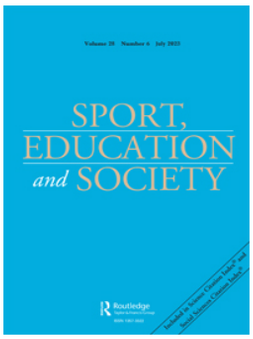

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Research Article

What counts as nature in designing environmental links to health education curriculum in initial teacher education?

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ABSTRACT

In this paper we report on a teacher education co-design project that explored Australian pre-service primary generalist teachers' ideations of the pedagogical links between health education and nature. As part of their coursework in a Master of Teaching degree at an Australian University, students were invited to design a Victorian Curriculum: Health and Physical Education (VC:HPE) activity that connected primary curriculum (F-6) with nature. We conducted a 3-hour suite of online learning activities and prompts using Zoom, Padlet and Moodle. The data consists of the students' curriculum design artefacts as well as recordings of the group discussions and non-assessment-based presentations of their work. Drawing on theories of child-nature interaction, we present an analysis of the ways in which n = 72 pre-service teachers across 18 groups of 4–5 educators conceptualised links between 'nature' and HPE across their activity designs. Prior to the workshop, the majority of pre-service teachers had not previously considered links between the HPE learning area and nature. Through the activities of the co-design workshop, students were surprised with the variety of pedagogical possibilities that were able to be made. There was much student discussion about the possibilities and limitations of balancing safety and risk in their nature-based activity designs. We present a thematic analysis of the quality of student-nature interactions in the groups' learning designs through: (i) exploration; (ii) embodiment; (iii) cultivation; (iv) appropriation; and (v) representation. The analysis and discussion has implications for the way quality health education is linked to nature-based learning environments, teacher education and contemporary curriculum enactment that incorporates nature and the environment as part of the learning design.

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Introduction

It has long been recognised that nature-based experiences contribute to the well-being and development of children, and instils an awareness of biodiversity and value for life beyond the human realm that can promote environmental attunement and ecological responsibility through life (Mann et al., 2022; Taylor, 2017; Welch et al., 2021b). Interactions with natural environments can be symbiotically beneficial for care of self and care of place. While there have been efforts to

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integrate First Nations cosmologies of nature and notions of healing and wellness linked to health education and environmental education in schooling, in the Australian context there is an absence of rich Indigenous culture and history in the HPE learning area and notions of nature and the environment. Despite educational importance placed on nature-based experiences for children, the dominant socio-political and economic systems of recent decades have experienced a decline in value placed on the natural world. Consequently, this has marginalised the value of nature in planetary health for current and future communities and generations (Spajic et al., 2019). Research shows that many children are experiencing life without an understanding of, or connection to 'diverse natures', or with an intrinsic or instrumental value for its existence and preservation (Chawla, 2015). This has been expressed most consequently for some young people in the sharp declines of ecological literacy and the emergence of 'biophobia' or fear of the natural world (Mann et al., 2022). Simultaneously, there are reports that young people are increasingly more invested in, and have increased anxiety for, protecting the environment or Country[1] and its biodiversity to minimise the causes of anthropocentric climate change than they have in recent history (Godden et al., 2021; Spajic et al., 2019). This presents a complex tension between supporting young people's wellbeing and mental health in the face of profound ecological loss and instability (Vamvalis, 2022).

There is very little research from the Australian context in relation to the way teachers conceptualise nature and the environment in contemporary health education curriculum planning and enactment. Taylor et al. (2016, 2019) have demonstrated how environmental health has lacked a theoretical foundation within the Health and Physical Education learning area, with environmental health education largely reduced to risk-based scenarios such as toxins, pollutants and degradation risk. Yet, education and educators are often called upon in documents and reports (e.g. ACARA, 2021; Gruno & Gibbons, 2020) for the role they play in supporting students to have rich child-nature connections for their own, community and planetary health and wellbeing. The organisation and enactment of official curriculum documents in Australia and other countries such as the UK and New Zealand, with few exceptions (Outdoors Victoria, 2022) leave little guidance for HPE teachers to make nature-based environmental links in health education. A close reading of the Australian Curriculum: Health and Physical Education (AC:HPE) shows an explicit link to the environment and community in the Primary Level 3–4 learning outcome: 'Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing', yet the relationship between health and nature-based learning is likely to be absent from planning intentions, or implicitly noted as beneficial in notions of outdoor learning. There is a national curriculum initiative of Outdoor Learning (ACARA, 2018) however this is not part of state and territory mandated curriculum, and thus variably enacted, if at all. In the state of Victoria, outdoor learning, outdoor education and outdoor recreation are often used interchangeably and valued for their role in HPE for promoting lifelong physical activity or understanding risk versus challenge (VCAA, 2016). This is quite different to notions of nature-based learning that are about curiosity and the quality of the nature-based interaction as exemplified in literature from the Scandinavian context such as Gurholt & Sanderud's work on children's experiences of free play in nature (2016) or what Sanderud et al. (2021) describe as didactic sensitivity, where teachers have highly tacit and flexible judgement with intuition in co-creating and facilitating local open-ended child-environment relationships. In Australia, notions of nature-based learning are most likely to be initiated within the Early Years Learning Framework (2018), and the curriculum areas of Geography and Science rather than HPE (Gray, 2018). There are notable curriculum links to the cross-curricular priority of Indigenous Cultures and Histories, which offers much potential for links to nature via notions of Country and ancestral and spiritual connection to place, however teaching and learning are not accountable in practice to Indigenous futurities and shifting the hegemonic 'white' norms of the learning area remain a challenge (Harrison & Skrebneva, 2020; Whatman et al., 2017).

Through this participatory research, we begin to address a tension of absence of nature-based links in Australian health education, by exploring how the HPE curriculum can support nature-based learning experiences through a novel program of learning with pre-service generalist teachers

from a large Australian University. Through this small study in health education pedagogical planning, we build on studies that seek to develop student's critical understanding of the value of nature-culture and connection to land and Country. The research participants worked in groups to co-design a nature-based learning activity for primary students that aligned with the VC:HPE. Through the students' curriculum design process we report on some of the opportunities and challenges for where environment and nature-based education can explicitly be embedded in HPE school learning programs and activities. The context of this study is limited to the Primary F-6 curriculum. Drawing on critical theory from childhood and environmental studies (Kyttä, 2004; Kellert, 2002), we analyse the pre-service teachers' co-design activities and group discussions to explore the types and qualities of student-nature interactions in the educators' curriculum design plans. We conclude by discussing the possibilities and challenges of designing student interactions with nature more intentionally in health education.

Nature and nature-based experiences

A definition of 'nature'

In Western intellectual traditions, the term 'nature' has been used to describe the living and non-living species and ecosystems that occur 'naturally' without human influence (Tuan, 1978). However, Indigenous and contemporary socio-scientific perspectives both query this dominant, dualistic conception of 'nature' as something separate to, or removed from human influence. It is common to see 'nature-culture' hyphenated or 'nature' in inverted commas or italics as a gesture to depart from such dualism. Many First Nations cultures view themselves and nature as part of extended ecological family or 'kin' that share ancestry and origins. This relational conception cultivates both a deep sense of land (or Country) and belonging in people, and a sense of care for the places and relations they are a part of (Salmon, 2000). O'Flynn et al. (2022) in their research invite health educators to 'see children as Country' in their participatory research with Yuin Aboriginal community. Scholarship has also increasingly embraced a broader, relational perspective of 'nature'. For example, Carver et al. (2002) define nature as the continuum of human-environment influence, ranging from an entirely human designed space to 'untouched' wilderness. Posthumanist researchers including Karen Barad and Donna Harraway adopt a relational lens by viewing humans and non-humans as inseparable partners in a continuously evolving ecosystem (Barad, 2018; Haraway, 2016). For this study, we draw from these perspectives by defining nature as any outdoor relationship that contains living non-human elements, and focusing on the qualities of complex human-non-human relations that are supported by educational activities. Our position, connecting to the notion of 'environmental attunement' (Welch et al., 2021a), is to respect and include local First Nations ways of knowing and to cultivate a place-consciousness that is relational to movement, healing and wellbeing with a sensitivity to the complex interrelationships between nature and culture with the un/built environment and landscapes. We position children as in a constant socio-spatial relationality of nature-culture through their everyday interactions and negotiations with diverse natures; including urban environments (Hadfield-Hill & Zara, 2019). This is distinct from commonly held perceptions of nature as 'out there'.

Educative qualities of nature-based experiences

It is well known that nature-based experiences contribute to a child's wellbeing and development and instils an awareness and value for nature (Wells & Evans, 2003; Wells, 2000; Kellert, 2002; Gill, 2014; Chawla & Cushing, 2007). However, the educative qualities of nature-based experiences are also vital when designing activities to support rich child-nature relations. Social ecologist Stephen Kellert (2002) characterises three types of child-nature experiences, direct, indirect and symbolic, that he differentiates according to the qualities of nature within a context. Here, direct experiences refer to direct physical contact with natural settings that exist independently from humans (e.g. natural reserves or parks), and are the most valued for the benefits they afford children; indirect

experiences, involve direct, physical contact with nature, but in far more restricted, programmed, and managed contexts (e.g. zoo, aquarium or domesticated gardens); and symbolic experiences are those where actual physical environments are replaced by representations of nature (e.g. photographs, images, or stories of natural places or species). Environmental psychologists have further developed this idea by revealing that children's 'agency' also plays a role in shaping their experiences in nature. For example, play researchers (e.g. Hart, 2009; Sobel, 2002) seeking to learn about the special play places of children found they often occur in natural areas close-to-home (e.g. an abandoned lot or park). Because these places are local, familiar and engaging, parents feel more comfortable about granting their children greater autonomy to design and direct their own activities (Kyttä, 2004; Hart, 2009). Regular play in these local natural areas enables children to experience the diversity of sensorial affordances and develop their physical and psychological well-being, and ecological literacy (Chawla, 2009, 2015; Cumbo & Iversen, 2020).

The interaction of socio-physical factors shaping child-nature experiences has been articulated by Kyttä (2004), who in her 'Bullerby Model' describes four types of child-nature experiences – the cell, glasshouse, wasteland and Bullerby – which are influenced by (i) the quality of the natural environment children can access, and (ii) the degree of independent mobility a child is afforded by their adult caregivers in these places. According to Kyttä, the 'Bullerby', a Swedish term meaning 'noisy village', depicts the ideal type of experience as children can access an engaging outdoor play place, with high degree of autonomy from their parent caregivers. In each of the other scenarios, one or both of these factors is constrained, which in turn constrains the development opportunities for children.

While useful, Western academic conceptual framing of child-nature experiences has been critiqued for presenting an anthropological position on human-nature relations, and that contemporary human societies are inherently 'disconnected' from nature; a position notably incongruent with First Nations and posthumanist researchers. Drawing from Malone (2016), Taylor et al. (2021) summarise that 'the founding philosophy of many nature-based education initiatives draw on 'anthropocentric thinking', underpinned by three dominant assumptions: first, that human societies used to be 'closer to' and more in tune with nature; second, our current lifestyles are unnatural and disconnected from nature; and third, proximity to nature is a thing that needs to be learned' (p.408). In our definition of nature, we seek to acknowledge child-nature interactions in more expansive non-dualistic ways and we conceptualise the 'qualities' of child-nature experiences as 'emplaced' (Pink, 2011), continuously evolving in response to personal, contextual, structural, physical influences in correspondence with place (e.g. Sanderud et al., 2021).

The study context: curriculum planning and initial teacher education

Discussions surrounding 'nature-based environments' remain relatively underdeveloped in the Australian context and are often subjugated from common conceptions of the HPE curriculum research and practice (Taylor et al., 2019). Whilst some HPE researchers have taken steps to highlight and address this (Sanderud et al., 2021), the potential for supporting nature-based learning experiences that align with the health education curriculum needs further explication. Some school-based activities and curriculum learning areas/ disciplines lend themselves more readily to support nature-based learning. This is not without tensions and challenges for inclusive and equitable learning opportunities. Outdoor education for example, is linked to nature-based experiences, but is marginalised from curriculum and schooling activities, or in many instances offered only to Private school students with the resources and means to do so. Outdoor education has encountered challenges of recognition and has never fully been realised in consistent or commonplace implementation (Quay, 2016). This paper seeks to make a small contribution to grappling with the intersections of school based health education and nature-based learning. The research method draws on the role of curriculum planning given its importance in initial teacher education to develop pedagogical content knowledge practices and processes (Oh et al., 2013; Penney et al., 2009).

Method

In this study, we aimed to explore opportunities for the HPE curriculum in F-6 (Primary Years) to support student-nature interactions. We carried out our inquiry through a series of online co-design workshops with preservice teachers. Ethics approval to carry out the research was sought from the university Human Research Ethics Committee prior to commencing research. Students consented to their participation in the study within the class. The study provided a learning benefit to the students through a novel workshop as part of their coursework, by engaging with contemporary ideas in health education. Some students went on to design using the concepts of nature and health explored in this co-design workshop in their final assessment task; where they could select a topic of their choice in primary curriculum design and assessment.

Participants

Participants included 72 preservice teachers who were enrolled in a Masters of Teaching Early Years / Primary and were participating in the compulsory generalist Health and Physical Education (HPE) subject. The participants were in the final semester of their studies and close to graduating. The pre-service teachers were a very demographically diverse group – a large proportion (approximately 50%) were international students and had completed their primary and secondary education outside Australia, in China, Vietnam, UK, Philippines, India or Singapore. Students were from both urban and rural backgrounds and had diverse experiences in 'nature' and different levels of teaching experience, with some never having taught students before, and others with some years of experience.

Three-phase co-design process

The research activities involved a three-phase co-design process carried out with pre-service teachers. Activities were carried out during the Government mandated Covid-19 lockdowns in Melbourne during 2020. All activities were carried out online using Zoom conferencing to support remote, synchronous learning. The online activities were designed and facilitated by the two authors of this paper through the topic of curriculum planning. One author was a coordinator of the generalist HPE unit and had been working with the students for the whole semester. The other author was a guest post-doctoral researcher who specialised in participatory design with children in nature-based contexts. The process involved three phases that were designed to support participants reflect on how student-nature experiences could be supported through HPE curriculum design:

(1) Students engaged with two readings (Truong, 2017; WHO, 2018) that focus on the role of health education in schools, and were directed to focus on links to environments. These readings were selected as they provided clear links to the workshop content and built upon content that had been examined prior in the course.
(2) Students then participated in an one-hour interactive seminar where the guest lecturer carried out a 20-min presentation introducing research on the benefits of child-nature experiences (e.g. Townsend & Weerasuriya, 2010; Jack, 2010); and key theoretical concepts from environmental psychology and children's geographies (e.g. Kytta, 2004; Chawla, 2007) that explores the various qualities of child-nature interactions and the role of adult caregivers (e.g. parents and teachers) in shaping these interactions. Participants were then separated into break-out groups (5-6 people / group) to discuss how the themes presented could be incorporated within HPE curriculum programming and planning which was followed by a whole-group Q&A discussion session (40-mins).
(3) A one-hour workshop (with four separate groups), where participants were invited to codesign a learning activity for a specific year level that supported student-nature interactions, and aligned

with the HPE Curriculum. Participants were firstly introduced to the codesign task before being separated into break-out groups (4–5 people) to codesign their activity. Each group had an allocated Padlet board (https://padlet.com/) to note down key discussion points and the ideas that emerged. The Padlet also contained three prompt questions derived from the work of Kyttä (2004) and Kellert (2002) to promote reflexive thinking about the following three questions: (i) What is the 'nature' you are introducing into your activity?; (ii) What is the role and relations between students, the teacher and nature in your activity?; and (iii) What are the links to the HPE curriculum?

The two researchers moved between each of the break-out groups to take-part in co-design discussions. During the final 15-mins, each group returned to the main room to outline their activity and critical discussions with the researchers and other students.

Data collection and analysis

The data collected through these activities included (i) the recordings of the seminar Q&A and codesign group discussion that were later transcribed, and (ii) the Padlet boards containing the activity ideas, curriculum links and supplementary notes documented by participants and researchers during the session.

Data was analysed by firstly tabulating the data generated from the Padlet board and transcription to understand the qualities of each learning activity by the 18 participant groups. This table included a brief activity summary, target year level, HPE curriculum links, the type of 'nature', and quality of the student-nature interaction that the activity supported (Table 1). Our classification of 'nature' is a physical location where the learning activity is carried out (e.g. a classroom, an outdoor school area, or in a local park or reserve). This was important to unveil the types of 'nature' children had available to them, and the agency of this nature was afforded by humans. For instance, nature in a kitchen garden cultivated by and for human use can be considered to have less agency (independence from humans) than a nature reserve or beach environment (Kellert, 2002; Kyttä, 2004). The 'quality of student-nature interactions' promoted through each activity were generated through a process of inductive coding grounded in Kytta's Bullerby model (2004) where we looked at: (i) how students were engaging with nature (e.g. directly, indirectly); (ii) the level of student and teacher agency in directing these interactions (e.g. child-directed, teacher-facilitated, teacher-directed); and (iii) the agency of the 'nature' children were being exposed to, as previously described (Kyttä, 2004). These deeper reflections were intended to unveil preconceptions about 'nature', the role of the teacher in facilitating an outdoor activity beyond the classroom, and ways to balance the learning priorities of the HPE curriculum with the curiosities and learning opportunities a natural environment has to offer.

Over a process of inductive and deductive coding the data over multiple times, we then devised five core themes that depicted the qualities of student-nature interactions across the 18 participant groups, which we will describe below: exploration, embodiment, cultivation, appropriation and representation.

Findings

The 18 groups each designed an activity that they thought linked the HPE curriculum to themes of nature presented in the earlier lecture (see Table 1 for a tabulated summary of these activities). Twenty different curriculum links were identified across all the groups, with only three curriculum points being cited by more than one group:

- VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing (used by eight groups);

Table 1. Activity summary of 18 participant groups.

#	Activity summary	Year	Nature	Student-nature interaction	Curriculum links identified by group
1	Create a kitchen garden. Show them how to carry tools and vegetables in a safe way.	3	School kitchen garden	Cultivation	VCHPEP091: Identify and practise strategies to promote health, safety and wellbeing; VCHPEM100: Examine the benefits of physical activity and physical fitness to health and wellbeing
2	Students explore and capture plants in the kitchen garden, pick edibles, make a nutritious salad and reflect on links between the garden and nutrition.	3–4	School kitchen garden	Exploration Cultivation	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments, and health and wellbeing
3	Sensorial treasure hunt where students touch the different plants and textures, listen to different sounds, and look for different animals and observe how they move. Then return to the classroom and mimic how they move in animal yoga.	F-1	Natural area at school	Exploration Embodiment Representation	VCHPEP063: Participate in play that promotes engagement with outdoor settings including aquatic and the natural environment
4	Students walk through parkland to collect natural materials from the ground that reflect the colours of the seasons. Then return to classroom to sort into colours and share thoughts on these items collected, and then create a collage using art materials (paints, crayons) + collected materials	F-1	Parkland or reserve near to the school.	Exploration Appropriation	VCHPEP063: Participate in play that promotes engagement with outdoor settings including aquatic and the natural environment VCHPEP079: Identify and explore natural and built environments in the local community where physical activity can take place
5	A mindfulness audio journey where students explore different sounds in the place, and then reflect on how these sounds make them feel using design prompts (e.g. emoji images or reflective discussion).	1–2	Parkland outside or within the school.	Exploration Embodiment	VCHPEP074: Recognise situations and opportunities to promote their own health, safety and wellbeing
6	'What is the Ocean?' – students move through a series of activities to learn about the ocean. (i) movement and health – exploring movements of different aquatic animals + health benefits of movement; (ii) beach safety, and how to avoid panicking at the beach; and (iii) sustainability, litter and pollution.	3–4	Classroom with visual aids	Representation	VCHPEP090: Describe and apply strategies that can be used in situations that make them feel uncomfortable or unsafe; VCHPEP091: Identify and practise strategies to promote health, safety and wellbeing VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments, and health and wellbeing. VCHPEM097: Practise and fundamental movement skills in different movement situations in indoor, outdoor and aquatic settings; VCHPEM098: Perform movement sequences which link fundamental movement skills.
7	Students reflect on how different cultures use natural materials in sport, and then forage for materials in nature, create sporting equipment before playing the game/s.	3–4	Natural area at school	Appropriation Embodiment	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments, and health and wellbeing.
8	'Bear hunt' – students to find bears hidden around school grounds by teachers using a map, passing through a range of set obstacles.	1–2	School grounds	Appropriation Embodiment	VCHPEM081: Construct and perform imaginative and original movement sequences in response to stimuli.

(*Continued*)

Table 1. Continued.

#	Activity summary	Year	Nature	Student-nature interaction	Curriculum links identified by group
9	An inter-year obstacle course: Year 6 students design an obstacle course using outdoor, natural areas at the school. Foundation students are then guided to move through the obstacles playfully.	5-6 + F	School grounds	Appropriation Embodiment	VCHPEP113: Explore how participation in outdoor activities supports personal and community health and wellbeing and creates connections to the natural and built environment; VCHPEM117: Propose and apply movement concepts and strategies; VCHPEM121: Apply critical and creative thinking processes in order to generate and assess solutions to movement challenges; VCHPEM122: Demonstrate ethical behaviour and fair play that aligns with the rules when participating in a range of physical activities. Foundation VCHPEP060: Practise personal and social skills to interact with others; VCHPEP062: Identify actions that promote health, safety and wellbeing; VCHPEP063: Participate in play that promotes engagement with outdoor settings including aquatic and the natural environment; VCHPEM064: Practise fundamental movement skills and movement sequences using different body parts and in response to stimuli in indoor, outdoor and aquatic settings; VCHPEM069: Use trial and error to test solutions to movement challenges.
10	'At the beach' – engage students in three activities. (i) Safety – learn about safe currents; (ii) Movement and exploration – explore the rock platform and sand dune ecosystems; and (iii) Sustainability – study the pollution and litter at the beach and write a letter to local member about the beach condition.	3–4	Beach – rockpools, sand dunes.	Exploration Embodiment Appropriation	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing. VCHPEP091: Identify and practice strategies to promote health, safety and wellbeing.
11	'A beach scavenger hunt' – students search for different things in the natural environment (on a list as provided by their teacher). This list may include instructions like 'something shiny, something yellow, something sticky, something furry' then bring all of their scavenged items together to create a piece of art.	3–4	Beach – rockpools, sand dunes, beach.	Exploration Appropriation	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing.
12	Nature obstacle course. Students (in groups of 4-5) are to find fixed natural objects around school grounds, and then incorporate these into an obstacle course for other groups to complete. Students then examine the ways their unique nature elements enhanced the obstacle course.	3–4	School outdoors	Appropriation Embodiment	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing. VCHPEP091: Identify and practice strategies to promote health, safety and wellbeing.
13	'Beach pollution and health' – students to learn about the potential dangers of the beach including polluted water and litter, and the impact on health.	5–6	Beach	Appropriation	VCHPEP079: Identify and explore natural and built environments in the local community where physical activity can take place
14	'Water movement' – an aquatic activity where students are taken through a series of movements in the water, so they can learn to control and move their body and learn about the benefits of swimming for health.	5–6	Swimming pool	Embodiment	VCHPEM117: Propose and apply movement concepts and strategies

15	'Nature yoga' – teacher to take students through some yoga poses, inviting students to be in the moment by focusing on the sounds around them, and the movement and breath.	5–6	Green space at school	Embodiment	VCHPEP110: Examine the influence of emotional responses on behaviour, relationships and health and wellbeing.
16	'Fairy house' – students move through the environment, exploring and collecting natural materials; and then work in teams to build a fairy garden using materials found.	3–4	Bushland outside school	Exploration Appropriation	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing.
17	'My garden' – students invited to explore their own garden at home and reflect on what the grow and when. The teacher then provides students flash cards of different fruits and vegetables and the seasons they usually grow.	F	Home edible garden Classroom	Cultivation Representation	VCHPEP063: Participate in play that promotes engagement with outdoor settings including aquatic and the natural environment
18	'Mindfulness' – two parts: (i) Teacher-led yoga where the teacher mimics the shape of different natural creatures (trees, ants, birds) and students follow. (ii) Students then explore the natural area and collect objects that make them happy; (iii) Students sit in a circle, reflect on the objects and how they feel now.	F-1	Natural area at school	Appropriation Embodiment	VCHPEP096: Participate in outdoor games and activities to examine how participation promotes a connection between the community, natural and built environments and health and wellbeing. VCHPEP091: Identify and practice strategies to promote health, safety and wellbeing.

- VCHPEP091: Identify and practice strategies to promote health, safety and wellbeing (used by five groups); and
- VCHPEP063: Participate in play that promotes engagement with outdoor settings including aquatic and the natural environment (used by four groups).

Interestingly, groups adopted a different approach to linking the curriculum to the task. Fourteen of the groups approached the activity by firstly nominating parts of the curriculum they thought would provide an avenue to connect students to nature, and then designed the activities in response to these. For example, 'we looked at Foundation [and] looked at the curriculum links first and then decided on the topic.' The remaining four groups approached it differently, designing the activities first, before making links to the curriculum retrospectively. Interestingly, those who made curriculum links retrospectively tended to identify more links from both within HPE and other disciplines, whilst also adopting a broader interpretation of links as illustrated with group 9 who identified nine curriculum links with their inter-year obstacle course (Year 5–6 and Foundation). In both instances no students thought to make connections to the Outdoor Learning framework or Aboriginal and Torres Strait Islander Cultures and Histories cross curricular priorities.

The physical locations of activities designed by participant groups is an important indicator of what students perceive nature to be, and the role natural environments can play in supporting learning. Table 1 shows how of the 18 participant groups, two-thirds (n = 12) situated their activities within school grounds in three types of natural areas – a park or green space (n = 8); a school kitchen garden (n = 3) and within a classroom (n = 1) whilst others returned to the classroom at some point in their activity (n = 2). The remaining six groups opted to venture beyond school grounds, situating activities in a park or reserve that contained bushland (n = 2), the beach (n = 3) and a swimming pool (n = 1).

Interestingly, when describing 'nature' in their activities, it was clear participant groups had reflected on the unique qualities and characteristics of nature to varying degrees. A number of groups skated over the role and qualities of nature in their activities or equated 'nature' with the 'outdoors'. For example, some groups would describe the 'school oval' or 'school garden' as the location without describing how the specific qualities of these environments contributed to their activity. '[We will hide the bears] in the school gardens and the oval and give the students directions like 'go over' or 'go under' so there are links to safety while they are outside' [Group 8].

Other groups emphasised the unique qualities nature could offer their students, by either describing details of the natural materials that they intended to use as part of their activity as illustrated by Group 4. 'The teacher will instruct the children that they are going on a nature walk and they are collecting things they find on the ground, so they don't destroy anything in the process. They are looking for the colours that represent that season – and they can interpret that however they choose'. Or, by detailing the specific sensorial and physical qualities the natural environment could bring to the activity, as illustrated by Group 3 describing their activity in a nature reserve, 'We want the students to touch the different plants and feel their different textures, listen to different sounds, look for different animals and insects as they move through the place and observe how they move'.

How did the designed activities promote student nature interactions?

Our data analysis revealed five distinct qualities of student-nature interaction across the group activities: (i) exploration; (ii) embodiment; (iii) cultivation; (iv) appropriation; and (v) representation. Many group activities two or more of these types of interactions in their activities (see Table 1).

The first theme, exploration, describes open-ended, relatively unstructured interactions with nature, as students are invited to directly engage with nature, according to their curiosity and senses (sight, sound, smell, touch). These types of interactions allow students to witness the agency of living and non-living qualities of nature – providing space for students to realise their

curiosities, and experience unpredictable interactions. This type of interaction was supported by seven of the 18 group activities (Table 1). For example, in Group 11's beach activity, students are invited to 'explore the rock platform and observe the different creatures living there … we want them to explore this according to their own interests', or Group 3 who invites students to notice the diversity within a nature reserve by 'looking', 'listening' and 'touching' the various species and textures they encounter.

The second theme, embodiment, describes the types of activities that focus on sensorial, whole body action within natural environments, which we observed across ten groups (Table 1). This type of student-nature interaction can be contrasted from the exploration theme in that interactions with nature are structured and often teacher-led rather than driven by students or contributions from nature. These activities tended to focus on the physical education or movement strand of the curriculum. This is illustrated by Group 14 who designed a water movement activity where teachers guided their students through a series of movements in the swimming pool, and in the mindfulness activities (of Groups 3 and 15) who focus on sensorial engagements with nature (look, listen, touch) for part of the activity. Whilst aspects embodiment and exploration were both overlayed in some of the activities and they often support each other in important physical education experiences, the theme of embodiment in the findings here relates to planned movement educational experiences or physical skills.

The third theme, cultivation describes a more intentional form of interaction with nature, where specific types of plants (or could be other living creatures) are selected, cared for, and sown to support learning about the growth cycle and often linked to 'healthy' eating. This type of interaction was most obviously observed in the three activities situated in a school kitchen garden (Table 1). The kitchen garden environments described were different from bushland or the ocean in that opportunities for 'wildness' of non-human elements is constrained by regular cultivation and their purpose of providing food for people. However, the quality of student engagement with these kitchen gardens varied considerably across the three groups, with one group designing a highly structured activity – inviting students to collect data on plant growth and water usage over time, whilst highlighting themes of 'movement' and 'safety' 'so students can learn about safe lifting and how to move through the garden safely'.

In contrast, another group adopted a more open-ended approach, inviting students to design their own garden by deciding on the plants they would like and how they should be planted, and allowing them to observe the garden over time, noticing shifts and the gradual habitation of other species (e.g. insects and birds). 'We want the garden to be a fun and creative place for students as well as a place to learn about food'.

The fourth theme, appropriation, observed in 10 group activities, describes the interactions where the natural elements are intended as a tool or host for a student activity, with little opportunity to express its own agency within the task. Similarly, the actions of the student are relatively constrained to the task or intention set by the teacher. This is most clearly seen in the many treasure hunt activities, where the gaze of students is directed to focus on the 'treasure' of interest, such as the bears hidden throughout the school grounds (Group 8), or natural materials of a specific colour to later incorporate into an art exercise in the classroom (Group 4). It is also seen in the obstacle course activities, where the physical features are intended as tools to promote teamwork between students, as illustrated by Group 9 whose activity invited year 5/6 students to design an obstacle course for foundation / year 1 students at school. This group emphasised that 'we wanted to promote teamwork in this activity by getting the groups [to] work together to find materials and create obstacle courses for other students'.

Fifth and finally, representation refers to situations where students are engaging with representations of nature, rather than engaging with nature through direct, embodied interaction – a phenomenon we observed in three groups. This is most clearly demonstrated by Group 6 who situated their activity within the school classroom, and invited students to observe aquatic species using images and videos and then reflect on movement in aquatic v terrestrial environments. In another

example, Group 3 planned a return to the classroom after exploring nature to then mimic the various animals they have observed through animal yoga.

When quizzed as to why they had opted to situate their activities in particular locations, pragmatic considerations and the balance of safety and risk were revealed to be the primary influencers shaping their decisions.

Pragmatic considerations

The time and resources required to carry out an activity were a primary consideration for participants. The 12 groups who opted to situate activities within school grounds emphasised that the natural areas within the school were convenient to access and allowed for more time and resource efficiency as additional supervision requirements were not required. These natural areas included school kitchen gardens (#3), outdoor green space such as a sporting field or a grassy area with trees (#8), and in one case a classroom that had been repurposed with materials to represent an oceanic environment (Table 1).

However, six participant groups opted to situate their activities outside of the school, with some raising concerns that the school may not contain an adequate example of 'nature' that would support the type of experience they had designed. For example, Group 16 had situated their activity in bushland so year 3–4 students could collect a diversity of natural materials and then work in groups to create a fairy house or garden. 'The first part of the activity could be about developing their gross and fine motor skills as they are scrambling through trees and things … [the second part] is about teamwork and developing their social and emotional skills within the bush so they connect to nature'. When asked about the location of the activity, participants described that the activity would likely have to be carried out off school grounds – 'unless the school had bushland on the grounds … green spaces or sporting fields are just not interesting enough … they don't have enough things for kids to find or connect with'.

Other groups were explicit about spending the additional time and resources (e.g. travel costs, supervision) so their students had an opportunity to connect with what they considered to be an engaging natural environment. For example, three participant groups designed activities that were situated at the beach, with each activity including inviting students to explore the living and non-living components of the rock platforms and sand dunes, and then learn how to observe a rip or dangerous ocean current. These activities relied almost entirely on the beach environment to support an engaging learning experience – a benefit that these participant groups emphasised was worth the additional resources. 'The beach is the beach. There is so much to learn there … It requires more work to organise but we thought it was worth it' (Group 11).

Balancing safety and risk

Student safety, and ways to balance student safety with risk, was a second consideration expressed by all 18 participant groups. This consideration has obvious links with the first – pragmatic concerns – as the location and quality of an activity can inform the time, resources and supervision required to mitigate risks involved. However, it has been presented as a separate theme here because discussions with participants revealed a diversity in what was considered 'safe', and the willingness or confidence of participants to mitigate perceived or potential risks of 'being in nature'.

This is clearly demonstrated across the five groups who designed activities that were intended to connect students to the marine environment. All five groups expressed an awareness of the potential risks the beach presented, from dangerous aquatic animals, currents, or students simply 'wondering off'. However, they opted to manage these risks very differently, with three of the groups (10, 11, 14) opting to take their students to the beach, and manage risks by (i) ensuring there was adequate adult supervision, (ii) agreeing on activity boundaries with students, and (iii) designing a low-risk activity, such as looking at (not touching) marine creatures living on the rock platform or observing

the ocean currents from the sand. The participants in these groups valued the learning benefits the beach could offer students, and had participants that had grown up in coastal communities and were confident managing any potential risks the beach posed, as expressed by one participant who said, 'A few of us grew up on the coast, so we are comfortable with the beach … we could get the local lifeguard to talk to the kids about beach safety as well … It's important to actually be there'.

The other two groups took a very different approach by inviting students to engage in riskier activities, such as swimming or interacting with aquatic creatures, but controlling this risk by situating the activities in more controlled and predictable environments. For example, Group 14 designed an activity around the theme of 'movement' and opted to situate their activity at a local swimming pool as it provided a more controlled environment that could 'teach children about controlling their body and movements while learning about the benefits of the water'. When quizzed as to why they chose the swimming pool as a location, the participants expressed that they perceived the beach to be a relatively dangerous place to swim, and they didn't feel comfortable mitigating these risks. 'The pool is safer for students as it is more contained than the beach … there are no rips or dangerous creatures or anything like that … It's really hard to do a beach activity without going to the beach … and it's really hard to take 25 grade one students to the beach'. This perception of nature as being full of potential dangers was a perception that shaped group 13's activity on beach safety as illustrated by one participant who said, 'I remember a class back in primary school and they showed us this photo and someone was playing volleyball on the beach and there was a broken glass bottle, underneath them, and it was like really shock value but I've always remembered it to this day.'

Finally, Group 6 opted to avoid the risks of the beach environment altogether by situating the activities in the classroom and using design materials and media to invite year 3–4 students to learn about the movements of other aquatic creatures, 'cleaning up the beach', and some basic safety principles about being near or in the ocean. The participants in this group expressed that they didn't feel confident in their understanding of the risks of the ocean or how to manage them appropriately. 'None of us grew up near the beach so we want to try and recreate the learnings at the beach but in the classroom'.

Discussion

What counts as 'nature' in HPE?

At the beginning of the co-design workshop, the majority of the pre-service teachers expressed that they hadn't considered 'nature' and 'environment' as related to the 'HPE' learning area before. By the end of the session there was a clear sense of purpose and appetite for curriculum design possibilities with common themes across the cohort. This was especially evident when students began to investigate health in a multidisciplinary way linked to learning about health with environment and community, rather than individualised notions of health behaviour change and learning for health. The workshop generated ideas and much design potential. At the same time, the participants' notions of 'nature' or the 'environment' were largely taken for granted in the design of their activities, rather than problematised or considered in a relational way. There was a common assumption that natural areas would be readily accessible to schools, either within them or close by. This not only raises questions about school policies of green space use for learning, but also whether the school system can meet the assumption that there are resources like a kitchen garden, despite such learning affordances often being challenging to initiate and maintain in school settings. There were also different cultural interpretations of nature with a few teachers frightened of the perceived natural environment, expressing discomfort in taking students into the 'unknown'. For instance, as an exception to the majority, one student mentioned that they grew up in Hong Kong without 'nature' and expressed that they were not sure where to start with this activity or

the concept of nature. For most, nature was something perceived to be 'used' for activities rather than considering the qualities of the human-nature interaction or a sense of care and connection to nature or Country and no groups explicitly mentioned links to Indigenous cultures or histories or finding out more about the Traditional Owners of the place on which the activities were designed on or for. This demonstrates how in future research, there is a need to not only co-design with First Nations people and integrate this into the workshop, but also engage educators with co-ontological ways of knowing and being with nature on Country when doing curriculum design work (Moran et al., 2018).

The types of activities designed and the educators' imagination of nature were often shaped by curriculum content descriptors and elaborations (learning outcomes) in the topics of safety, movement, physical activity, food and nutrition. These topics were not prompted in the facilitation of the workshop but were deemed suitable for curriculum planning via the co-design process of groupwork discussion. This demonstrates how some areas of the curriculum lend themselves more readily to nature-based content, but it also presents a tension in how the curriculum language along with the students' prior knowledge dictates the types of interactions with nature that are likely to be planned with HPE curriculum. For instance, Group 6 had an activity where the focus was on specific movement skills and this was applied to the context of the ocean. However, if we look at Kellert (2002) and Kyttä (2004), it's about more than just the environment as setting, it's also about the quality of the interaction with nature which requires reflection on the intention behind the activity and the role and relational agency of nature.

This research raises a number of questions about professional development and pedagogical content knowledge for teachers who are linking nature to health education curriculum. To develop this work further, teachers and student teachers will need an explicit pedagogical content knowledge of human-nature relations. Ideally, there would be guiding frameworks and more time for formative and summative feedback on the workshop of curriculum design ideas to develop a 'dialogic sensibility' of nature in pedagogy. We did attempt to incorporate formative feedback into the discussion of students' work as part of the workshop, but this would need to be developed further and formalised as part of student assessment in order to have a better chance of providing the educators with the knowledge and skills needed to critically integrate these concepts in their pedagogy.

Nature and health curriculum, an educational and planetary imperative?

Is it the responsibility of health education to build intentional connections with nature-based learning? Some might question that such initiatives only load teachers up with the burden of more work in an already overcrowded curriculum. On the other hand, whilst we agree with the sentiment of not wanting to crowd teachers' workloads, we would argue that a contemporary health education must look to interdisciplinary links, and especially the environment and nature as part of a quality health education program to transform how health education is conceptualised and enacted in Australian schooling. As we have shown, at least in Australia, there are some explicit curriculum links to nature and the environment within HPE curriculum. Our efforts in the current climate are best directed at how to do this work well across educational policy, practices and pedagogy and to lobby for its ongoing and more nuanced inclusion. There will only be an increasing range of initiatives that link schools, health and climate formally and informally. The state-wide Achievement Program in Victoria Australia which is the local settings based approach to health promotion, for instance, recently drew on the Victorian Public Health and Wellbeing Plan 2019–2023 as a strategy to increase students' connection with nature, along with; eat more plants; increase active travel; reduce waste; use less energy; and get climate-ready (State of Victoria, 2018).

While the findings of our co-design workshop demonstrated that these pre-service teachers were exposed to new ways of thinking to create deeper and interdisciplinary engagement within the design of learning activities to support nature-based programming within HPE, there were

significant limitations to their conceptions of nature such as the exclusion of First Nations notions of Country. While there are limitations to the pilot co-design workshop reported in this research for forging critical understandings of nature amongst educators, this research offers important insights into ways forward in making links between health education curriculum planning, nature and more broadly planetary health. An obvious place to look in doing this type of work is Outdoor Education, a long-time friend of Physical Education for not only pedagogical approaches, but also debates and resources on mitigating and conceptualising risk in nature-based activities. There are also important links to Geography, The Arts, Design and Technology and Environmental Education and Science to explore. Many of these connections depend on the level of learning/ age of students and the local communities in which teachers are working. Beyond the imagined places of nature for teaching and learning, there is scope to further prompt teachers to engage with their own personal, local and nearby places in their everyday life. Understanding nature-based education as an aesthetic and embodied experience may provide fruitful for conceptualising the role of nature in health education (Finley, 2011). There are useful methods to draw on, such as what Lundvall and Maivorsdotter (2021) refer to as the notion of 'environing'; an embodied process of exploring stories of place. There is also potential in linking to socio-ecological approaches to health education (O'Connor & Alfrey, 2015). Enacting such co-ontologies in teacher education and schooling will help educators to connect with their own ecological identities, but also expand notions of the links between health, nature and the environment in ways that haven't previously been explored. Such pedagogical links between 'nature' and health education are essential for contributing to societal relational webs of care, nurture understandings of complexity and transform embodied and collective decision making in ecological health and wellbeing.

Note

1. In Australia, Country entails a fundamental relationship and sense of belonging. It is often conceptualised as 'land' in North America and New Zealand. Aboriginal knowledge is always with Country (McKnight, 2016) and is a key priority concept in the Australian Curriculum (Harrison & Skrebneva, 2020). Country provides a holistic framework with links to the social determinants of health that are fundamental to health and wellbeing (Ganesharajah, 2009).

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