*(1), 55–68.

Bortolotti, A. (2021). Perspectives on outdoor sports: Uncertainty between nature and culture. *Journal of Physical Education & Sport*, *21*(1), 638–642. DOI: 10.7752/jpes.2021.s1075.

Boyes, M. (2000). The place of outdoor education in the health and physical education curriculum. *Journal of Physical Education New Zealand*, *33*(2), 75–88.

Braga, L., Jones, E., Bulger, S., & Elliott, E. (2017). Empowering teachers to implement innovative content in physical education through continuous professional development. *Teacher Development*, *21*(2), 288–306. DOI: 10.1080/13664530.2016.1235608.

Braidotti, R. (2019). *Posthuman knowledge*. Polity.

Brewer, J., & Sparkes, A.C. (2011). The meanings of outdoor physical activity for parentally bereaved young people in the United Kingdom: Insights from an ethnographic study. *Journal of Adventure Education & Outdoor Learning*, *11*(2), 127–143. DOI: 10.1080/14729679.2011.633382.

Brown, T.D., & Whittle, R.J. (2021). Physical literacy: A sixth proposition in the Australian/Victorian Curriculum: Health and physical education? *Curriculum Studies in Health and Physical Education*, *12*(2), 180–196.

Cairney, J., Kiez, T., Roetert, E.P., & Kriellaars, D. (2019). A 20th-century narrative on the origins of the physical literacy construct. *Journal of Teaching in Physical Education*, *38*(2), 79–83. DOI: 10.1123/jtpe.2018-0072.

Carl, J., Abu-Omar, K., Bernard, P., Lohmann, J., White, P., Peters, J., Sahlqvist, S., Ma, J., Duncan, M., Barnett, L.M. (2024). Physical literacy in the context of climate change: Is there a need for further refinement of the concept? *Journal of Physical Activity and Health*, *21*(4), 316–319. DOI: 10.1123/jpah.2023-0714.

Carl, J., Barratt, J., Töpfer, C., Cairney, J., & Pfeifer, K. (2022). How are physical literacy interventions conceptualized? – a systematic review on intervention design and content. *Psychology of Sport and Exercise*, *58*, 102091. DOI: 10.1016/j.psychsport.2021.102091.

Carl, J., Bryant, A.S., Edwards, L.C., Bartle, G., Birch, J.E., Christodoulides, E., Emeljanovas, A., Fröberg, A., Gandrieau, J., Gilic, B., van Hilvoorde, I., Holler, P., Iconomescu, T.M., Jaunig, J., Laudanska-Krzeminska, I., Lundvall, S., De Martelaer, K., Martins, J., Mieziene, B., Elsborg, P. (2023). Physical literacy in Europe: The current state of implementation in research, practice, and policy. *Journal of Exercise Science & Fitness*, *21*(1), 165–176. DOI: 10.1016/j.jesf.2022.12.003.

Carlin, A.P. (2016). On some limits of interdisciplinarity. *Social Epistemology*, *30*(5-6), 624–642.

Carter, R.L., & Simmons, B. (2010). The history and philosophy of environmental education. In A.M.K. Bodzin & B.S. Weaver, (Eds.), *The inclusion of environmental education in science teacher education* (pp. 3–16). Springer.

Casado-Robles, C., Viciana, J., Guijarro-Romero, S., & Mayorga-Vega, D. (2022). Effect of an inside-outside school alternated teaching unit of knowledge of the environment for practicing physical activity: A cluster randomized control trial. *Journal of Teaching in Physical Education*, *41*(1), 149–158. DOI: 10.1123/jtpe.2020-0132.

Casas E.V., Pormon, M.M., Manus, J.J., Lejano, R.P. (2021). Relationality and resilience: Environmental education in a time of pandemic and climate crisis. *The Journal of Environmental Education*, *52*(5), 314–324.

Chen, Y. (2016). Trash to treasure: Using recyclables in physical activity settings. *Journal of Physical Education, Recreation & Dance*, *87*(7), 45–51. DOI: 10.1080/07303084.2016.1202801.

Clocksin, B.D. (2006). Sequencing low adventure activities in elementary physical education. *Teaching Elementary Physical Education*, *17*(3), 16–22.

Colella, D., & D'Arando, C. (2021). Teaching styles and outdoor education to promote non-linear learning. *Journal of Physical Education & Sport*, *21*(1), 507–513. DOI: 10.7752/jpes.2021.s1054.

Cook, G., Boyan, A., Mendelsohn, A., Green, A., & Woolvett, C. (2007). How a climbing wall became part of a NEW physical education program. *Pathways: The Ontario Journal of Outdoor Education*, *19*(4), 12–15.

Cooley, S.J., Cumming, J., Holland, M.J.G., & Burns, V.E. (2015). Developing the Model for Optimal Learning and Transfer (MOLT) following an evaluation of outdoor groupwork skills programmes. *European Journal of Training & Development*, *39*(2), 104–121. DOI: 10.1108/EJTD-06-2014-0046.

Cosgriff, M. (2008). What's the story? Outdoor education in New Zealand in the 21st century. *Physical Educator - Journal of Physical Education New Zealand*, *41*(3), 14–25.

Cotterill, S.T., & Brown, H. (2018). An exploration of the perceived health, life skill and academic benefits of dinghy sailing for 9-13-year-old school children. *Journal of Adventure Education and Outdoor Learning*, *18*(3), 227–241. DOI: 10.1080/14729679.2018.1424001.

Cuenca-Soto, N., Martínez-Muñoz, L.F., Chiva-Bartoll, O., & Santos-Pastor, M.L. (2023). Environmental sustainability and social justice in Higher Education: A critical (eco)feminist service-learning approach in sports sciences. *Teaching in Higher Education*, *28*(5), 1057–1076. DOI: 10.1080/13562517.2023.2197110.

Dahl, L., Standal, O.F., & Moe, V.F. (2019). Norwegian teachers' safety strategies for Friluftsliv excursions: Implications for inclusive education. *Journal of Adventure Education & Outdoor Learning*, *19*(3), 256–268. DOI: 10.1080/14729679.2018.1525415.

Dudley, D., Cairney, J., Wainwright, N., Kriellaars, D., & Mitchell, D. (2017). Critical considerations for physical literacy policy in public health, recreation, sport, and education agencies. *Quest*, *69*(4), 436–452. DOI: 10.1080/00336297.2016.1268967.

Durden-Myers, E.J., Bartle, G., Whitehead, M.E., & Dhillon, K.K. (2021). Physical literacy and intentionality: Embodied beckoning. *Journal of Physical Education, Recreation & Dance*, *92*(9), 42–49.

Dyment, J. (2005). Green school grounds as sites for outdoor learning: Barriers and opportunities. *International Research in Geographical & Environmental Education*, *14*(1), 28–45.

Dyment, J., & Bell, A. (2007). Active by design: Promoting physical activity through school ground greening. *Children's Geographies*, *5*(4), 463–477. DOI: 10.1080/14733280701631965.

Dyment, J.E., & Bell, A.C. (2008). Grounds for movement: Green school grounds as sites for promoting physical activity. *Health Education Research*, *23*(6), 952–962. DOI: 10.1093/her/cym059.

Edwards, L.C., Bryant, A.S., Keegan, R.J., Morgan, K., Cooper, S.-M., & Jones, A.M. (2018). Measuring' physical literacy and related constructs: A systematic review of empirical findings. *Sports Medicine*, *48*(3), 659–682. DOI: 10.1007/s40279-017-0817-9.

Edwards, L.C., Bryant, A.S., Keegan, R.J., Morgan, K., & Jones, A.M. (2017). Definitions, foundations and associations of physical literacy: A systematic review. *Sports Medicine*, *47*(1), 113–126. DOI: 10.1007/s40279-016-0560-7.

Elsborg, P., Melby, P.S., Kurtzhals, M., Kirkegaard, H., Carl, J., Rask, S., Bentsen, P., NIelsen, G. (2024). From global domains to physical activity environments: Development and initial validation of a questionnaire-based physical literacy measure designed for large-scale population surveys. *Measurement in Physical Education and Exercise Science*, *28*(2), 206–223. DOI: 10.1080/1091367X.2024.2304011.

Engelen, L., Wyver, S., Perry, G., Bundy, A., Chan, T.K.Y., Ragen, J., Bauman, A., Naughton, G. (2018). Spying on children during a school playground intervention using a novel method for direct observation of activities during outdoor play. *Journal of Adventure Education & Outdoor Learning*, *18*(1), 86–95. DOI: 10.1080/14729679.2017.1347048.

Ernst, J., Burgess, E., & Bruno, L. (2021). Nature preschool as a promoter of physical activity in young children: An exploratory study of nature preschool in a northern climate. *International Journal of Early Childhood Environmental Education*, *8*(3), 3–19.

Fang WeiTa, F.W., Ng, E., & Chang MeiChuan, C.M. (2017). Physical outdoor activity versus indoor activity: Their influence on environmental behaviors. *International Journal of Environmental Research and Public Health*, *14*(7), 797. DOI: 10.3390/ijerph14070797.

Fernandez-Rio, J., & Iglesias, D. (2024). What do we know about pedagogical models in physical education so far? An umbrella review. *Physical Education and Sport Pedagogy*, *29*(2), 190–205.

Finn, K.E., Yan, Z., & McInnis, K.J. (2018). Promoting physical activity and science learning in an outdoor education program. *Journal of Physical Education, Recreation & Dance*, *89*(1), 35–39. DOI: 10.1080/07303084.2017.1390506.

Fleishack, P. (2012). A journey in the wilderness: Essential milestone in a 21st century education? Physical educator. *Journal of Physical Education New Zealand*, *45*(2), 16–20.

Floresca, J.A. (2019). Nature walk program as means of reconnecting with the natural environment: An alternative physical education. *Education Quarterly Reviews*, *2*(1), 155–163.

Fröberg, A., Wiklander, P., & Lundvall, S. (2022). Sustainable development competencies among more than 1100 certified physical education and health teachers in Sweden. *International Journal of Environmental Research and Public Health*, *19*(23), 15914. DOI: 10.3390/ijerph192315914.

Fröberg, A., Wiklander, P., & Lundvall, S. (2023). Sustainability-oriented learning in Physical Education and Health (PEH)? A document analysis of the Swedish syllabi. *Curriculum Studies in Health and Physical Education*, *14*(3), 340–356. DOI: 10.1080/25742981.2022.2112921.

Frühauf, A., Kopp, M., & Greier, K. (2023). Information on the potential for integrating environmental education into physical education [Möglichkeiten und hintergründe zur integration von umweltbildung im sportunterricht.]. *Sportunterricht*, *72*(9), 395–399. DOI: 10.30426/SU.2023.09.2.

Fyfe-Johnson, A.L., Saelens, B.E., Christakis, D.A., & Tandon, P.S. (2019). Physical activity and parental attitudes and beliefs of children attending a nature preschool. *International Journal of Early Childhood Environmental Education*, *6*(3), 3–17.

Gagnon, A.G. (2024). Outdoor education as a service-learning project. *Strategies: A Journal for Physical and Sport Educators*, *37*(1), 3–11. DOI: 10.1080/08924562.2023.2276464.

Gatzemann, T., Schweizer, K., & Hummel, A. (2008). Effectiveness of sports activities with an orientation on experiential education, adventure-based learning and outdoor-education. *Kinesiology*, *40*(2), 146–152.

Gilkes, B., Wintle, J., & Reed, J. (2024). A small-scale evaluation of instructional approaches and perspectives on the benefits of adventurous education for young people. *Journal of Adventure Education & Outdoor Learning*, *24*(2), 317–333. DOI: 10.1080/14729679.2022.2160993.

Gómez Quintana, I., Hidalgo Castro, Y., Díaz Cabrera, J.C., Pozo Contrera, A.d J., & Ramos Pérez, E. (2023). Development of environmental education in university students from the Physical Education subject. *Desarrollo de la educación ambiental en estudiantes universitarios desde la asignatura Educación Física*, *18*(1), 1–13.

González, G.L. (2001). Expeditionary learning: An alternative teaching method for physical education. *JOPERD: The Journal of Physical Education, Recreation & Dance*, *72*(3), 31–47.

Gough, A. (2013). The emergence of environmental education research: A "history" of the field. In R.B.B. Stevenson, M. Dillon & J. Wals, (Eds.), *International handbook of research on environmental education* (pp. 13–22). Routledge.

Gough, A. (2024). Changing politics for changing times: Rethinking research stakeholders and strategies for environmental education. *Australian Journal of Environmental Education*, *40*(3), 417–430. DOI: 10.1017/aee.2024.41.

Green, N.R., Roberts, W.M., Sheehan, D., & Keegan, R.J. (2018). Charting physical literacy journeys within physical education settings. *Journal of Teaching in Physical Education*, *37*(3), 272–279. DOI: 10.1123/jtpe.2018-0129.

Gruno, J., & Gibbons, S.L. (2020). Incorporating nature-based physical activity in physical and health education. *Journal of Physical Education, Recreation & Dance*, *91*(3), 26–34.

Gruno, J., & Gibbons, S.L. (2021). Using discussion to inform action: Formative research on nature-based physical activity as a means of fostering relatedness for girls in physical and health education. *European Physical Education Review*, *27*(4), 743–760. DOI: 10.1177/1356336X21991181.

Hall, N., Robinson, D.B., Bradford, B., & Costa, J.d (2022). Alternative environment activities in physical education: A research-informed rationale and practical suggestions for teacher practice. *Journal of Physical Education, Recreation & Dance*, *93*(1), 36–44. DOI: 10.1080/07303084.2021.2000526.

Hart, P.W., & **PJ** (2022). Postqualitative inquiry: Theory and practice in environmental education (Editorial). *Australian Journal of Environmental Education*, *38*(3-4), 208–210. DOI: 10.1017/aee.2022.44.

Hernawan, H., WİDyawan, D., Mukhtar, M., Nugraha, H., & Haqiyah, A. (2024). Physical activities and sedentary time of students outdoor education and conventional education in primary schools. *International Journal of Disabilities Sports & Health Sciences*, *7*(2), 389–395. DOI: 10.33438/ijdshs.1403090.

Holler, P., Jaunig, J., Amort, F.-M., Tuttner, S., Hofer-Fischanger, K., Wallner, D., Simi, H., Müller, A., van Poppel, M.N.M., Moser, O. (2019). Holistic physical exercise training improves physical literacy among physically inactive adults: A pilot intervention study. *BMC Public Health*, *19*(1), 393. DOI: 10.1186/s12889-019-6719-z.

Huang, Y., & Reynoso, L.C. (2018). Based on physical self-concept to discuss the effect of environmental education on health related physical education. *Ekoloji Dergisi*, i(106), 1645–1651.

International Physical Literacy Association (2017). IPLA definition. Retrieved 2023-11-28 from https://www.physical-literacy.org.uk/.

Jidovtseff, B., Kohnen, C., Belboom, C., Dispa, C., & Vidal, A. (2021). Outdoor education practices in Belgian preschools and relationships with both environmental and personal factors. *Journal of Physical Education & Sport*, *21*(1), 530–536. DOI: 10.7752/jpes.2021.s1058.

Johnson, T.G., & Turner, L. (2016). The physical activity movement and the definition of physical education. *Journal of Physical Education, Recreation & Dance*, *87*(4), 8–10.

Keegan, R.J., Barnett, L.M., Dudley, D.A., Telford, R.D., Lubans, D.R., Bryant, A.S., Roberts, W.M., Morgan, P.J., Schranz, N.K., Weissensteiner, J.R., Vella, S.A., Salmon, J., Ziviani, J., Okely, A.D., Wainwright, N., Evans, J.R. (2019). Defining physical literacy for application in Australia: A modified delphi method. *Journal of Teaching in Physical Education*, *38*(2), 105–118. DOI: 10.1123/jtpe.2018-0264.

Kurtzman, A.E., Beddoes, Z., & Gaudreault, K.L. (2023). Social-emotional learning through adventure education in PETE: Strategies for PETE faculty. *Journal of Physical Education, Recreation & Dance*, *94*(6), 13–20. DOI: 10.1080/07303084.2023.2221714.

Lamoneda, J., González-Víllora, S., Evangelio, C., & Fernandez-Rio, J. (2024). Hybridizing outdoor adventure education and cooperative learning in physical education. Students and teachers' views. *Journal of Adventure Education & Outdoor Learning*, *24*(2), 159–174. DOI: 10.1080/14729679.2022.2087194.

Land, N., & Vidotto, D. (2021). Tracing, interrogating, and re-imagining how physical development matters in Canadian early childhood studies. *Sport, Education and Society*, *26*(6), 606–618.

Lavie Alon, N.T., & **Tali** (2015). Student self-reported learning outcomes of field trips: The pedagogical impact. *International Journal of Science Education*, *37*(8), 1279–1298. DOI: 10.1080/09500693.2015.1034797.

Leahey, E., Beckman, C.M., & Stanko, T.L. (2017). Prominent but less productive: The impact of interdisciplinarity on scientists' research. *Administrative Science Quarterly*, *62*(1), 105–139.

Legge, M. (2022). Letting them go – outdoor education with/without the teacher educator. *Journal of Adventure Education and Outdoor Learning*, *22*(1), 1–11. DOI: 10.1080/14729679.2020.1841661.

Li, P. (2022). Factors that environmental film teaching toward environmental knowledge and behaviour on physical education students. *Journal of Environmental Protection and Ecology*, *23*(2), 745–752. DOI: https://scibulcom.net/en/article/L8Mc8QI9lzvCYgxBqVXd.

Lundvall, S., & Maivorsdotter, N. (2021). Environing as embodied experience-A study of outdoor education as part of physical education. *Frontiers in Sports and Active Living*, *3*, 768295. DOI: 10.3389/fspor.2021.768295.

Luthe, T., Häusler, R., & Roth, R. (2007). The realization of alternative snow sport activities and their educational use for a sustaining development [Die Durchführung alternativer Schneesportausfahrten und deren Nutzung zur Bildung für eine nachhaltige Entwicklung (BfnE).]. *Sportunterricht*, *56*(12), 366–368.

Lyngstad, I., & Saether, E. (2021). The concept of 'Friluftsliv Literacy' in relation to physical literacy in physical education pedagogies. *Sport, Education and Society*, *26*(5), 514–526. DOI: 10.1080/13573322.2020.1762073.

Macdonald, D. (2013). The new Australian health and physical education curriculum: A case of/for gradualism in curriculum reform? *Asia-Pacific Journal of Health, Sport and Physical Education*, *4*(2), 95–108.

Mañanas-Iglesias, C., Galán-Arroyo, C., Rojo-Ramos, J., & Adsuar, J.C. (2023). Analysis of teachers' preparation for outdoor learning activities [Análisis de la formación del profesorado hacia las prácticas educativas al aire libre.]. *RETOS - Neuvas Tendencias en Educacion Fisica, Deporte y Recreacion*, *49*, 970–977. DOI: 10.47197/retos.v49.94076.

Mandrillon, K., Desplanques, F., & Gottsmann, L. (2024). Towards an integration of physical activity and environmental awareness: Analysis of students' activity in physical education. *Physical Education & Sport Pedagogy*, 1–22. DOI: 10.1080/17408989.2024.2319059.

Martin, P., & McCullagh, J. (2011). Physical education & outdoor education: Complementary but discrete disciplines. *Asia-Pacific Journal of Health, Sport and Physical Education*, *2*(1), 67–78. DOI: 10.1080/18377122.2011.9730344.

Maurer, M., & Bogner, F.X. (2020). Modelling environmental literacy with environmental knowledge, values and (reported) behaviour. *Studies in Educational Evaluation*, *65*, 100863.

McBride, B.B., Brewer, C.A., Berkowitz, A.R., & Borrie, W.T. (2013). Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere*, *4*(5), 1–20.

McNamee, J., & Timken, G. (2017). Outdoor pursuits in physical education: Lessons from the trenches. *Journal of Physical Education, Recreation & Dance*, *88*(3), 8–15. DOI: 10.1080/07303084.2016.1270784.

Menear, K.S., Smith, S.C., & Lanier, S. (2006). A multipurpose fitness playground for individuals with autism: Ideas for design and use. *Journal of Physical Education, Recreation & Dance (JOPERD)*, *77*(9), 20–25.

Mikaels, J. (2018). Becoming a place-responsive practitioner: Exploration of an alternative conception of 'Friluftsliv' in the Swedish Physical Education and Health Curriculum. *Journal of Outdoor Recreation, Education, and Leadership*, *10*(1), 3–19. DOI: 10.18666/JOREL-2018-V10-I1-8146.

Mischenko, N.y, Kolokoltsev, M., Romanova, E., Bayankin, O., Kispayev, T., Vrachinskaya, T., Loginov, D., Aganov, S. & Guryanov, M. (2023). Mixt-technology for the development of environmental competence in physical education classes in 7-9-years-old children. *Journal of Physical Education and Sport*, *23*(1), 52–58. DOI: 10.7752/jpes.2023.01006.

Mygind, E. (2007). A comparison between children's physical activity levels at school and learning in an outdoor environment. *Journal of Adventure Education and Outdoor Learning*, *7*(2), 161–176. DOI: 10.1080/14729670701717580.

Nguyen, N. (2015). Incorporating outdoor education into the physical education curriculum. *Strategies: A Journal for Physical and Sport Educators*, *28*(1), 34–40. DOI: 10.1080/08924562.2015.981126.

O'Connor, J.P., & Jess, M. (2020). From silos to crossing borders in physical education. *Sport, Education and Society*, *25*(4), 409–422.

Osborne, R. (2012). Physical education in the decade of education for sustainable development: A study with Brazilian physical education teachers and educators. *Human Movement*, *13*(3), 280–287. DOI: 10.2478/v10038-012-0033-2.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, Aørn, Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D. (2021). The PRISMA. 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. DOI: 10.1136/bmj.n71.

Palmer, J. (2002). *Environmental education in the 21st century: Theory, practice, progress and promise*. Routledge.

Pazos-Couto, J.M., Arevalo, S.T., Middleton, O.L., & Kawada, F.H. (2021). Eco-motricity: An epistemic turn to re-thinking physical education in Chile. *Journal of Human Sport & Exercise*, *16*(1), 97–111. DOI: 10.14198/jhse.2021.161.09.

Peacock, J., Bowling, A., Finn, K., & McInnis, K. (2021). Use of outdoor education to increase physical activity and science learning among low-income children from urban schools. *American Journal of Health Education*, *52*(2), 92–100. DOI: 10.1080/19325037.2021.1877222.

Philippi, P.E., & Mulhearn, S.C. (2023). Channeling your inner sasquatch: Bringing outdoor adventure learning to elementary physical education. *Strategies: A Journal for Physical and Sport Educators*, *36*(6), 17–23. DOI: 10.1080/08924562.2023.2259440.

Pignato, S., Patania, V., Manzo, G., & Coppola, R. (2021). Stage of nature and motor knowledge in the primary school. Teaching physical education in an open environment. *Journal of Physical Education & Sport*, *21*(1), 606–611. DOI: 10.7752/jpes.2021.s1070.

Priest, S. (1986). Redefining outdoor education: A matter of many relationships. *The Journal of Environmental Education*, *17*(3), 13–15.

Pushkarenko, K., Causgrove Dunn, J., & Wohlers, B. (2021). Physical literacy and inclusion: A scoping review of the physical literacy literature inclusive of individuals experiencing disability. *PROSPECTS*, *50*(1-2), 107–126. DOI: 10.1007/s11125-020-09497-8.

Quay, J. (2002). The importance of context to learning: Physical education and outdoor education seeing eye to eye In: *The importance of context to learning: Physical education and outdoor education seeing eye to eye*.

Raven, P.H., Berg, L.R., & Hassenzahl, D.M. (2008). *Environment* (6th ed.). John Wiley & Sons.

Richards, K.A.R., Jacobs, J.M., Wahl-Alexander, Z., & Ressler, J.D. (2018). Preservice physical education teacher socialization through an outdoor education field experience. *Journal of Adventure Education & Outdoor Learning*, *18*(4), 367–381. DOI: 10.1080/14729679.2018.1483252.

Riley, K., Froehlich Chow, A., Wahpepah, K., Houser, N., Brussoni, M., Stevenson, E., Erlandson, M. C., Humbert, M. L. (2023). A nature's way—Our way pilot project case assemblage: (Re) storying child/Physical literacy/land relationships for Indigenous preschool-aged children's wholistic wellness. *Children*, *10*(3), 497.

Riley, K., & Proctor, L. (2022). A physical education/environmental education nexus: Transdisciplinary approaches to curriculum for a sense of belonging. *Australian Journal of Environmental Education*, *38*(3-4), 267–278.

Riley, K., & Proctor, L. (2023). The senses/sensing relationship in physical literacy: Generating a worldly (re) enchantment for physical education. *Sport, Education and Society*, *28*(6), 655–666.

Riley, K., Jukes, S., & Rautio, P. (2024). Relational ontologies and multispecies worlds: Transdisciplinary possibilities for environmental education (Editorial). *Australian Journal of Environmental Education*, *40*, 95–107. DOI: 10.1017/aee.2024.23.

Rodrigues, C., & Payne, P.G. (2017). Environmentalization of the physical education curriculum in Brazilian Universities: Culturally comparative lessons from critical outdoor education in Australia. *Journal of Adventure Education and Outdoor Learning*, *17*(1), 18–37. DOI: 10.1080/14729679.2015.1035294.

Rose, T. (2001). Incorporating the outdoors in physical education. *JOPERD: The Journal of Physical Education, Recreation & Dance*, *72*(6), 17–18.

Samsudin, S., Kamalden, T.F.T., Aziz, A., Ismail, M.H., Yaakob, S.S.N., & Farizan, N.H. (2021). The impact of outdoor education camp program in building resilience among university students. *Asian Journal of University Education*, *17*(4), 71–83.

Sanderud, J.R., Gurholt, K.P., & Moe, V.F. (2020). 'Winter children': An ethnographically inspired study of children being-and-becoming well-versed in snow and ice. *Sport, Education & Society*, *25*(8), 960–971. DOI: 10.1080/13573322.2019.1678124.

Santos, F., Newman, T.J., Aytur, S., & Farias, C. (2022). Aligning physical literacy with critical positive youth development and student-centered pedagogy: Implications for today's youth. *Frontiers in Sports and Active Living*, *4*, 845827.

Santos-Pastor, M.L., Ruiz-Montero, P.J., Chiva-Bartoll, O., Baena-Extremera, A., & Martínez-Muñoz, L.F. (2022). Environmental education in initial training: Effects of a physical activities and sports in the natural environment program for sustainable development. *Frontiers in Psychology*, *13*, 867899. DOI: 10.3389/fpsyg.2022.867899.

Schwab, K., & Dustin, D. (2014). Engaging youth in lifelong outdoor adventure activities through a nontraditional public school physical education program. *Journal of Physical Education, Recreation & Dance*, *85*(8), 27–31. DOI: 10.1080/07303084.2014.946189.

Sjödin, K., Quennerstedt, M., & Öhman, J. (2023). The meanings of friluftsliv in Physical Education Teacher Education. *Sport, Education & Society*, *25*(6), 744–756, DOI: 10.1080/13573322.2023.2187770

Stickney, J., & Skilbeck, A. (2020). Problematising 'transformative'environmental education in a climate crisis. *Journal of Philosophy of Education*, *54*(4), 791–806.

Stratton, C.J. (2022). What you really need to teach outdoor adventure education. *Strategies: A Journal for Physical and Sport Educators*, *35*(5), 28–30. DOI: 10.1080/08924562.2022.2100138.

Sutherland, S., & Legge, M. (2016). The possibilities of 'Doing' outdoor and/or adventure education in physical education/teacher education. *Journal of Teaching in Physical Education*, *35*(4), 299–312. DOI: 10.1123/jtpe.2016-0161.

Sutton, A., Clowes, M., Preston, L., & Booth, A. (2019). Meeting the review family: Exploring review types and associated information retrieval requirements. *Health Information & Libraries Journal*, *36*(3), 202–222.

Taplin, L. (2019). Physical literacy as a journey. In M. Whitehead (Eds.), *Physical literacy across the world* (pp. 239–254). Routledge.

Thomas, G. (2015). Signature pedagogies in outdoor education. *Asia-Pacific Journal of Health, Sport and Physical Education*, *6*(2), 113–126. DOI: 10.1080/18377122.2015.1051264.

Thomas, G., Grenon, H., Morse, M., Allen-Craig, S., Mangelsdorf, A., & Polley, S. (2019). Threshold concepts for Australian university outdoor education programs: Findings from a Delphi research study. *Journal of Outdoor and Environmental Education*, *22*(3), 169–186. DOI: 10.1007/s42322-019-00039-1.

Timken, G.L., & McNamee, J. (2012). New perspectives for teaching physical education: Preservice teachers' reflections on outdoor and adventure education. *Journal of Teaching in Physical Education*, *31*(1), 21–38.

Tortella, P., Ceciliani, A., Fumagalli, G., Jidovtseff, B., Wainwright, N., Fjortoft, I., et al. (2021). Children's outdoor movement education: Position statement. *Journal of Physical Education & Sport*, *21*(1), 451–462. DOI: 10.7752/jpes.2021.s1046.

UNESCO. (2015). Quality physical education (QPE): Guidelines for policy-makers. Retrieved 2024-08-30 from https://en.unesco.org/inclusivepolicylab/sites/default/files/learning/document/2017/1/231101E.pdf.

Vijaykumar, R.T., Naseema, K., & **S** (2021). Environmental literacy research: Global scientometric mapping of five decades. *Current World Environment*, *16*(3), 963.

Vincent, S., & Focht, W. (2011). Interdisciplinary environmental education: Elements of field identity and curriculum design. *Journal of Environmental Studies and Sciences*, *1*(1), 14–35. DOI: 10.1007/s13412-011-0007-2.

Wainwright, N., Goodway, J., Whitehed, M., Williams, A., & Kirk, D. (2016). The foundation phase in Wales-A play-based curriculum that supports the development of physical literacy. *Education*, *44*(5), 513–524.

Wattchow, B., & Brown, M. (2011). *A pedagogy of place: Outdoor education for a changing world*. Monash University Publishing.

Whitehead, M. (2007). Physical literacy: Philosophical considerations in relation to developing a sense of self, universality and propositional knowledge. *Sport, Ethics and Philosophy*, *1*(3), 281–298. DOI: 10.1080/17511320701676916.

Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, *52*(5), 546–553. DOI: https://doi.org/10.1111/j.1365-2648.2005.03621.x.

Williams, A., & Wainwright, N. (2016a). A new pedagogical model for adventure in the curriculum: Part one-advocating for the model. *Physical Education and Sport Pedagogy*, *21*(5), 481–500. DOI: 10.1080/17408989.2015.1048211.

Williams, A., & Wainwright, N. (2016b). A new pedagogical model for adventure in the curriculum: Part two–outlining the model. *Physical Education and Sport Pedagogy*, *21*(6), 589–602. DOI: 10.1080/17408989.2015.1048212.

Young, L., O'Connor, J., & Alfrey, L. (2020). Physical literacy: A concept analysis. *Sport, Education and Society*, *25*(8), 946–959. DOI: 10.1080/13573322.2019.1677586.

Young, L., O'Connor, J., & Alfrey, L. (2023). Mapping the physical literacy controversy: An analysis of key actors within scholarly literature. *Physical Education and Sport Pedagogy*, *28*(6), 658–674. DOI: 10.1080/17408989.2021.2014437.

Author Biographies

Johannes Carl is a Post-doctoral Research Fellow at the Institute for Physical Activity and Nutrition at Deakin University, Burwood, Australia. His research activities consistently adopt an interdisciplinary perspective on health-enhancing physical activity, thereby also informing health and physical education. He is the principal investigator for the development of a "Global Physical Literacy Action Framework" and of a large European network examining the alignment of research, policy and practice with the concept of physical literacy across 40 countries.

Kathryn Riley is an Assistant Professor with the Faculty of Education at the University of Manitoba. Kathryn's research focuses on relational ontologies, pedagogies for (w)holistic wellbeing and an anticolonial praxis for social and ecological justice. Kathryn is the Principal Investigator in the Movement as Artivism project, exploring physical activity and arts-based practices in response to eco-anxiety with middle-years teachers and learners. Kathryn recently published a book (Re)Storying human/earth relationships in environmental education: Becoming (partially) Posthumanist. Kathryn is an Associate Editor with the Australian Journal of Environmental Education.

Jacqui Peters is a lecturer in health and physical education within the School of Education at Deakin University. She passionate about teaching and has a range of research interests including Health and Physical Education curriculum, assessment and policy and the experiences of early career teachers. Jacqui Peters is a board member of the Australian Council for Health, Physical Education and Recreatio Victoria.

Peta J. White is an Associate Professor in Science and Environmental Education at Deakin University. She co-directs the Centre for Regenerating Futures - a Faculty Centre that explores Anthropocene challenges and decolonising practices while building researcher capacity. She is the Editor-In-Chief of the Australian Journal of Environmental Education. Her current research follows three narratives: science and biology education; sustainability, environmental and climate change education; and collaborative/activist methodology and research.

Cite this article: Carl, J., Riley, K., Peters, J., & White, P.J. (2025). Research at the Nexus Between Physical Education and Environmental Education: A Narrative Integrative Review Through a Physical Literacy Lens. *Australian Journal of Environmental Education* **0**, 1–19. https://doi.org/10.1017/aee.2025.6