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Human and Nature in Physical Education and Health: A Diffractive Analysis of Policy Documents

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Abstract

The research field of physical education and health (PEH) holds a great potential for exploring environmental issues, but the interest has been scarce. In this paper, we aim to trouble the separation of humans and nature, which has long been reproduced in PEH research and practice. To frame the problem, we turn to environmental education (EE) research, where scholars have argued that the human/nature divide serves as a foundation for environmental degradation. Drawing on Karen Barad's posthumanist framework of agential realism, we explore the emerging conceptualisations of humans and nature when Swedish PEH policy documents are diffractively read through previous research, the concept of agential cuts and our own historicities. The analysis is presented through three diffraction patterns emerging around movement, health and indoors/outdoors, phenomena which are central not only to PEH but also to EE. We conclude that thinking with diffraction can open spaces within PEH educational policy for reimagining existing binaries between humans and nature. In this way, PEH practice might contribute to troubling the foundations for environmental injustices and issues of unsustainability.

Keywords: Diffractive analysis; environmental education; human/nature divide; physical education and health; policy documents

Introduction

This paper is an exploration of how humans and nature become conceptualised through a diffractive analysis of policy documents for the Swedish school subject physical education and health (PEH). In PEH research, the interest in a conceptual divide between humans and nature has been rare, so to frame the problem that we wish to address, we turn to environmental education (EE) research. In this field, scholars argue that a view of nature as different from, and less valued than, humans is the basis for environmental degradation (e.g., Brown, Siegel & Blom 2020; Isaksson & Weldemariam, 2024; Mcphie & Clarke, 2020). This othering of nature enables an unjust hierarchy of oppression (Mcphie & Clarke, 2015) and the idea of nature as a resource, which has allowed human practices to drastically alter different earth systems (Jukes, Stewart & Morse 2022b; Riley, 2023). Implied in the process of othering is the conceptualisation of humans and nature as separate. Aligning with the posthumanist framework of agential realism (Barad, 2007), we posit that this separation is both materially and discursively produced, i.e., a material-discursive phenomenon (See Section one below). Hence, it can be reworked, and educational practices that wish to avoid recreating the foundation for environmental degradation must create an awareness of how humans and nature become conceptualised.

In the global field of PEH research there is a growing interest in employing posthumanist approaches to questions about environmental issues (e.g., Mikaelis, 2019; Olive & Enright, 2021; Riley & Proctor, 2023; Taylor, Wright & O’Flynn 2019). In Sweden, however, environmental issues have only begun to interest PEH researchers (Mikaelis, 2019; Quennerstedt, Backman & Mikaelis 2024), and the combination of PEH and posthumanism is scarce (for one exception, see Larsson, 2023). The subject of PEH is interesting in relation to the problem stated above since its practice has been found to rest on a separation of humans and nature (Mikaelis, 2019). Further, PEH originates from the Swedish Ling-gymnastics, which carries a strong focus on human bodies (Kirk, 2010; Larsson, 2013). Moreover, one of the central objectives in the Swedish PEH curricula is to offer pupils possibilities to develop a relationship to nature (Swedish National Agency of Education [SNAE], 2011b, 2022). These examples indicate that humans and nature are presumed to be separate entities in PEH, and we thus find it important to discuss openings for practitioners who wish to trouble this separation.

We have chosen to look at policy documents since, in line with Bozalek (2022), we see educational policies as “material doings or enactments of the world” (p. 17). Hence, exploring the conceptualisations of humans and nature through a diffractive analysis¹ of policy documents is one way of addressing the human/nature divide enacted in PEH, as well as suggesting openings for how it can be reworked. In summary, with this paper we wish to contribute to the sparse work on educational policy addressing the intersection between the fields of PEH and EE (Mikaelis, 2019; Olive & Enright, 2021; Riley & Proctor, 2022) by exploring conceptualisations of humans and nature in Swedish PEH policy documents and discuss how these might be reworked. Our inquiry was guided by two entangled questions:

- *How do humans and nature become conceptualised when PEH policy documents are diffractively read through previous research, the concept of agential cuts, and our own historicities?*
- *What openings for reworking the separation of humans and nature in PEH practice are offered through this diffractive analysis?*

Before continuing, we wish to address an important issue of language. In English, the concepts of human and nature are nouns, and for the clarity of this paper we must use them as such. Consequently, we perform them as separate entities, which reproduces the divide that we aim to trouble (c.f., Brown et al., 2020). Therefore, we will henceforth write them with a strikethrough (c.f., Isaksson & Weldemariam, 2024; Jukes, 2021; Mcphie & Clarke, 2015) to indicate that we do not consider them pre-given entities. Citations will be excepted. Though perhaps making the text more difficult to read, we intend the strikethrough to be a disruption that forces the reader to pay attention to the ways in which ~~humans~~ and ~~nature~~ are taken for granted. We thereby use language in a way that “deliberately causes trouble in reading” (Murriss, 2022, p. 8), in alignment with the agential realist framework of the paper.²

In section one, we will account for the research apparatus, i.e., the phenomena that together constitute the practice through which the inquiry is made possible (Isaksson & Weldemariam, 2024). This will cover a selection of literature from the fields of EE and PEH, as well as an overview of Swedish PEH and its policy documents. Furthermore, we will account for Karen Barad’s framework of agential realism, a performative posthuman account in which the world is iteratively becoming through material-discursive practices. We will focus on the concepts of *agential cuts* and *diffraction* as they are central to the framing of the problem as well as the methodological assumptions of our analysis. The section will end with an account of how the diffractive analysis was carried out. In section two, we will account for three patterns that emerged through our analysis. This will mainly address the first question stated above. Finally, in section three, we will

¹The doings of a diffractive analysis and its underlying concepts will be elaborated on in Section one below.

²Karen Barad also stretches the use of punctuation throughout their scholarly work to challenge dominant onto-epistemological assumptions embedded in linguistic structures (Barad & Gandorfer, 2021).

address the second question stated above by discussing possible implications of our inquiry. We will then close the paper with some concluding remarks.

Section one: The research apparatus

Four main phenomena constituted the research apparatus of our inquiry: PEH and its policy documents, previous research, central concepts from agential realism, and the researchers. Since the inquiry involved no other *human* participants, research ethics did not entail any written consent. However, Barad (2007) and Murriss (2022) remind us that research as a worlding practice is always an ethical matter, which implies accounting thoroughly for the exclusions and inclusions of the research apparatus. Nevertheless, given that the entanglements of any phenomenon could be traced in infinity (Barad & Gandorfer, 2021), the account below is limited to the features of the four phenomena that became most important in response to our research questions.

The Swedish PEH context

In Sweden, PEH is mandatory from elementary to upper secondary school and centres around three main areas: *movement, health and life habits, and friluftsliv³ and outdoor activities*. In public debate, PEH is often legitimised in terms of instrumental values for *humans* (e.g., preventing obesity, increasing physical activity, enhancing children's concentration) rather than having (educational) values of its own (Capel & Blair, 2020). This favouring of the *human* body can be traced back to Swedish PEH's origin in the Ling-gymnastics and later evolution in close connection to (natural) science subjects such as sports physiology and sports medicine (Kirk, 2010). Friluftsliv has a strong position in the Swedish PEH curricula (SNAE, 2011b, 2022), although it is weakly implemented in teaching practices (Backman, 2018).

The PEH policy documents

In Table 1, we account for the policy documents included in our inquiry. We list their Swedish names, our translations into English, and the codes used to refer to them in the next section. Gy11 and Lgr22 are general for the Swedish school system, while the remaining documents are PEH-specific.

Previous research

In many countries, including Sweden, environmental education (EE) is expected to take place in PEH through the acknowledged key learning area of outdoor education. However, teacher habituses, student expectations and dominating logics of performance are limiting factors for expressions of EE in PEH (Backman, 2018). In this account, we treat EE and PEH as entangled by presenting a selection of literature that has explored them through relational perspectives. However, we begin with one difference between the wider fields of EE and PEH emerging as important in relation to the focus of our inquiry.

While posthumanist research focusing on the *human/nature* divide can be found in the field of PEH, it is more common in EE, where a reimagining of relationships between multiple bodies and a rethinking of how to do research are two prominent themes. Jukes (2021) argued that thinking with a landscape and its different bodies might challenge *human*-centred knowledge. This could pose ethical questions around the values behind different choices and highlight possible implications for all bodies. Similarly, Jukes et al. (2022b) argued that a diffractive reading

³In the Scandinavian countries, outdoor education in educational settings is often expressed as *friluftsliv* (literally translated to *free air life*), a concept now frequently occurring in English texts (Backman, 2018).

Table 1. Selected physical education and health policy documents

Swedish title	Our translation	Year	Code
Läroplan för gymnasieskolan	Curriculum for upper secondary school	2011	Gy11
Läroplan för grundskolan samt för förskoleklassen och fritidshemmet	Curriculum for elementary school, pre-school, and school-age educare	2022	Lgr22
Ämnesplan – Idrott och hälsa (gymnasieskolan)	Syllabus – Physical education and health (upper secondary school)	2010	ÄP gy
Kursplan – Idrott och hälsa (grundskola)	Syllabus – Physical education and health (elementary school)	2022	KP gr
Kommentarmaterial – Om ämnet Idrott och hälsa (gymnasieskolan)	Commentary material – About physical education and health (upper secondary school)	On the 2010 syllabus	KM gy
Kommentarmaterial till kursplanen i idrott och hälsa (grundskolan)	Commentary material to the syllabus for physical education and health (elementary school)	2022	KM gr
Bedömningsstöd i ämnet idrott och hälsa (gymnasieskolan)	Assessment support for the subject of physical education and health (upper secondary school)	2014	BS gy
Bedömningsstöd i idrott och hälsa (åk 7-9)	Assessment support for physical education and health (year 7-9)	2012	BS gr

of landscapes and places could offer possibilities to analyse entanglements of a multitude of species, thereby decentring *humans*. Further, Mcphie and Clarke (2015) and Morse (2021) explored imaginative walks through landscapes to create embodied experiences that challenge dominant narratives of colonialism and humanism.

In Sweden, Quennerstedt et al. (2024) investigated the relation between health and outdoor activities. By using Antonovsky's metaphor of the swimmer in the river, they argued for a shift from a *human*-centred to a relational conception of health. Isaksson and Weldemariam (2024) explored material-discursive entanglements of *humans* and *nature* in Swedish friluftsliv education. They concluded that learning with material-discursive phenomena, such as fire, water and sun, in unexpected encounters could serve as a foundation for troubling *human*-centredness in education, thereby fostering a humble approach to multiple bodies.

Regarding posthuman perspectives on environmental issues in policy studies, Blyth and Meiring (2018) explored the South African environmental curriculum in search for spaces where learning with others could be introduced. They argued that a posthumanist take on curriculum could attend to injustices and increase accountability for *human* doings now and in the future. Further, Clarke and Mcphie (2016) applied a philosophy of becoming to curricula developments in Scotland and argued that this ontology could be useful in overcoming a disconnection to *nature* by promoting animistic ways of being. Similarly, Ross and Mannion (2012) explored how the concept of dwelling could help understand curriculum making as a place-based lived experience. They argued that a dwelling perspective could point to how we "live in and through the world" (p. 311).

Recent PEH studies have critically explored *human*-centredness. Riley and Proctor (2023) offered alternative stories of movement in PEH through a diffractive reading of physical literacy and poems. They challenged normalised standards for movement learning by arguing that "movement does relationships (. . .) opening the individual to a myriad of possibilities" (p. 663). Similarly, Larsson (2023) argued that taking an agential realist perspective can enable movement pedagogies that go beyond the *nature/culture* divide. Taylor et al. (2019) studied PEH teachers' experiences of the relationship between the environment and health, and found that "plants,

water, ecosystems, bodies, objects and forces – all became significant in understanding how beliefs are formed around human and more-than human relationships” (p. 916).

Regarding policy studies in PEH, Olive and Enright (2021) challenged human/nature binaries in the Australian PEH curriculum through oceanic spatial conceptions (surfaces, depths, flows and currents). They concluded that thinking with human and environmental health as interconnected could open new possibilities to relate to formulations in the policy documents. Further, Riley and Proctor (2022) mapped how they troubled the idea of *emotional safety guidelines* in Canadian PEH by taking up “sense-making with the world” (p. 269) and arguing that policy making is entangled in worldmaking. In a Swedish study, Mikael (2019) showed that, throughout the PEH curriculum documents, nature was othered by being conceptualised as either an “‘outdoor gym’, ‘arena’, ‘resource’ or ‘location’” (p. 87).

This brief review notwithstanding, human-centredness is still rarely problematised in the intersection between PEH and EE, and especially in educational policy studies. This paper contributes to that research gap.

Theoretical framework

The basic premise of Karen Barad’s account of agential realism is that “existence is not an individual affair” (Barad, 2007, p. ix). Instead, what can be perceived as individuals, i.e. bounded entities (including humans), become meaningful as momentary materialisations within specific material arrangements, so called *phenomena*. These phenomena, or material-discursive practices, are constantly being reworked, and throughout Barad’s scholarship, attending to what exclusions and inclusions are enacted within the phenomena of which we are a part is central to questions of ethics and justice (Barad & Gandorfer, 2021).

Agential realism stresses performativity and how all doings enact certain materialisations, even activities we think of as representational, such as theorising, thinking, or talking (Barad, 2007). This has ethical implications not only for research practices but also for education. Murriss (2022) notes that teaching as a “world-making practice plays a role in constituting who and what comes to matter” (p. 29), and she stresses the need to do education differently to trouble the power-producing binaries that uphold an unjust relationship between humans and others. Brown et al. (2020) also state that environmental education practices “need new and creative ways of relating with others (. . .) to promote socio-ecological justice” (p. 221). Other educational scholars have found agential realism useful for opening an explorative approach to teaching practices (Larsson, 2023), and for deconstructing boundaries between the fixed categories of research in the quest for socioecological justice (Riley, 2023).

Since agential realism has been elaborated on for decades by Barad and other scholars, it is impossible to do justice to all its complexity within the scope of this paper. Therefore, we focus on two concepts that are central to our inquiry: agential cuts and diffraction.

Agential cuts

Agential cuts work to momentarily stabilise certain materialisations and make them distinguishable from others (Barad, 2007). In other words, they enact boundaries within the relationality of phenomena, shaping bodies that emerge as meaningful (Bozalek, 2022). Importantly though, agential cuts do not enact absolute separation, since the materiality on the other side of the cut is still encompassed in the same phenomenon (Barad, 2014). Hence, bodies are entangled through the material-discursive practice from which they emerge, while *at the same time* distinguishable as bounded entities through agential cuts. This is how parts of the world make themselves intelligible to others, and as such there is no way to avoid agential cuts; they are embedded in the world’s becoming (Barad, 2007). Moreover, there is no need for an intentional

human in the enactment of agential cuts since they emerge within specific material arrangements of which humans can be a part or not (Murriss, 2022).

Agential cuts enact what Barad (2007) calls *marks on bodies*, which means that “bodies differentially materialize as particular patterns of the world” (p. 176). These marks make it possible to trace the boundary-making practices through which bodies become meaningful (Barad, 2012). As no entities exist independently of the phenomenon within which they are enacted, ethically responsible knowledge-making practices need to be “asking the prior questions” (Barad & Gandorfer, 2021, p. 18); that is, tracing how the investigated concepts or entities emerge. Importantly though, the subject asking these questions is also part of the specific material arrangements within which the tracing is carried out. Hence, there is no outside from which to conduct research (or education), and no isolated subject that can be solely accountable for ethical concerns. Instead, Barad (2012) suggests we rethink ethics as entangled, emerging within phenomena. In this ethics of entanglements, we must account for and respond to the marks that are enacted by agential cuts within the apparatus of which we are a part (Murriss, 2022).

Diffraction

The physical phenomenon of diffraction occurs when waves overlap to create intensities or cancel one another out. None of the waves are held still as a reference point for the others to be reflected against. Rather, all waves involved change as they break through one another. While reflection deals with mirroring and sameness, diffraction draws attention to patterns of difference and the effects of those patterns, i.e., the marks they leave on bodies (Barad, 2007).

In a world that is iteratively becoming, the phenomenon of diffraction allows us to think with conceptualisations as they unfold. Building on the ideas of Donna Haraway, Barad (2007, 2014) calls this a diffractive analysis, in which insights such as texts, events, or concepts are read *through* one another, rather than comparing or interpreting them, while attending to how they both affect and are affected. A diffractive analysis attends to patterns of differences that “. . . come to matter, how they matter and for whom” (Barad, 2007, p. 90). These diffractive patterns enact agential cuts that include some bodies at the expense of others. Hence, a diffractive analysis is about responding to the agential cuts which we are a part of enacting, and it is thereby crucial for an ethics of entanglements since it traces the marks on bodies within a research apparatus or educational practice (Barad, 2014).

The researchers

As researchers, we are entangled with that which we are exploring (Barad, 2007). Riley (2023) notes that “stories of the past are never undone or erased but expanded upon through other stories that generate different trajectories of knowing/being/thinking/doing/feeling” (p. 40). Therefore, it matters that we brought into the research apparatus our embedded (and embodied) experiences of Swedish schooling, lives of outdoor and movement activities, research interests in PEH (Erik) and agential realism (Karin), middle-class Swedish childhoods in the late 20th century, and much more. Importantly, we were already entangled with the Swedish school system as pupils, student teachers, teachers and now researchers. At the same time, our different research interests, and the fact that Erik trained as a PEH teacher while Karin did not, brought different questions to the research process and a sensitivity to different patterns. Ultimately, our entangled historicities were part of constituting what fragments had the possibility to glow (See below).

Doing the diffractive analysis

In agential realism, words are material-discursive phenomena, which troubles the way in which they are assumed to function as mediators between human minds and an external world (Barad, 2007).

Rather, language is performing, i.e., leaving marks on bodies through agential cuts, and a diffractive analysis aims at tracing those marks instead of establishing an accurate account of what words mean. Hence, we did not interpret the PEH policy documents to represent them, as would a discourse analysis or a thematic analysis. Rather, we explored what emerged in the material-discursive practice where policy documents, previous research and two researchers met. As with other postfoundational approaches to (post-)qualitative research, the intention underpinning our diffractive analysis was to decentre ourselves as active knowledge makers in favour of becoming with the research process (Barad, 2007; Mazzei & Jackson, 2024).

In contrast to reflection as metaphorically returning to something frozen in time and space, our diffractive analysis worked in terms of re-turning, “as in turning it over and over again” (Barad, 2014, p. 168). During three workshops, we read policy documents and fragments from previous research, discussed and noted the insights that were most prominent. For several months, we then iteratively re-turned (to) and re-read these texts, as well as a growing number of personal notes, each time attending to new insights that emerged. We were informed by MacLure’s (2013) notion of *glow*, in which the material begins to vibrate around certain points and “agency feels distributed and undecidable, as if we have chosen something that has chosen us” (p. 661). This glow made itself intelligible through for example emotional or bodily sensations, heightened energy in the room, or a phrase or event that persistently demanded our attention by leaving marks (such as underlined sentences, exclamation marks, or smileys) on the printed documents and in our notebooks. The points of glowing not only emerged in the encounter between us and the policy documents we read. Bodies such as paper tags, post-it notes and pencils were important, as were tables, Bosse the dog and door frames. In addition, buses, cars and buildings enabled us to meet, while computers, printers and internet connections aided access to previous research, PEH policy documents and the working files for this text. Due to the scope of this paper, we will stop our account of the research apparatus here, acknowledging that the material-discursive phenomena that made our inquiry possible could be traced through an infinite number of connections.⁴

The marks from our re-turnings eventually materialised on post-it notes that were arranged and re-arranged in emergent patterns in response to the research questions (See Figure 1). These patterns then shifted through iterative collaboration in shared online files. Thus, we were responding to the agency of the research apparatus by “making new patterns of understanding-becoming” (Barad, 2014, p. 187, ftn 63). The shifting of the patterns continued throughout the whole review process, and they were not sedimented until this paper was published.

Section two: The diffraction patterns

In this section, we will write up three diffraction patterns in which *humans* and *nature* became conceptualised through our analysis. The patterns emerged around three phenomena central to Swedish PEH: movement, health and indoors/outdoors. These phenomena helped us to stay with the evolving patterns within an infinite multitude of entanglements.

As accounts of what happened during the research process, the patterns are written in past tense. Importantly however, they also enact iterative re-turnings and so does your reading of them. Hence, the temporary conceptualisations of *humans* and *nature* enacted here keep emerging in different ways through time and space.

⁴Ultimately, this tracing could have taken us to power plants and rare-earth mineral mines, thereby troubling the sense of placelessness in online collaboration. We wish to pay our respect to the multiple places (Indigenous or others) and their peoples (*human* or others) affected by this paper.



Figure 1. Emerging diffraction patterns. Photo: Karin Isaksson.

Pattern one: (human) bodies moving

This pattern evolved around movement, a core area of Swedish PEH. It first emerged as exclamation marks and comments around the following fragment from the printed policy documents:

Movement capability denotes the pupils' ability to develop joy of movement, coordination, endurance, strength, mobility, body awareness, mental capability, and motivation. (KM gy)⁵

In the encounter with this fragment, the *human* body emerged as a bounded entity in which movement capability was situated. We traced this to Ling gymnastics, where *human* bodies were technically drilled through calculated practices (Kirk, 2010), as well as to the subsequent physiological and biological focus in early research on movement, which has influenced PEH (Larsson, 2013), effectively conceptualising the *human* body as a (moving) entity. Then, during the first workshop, something happened that troubled this notion:

Erik gets up to fetch a glass of water. To do that, he needs to go around the table, lift his feet over Karin's bag, avoid stepping on Bosse the dog, go through the open door, round the sofa and into the kitchen area, where he must open a cupboard and reach for a glass before opening the tap and filling it with water. (Notes from workshop 1)

In the ordinary event of fetching a glass of water, Erik's body was entangled with a multitude of other bodies in the trajectory of the movement. In other words, the materiality of Erik's body, Karin's bag, Bosse the dog, tables, doors, a cupboard, a glass and a tap all emerged as meaningful to one another through agential cuts *within* the phenomenon of movement. Reading this through the

⁵All fragments from the PEH policy documents have been translated into English by the authors. We have chosen to stay close to the Swedish wording.

policy fragment above intensified a tension between, on the one hand, conceptualising the *human* body as harbouring movement capabilities, and on the other hand, seeing movement as emergent from the relationality of different bodies. This tension was further diffracted through a fragment from Larsson's (2023) analysis of French hurdler Guy Drut:

Although talking about various body parts, these body parts and Drut's whole being are neither given nor closed. It is almost as if he, in preparation for the encounter with the hurdles, dissolves or opens his body/being [in the process of] the hurdle practice. (Larsson, 2023, p. 10).

After reading this, we re-turned (to) the policy documents and found that other fragments had begun to glow. For example:

Teaching (. . .) should provide the pupils with (. . .) the ability to ergonomically adjust their movements to different situations. (ÅP gy)

[O]utdoor environments and nature provide opportunities for *more* varied movement activities. (KM gy, our emphasis)

These two fragments intensified the troubling of movement as situated in the *human* body. If the *human* body was indeed a bounded entity harbouring the capacity to move, then movement capabilities need *not* be contingent on situational factors. Moreover, certain places would not offer possibilities for *more* varied movements than elsewhere. In other words, the last two fragments would not make sense if the *human* body could move in isolation, regardless of any other materiality. Hence, by reading fragments from different parts of the policy documents through one another, and through insights from previous research, their meaning changed, and an opening was enacted to think with movement as a material-discursive phenomenon in which multiple bodies would be entangled. This insight intensified through more fragments from previous research:

[B]odies do not 'do' movement; movement happens with bodies; bodies matter with movement (Land & Danis, 2016 in Riley & Proctor, 2023, p. 663).

This movement was a series of movements – of bodies entangled with/in the rocky landscape (Morse, 2021, p. 1236).

The diffractive analysis now troubled pre-given boundaries, such that bodies emerged out of movement instead of movement being inherent in (*human*) bodies. In thinking with this insight, another fragment from the policy documents made itself intelligible:

The pupils should then be allowed to reflect upon movement activities (. . .) and relate [to] the surrounding environment. (KM gr)

Even though the concept of reflection in the fragment above could enact a distance between pupils and their environment, we suggest that thinking with the word *relate* through an "open, explorative and experimenting approach" can allow PEH practice to be enacted in ways where different materialities would be "open and always in the state of becoming" (Larsson, 2023, p. 12). This could open for questioning the separation of *human* bodies from other materialities and inspire pupils and teachers to become aware of the many ways in which bodies are entangled, movement being one of them.

Throughout this first diffraction pattern, the bounded *human* body became troubled when attention was directed towards the entanglements of bodies, and how they emerge *through* movement rather than to *do* movement. In the next pattern, two concepts from another core area of Swedish PEH, health and well-being, appear in a similar account.

Pattern two — Providing health?

This pattern did not emerge from an immense glow around one specific fragment; rather, it lingered in our discussions throughout all workshops and eventually materialised on post-it notes forming a pattern. Crucial for this pattern was Erik's long engagement with PEH and his appreciation of its strong historical focus on *human* health. The pattern emerged from a fragment in which *humans* were conceptualised as having (or not having) health:

Pupils should [...] be provided with the prerequisites for developing good life habits, with the purpose of being able to affect their health throughout life. (KP gr)

In contrast, *nature* emerged as a source of well-being but not as capable of having health or not:

[O]utdoor environments and nature as a source of well-being. (KM gy; ÄP gy)

When reading the two fragments above through one another, a conceptualisation of *humans* as different from other bodies, in terms of health and well-being, emerged. We further diffracted this difference through a fragment that glowed with several exclamation marks and comments:

[~~Humans~~ have] ... the *power to shape* society as well as their own lives. (Gy11, our emphasis)

With this fragment, the pattern further evolved into a conceptualisation of *humans* as active subjects with a passive world at their disposal. However, alongside this power to shape the world, a responsibility to care for it emerged through the reading of a fragment from Mikael's (2019) urging PEH practice to enable the fostering of "... [a]sense of stewardship for the natural world [and] nature caring individuals" (p. 85). We read this insight of care and responsibility through more fragments from the policy documents:

The teaching (...) should provide a basis for and promote pupils' ability to (...) act responsibly towards themselves and others. (Gy11).

[Pupils should gain] understanding of how to consider nature's conditions so that they can stay in nature on nature's terms (...) [and] how to take into account different places and environments during different seasons. (KM gr).

In addition to active subjects that could have health or not, *humans* were now conceptualised as caring and responsible subjects that could grant health and well-being to other bodies, including *nature*. However, thinking with this insight in turn opened for a conceptualisation of *nature* as capable of receiving, i.e., *having*, health. This insight was intensified through the reading of another fragment from previous research:

[T]he relation between outdoor activities and health is here putting the river i.e., the health of the planet, exclusively in focus (Quennerstedt et al., 2024, p. 11).

In the light of how the pattern had evolved, we re-turned (to) the fragment enacting *nature* as a source for health and well-being, asking ourselves if this *nature* could even be conceptualised as

the active subject caring for *humans* by providing health and well-being? While lingering on this provoking question, the pattern still bothered us. The trajectory through which health and well-being were passed from *humans* to *nature*, by means of care and responsibility, had been reversed, but *humans* and *nature* were kept separate. We had been focused on asking questions about which one could give health to the other, effectively cutting them apart as separate entities. However, relationality made itself intelligible through another fragment from previous research:

[W]hat is needed is an ethics that is (...) acting out multispecies relationships and goes beyond mere respect for the environment (Blyth & Meiring, 2018, p. 113).

This opened for health and well-being to become emergent within relations, thus mattering to all bodies. Instead of enacting *human* agency, phrases such as *act responsibly towards themselves and others*, and *take into account different places and environments* now emerged as openings for PEH practice to respond to Barad's (2012) call for an ethics of entanglements, i.e., attending to how bodies come to matter and what marks they leave on other bodies through their agential cuts.

In this pattern, *humans* and *nature* were initially conceptualised as bounded entities which could have health (or not), but then emerged through relations within phenomena such as health, care and responsibility. In the final pattern, the locality of *nature* is troubled in a similar sense, resonating with the third key knowledge area in Swedish PEH: *friluftsliv* and outdoor activities.

Pattern three — Placing nature

This pattern was provoked by two small but glowing words.

Pupils should (...) develop the ability to stay outdoors *and* in nature during different seasons. (KM gr; KP gr, our emphasis)

In the syllabus, outdoors denotes (...) the school yard, the school's local area with plazas, sports- and other activity facilities, *but* also groves, hills and other nature environments. (KM gr, our emphasis)

When reading the words *and* and *but* in the fragments above, a difference between indoors and outdoors emerged, where certain outdoor places were conceptualised as *nature* and others as *not-nature*. The two words enacted agential cuts that left marks on a piece of paper (See Figure 2).

We read these marks through a note from the workshop preparations:

*I kept thinking that maybe we ought to be outdoors when meeting with the documents so that *nature* could really take part, but soon realised that I conceptualised *nature* as being in a specific place, not counting paper, pens, and indoor chairs as *nature*.* (Karin's notes)

With this note, a conceptualisation emerged that resonated with *nature* "objectified as other" (Mikaels, 2019, p. 87), and "a discrete, and transcendent, 'nature'" (Clarke & Mcphie, 2016, p. 1005). We recognised this from our own lived experiences within the Scandinavian *friluftsliv* context, where a certain kind of ("genuine") *nature* would be sought for activities such as hiking or canoeing, not settling for an urban park or an indoor paddling arena. This conceptualisation provoked questions:

*Are we indoors or outdoors on Erik's porch which has a wooden floor but no roof? Are we in *nature*? Would we be in *nature* on the lawn? On the boulder by the lake? In a boat on the lake? Is the tree on the lawn *nature*? Are we outdoors, indoors or in *nature* in a cave? In a tent? In a wind shelter?* (Notes from workshop 1)

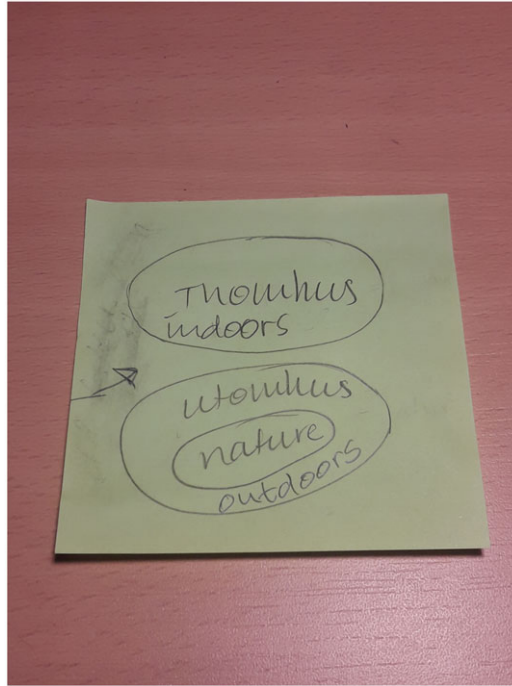


Figure 2. Marks of indoors-outdoors-nature relations.

We read these questions through the first two fragments from the policy documents, and the pattern glowed with Sandell's (2011) question "where is nature?" (p. 126). This provoked further thoughts on the matter:

If there is a distinction between a ~~human~~ indoors and an outdoor ~~nature~~, how would we account for all the ~~nature~~ that comes into our indoor environment through pipes, ventilation, radiators, windows, and electricity cables (not to mention all the bodies within "our own" bodies, such as bacteria, electrons, water, air, food, etc.)? If there is a distinction between certain places outdoor as ~~not-nature~~ and some as ~~nature~~, how would we account for the stones in a city pavement or the wood in a park bench? In the process of making a cobblestone or a wooden board, when is the boundary between ~~nature~~ and ~~not-nature~~ passed? (Karin's notes).

The pattern now materialised as marks on another piece of paper, in which the conceptualisations of places as indoors, outdoors and/or ~~nature~~ would be contingent on two entangled continuums (See Figure 3). Though the marks were still linear, not fully embracing the entangled messiness provoked by the questions above, indoors, outdoors and ~~nature~~ could only emerge as separate through agential cuts in the lines. In Figure 2, the cuts were already assumed, separating the three circles. However, in Figure 3, cuts would need to *be made* to separate indoors from outdoors and ~~nature~~ from ~~not-nature~~. The boundary-making practices enacting these cuts could then be traced to trouble what counts as ~~nature~~ in PEH policy and practice. This tracing would potentially trouble the practices of othering, where ~~nature~~ becomes a resource to be exploited by ~~humans~~ (Jukes et al., 2022b; Riley, 2023).

In this last pattern, the conceptualisation of ~~nature~~ evolved from mattering only in specific places to becoming entangled with different bodies (~~human~~ or others) in troubling an exclusively

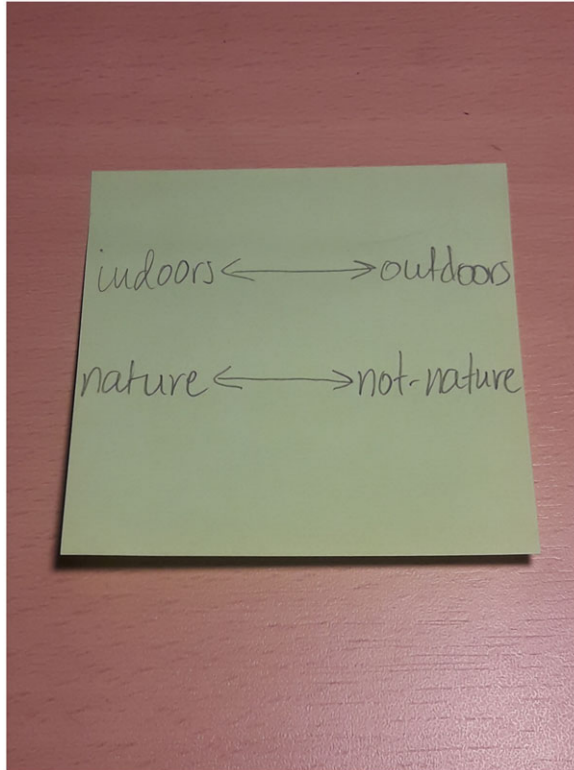


Figure 3. Marks of indoors-outdoors-nature continuum.

outdoor nature. In the next section, we discuss what possible implications the three patterns of this section hold for PEH practice and research.

Section three — diffractive insights

In the previous section, we accounted for three diffraction patterns through which we explored the emerging conceptualisations of *humans* and *nature* when Swedish PEH policy documents were diffractively read through previous research, the concept of agential cuts, and our own historicities. *Humans* and *nature* emerged as distinctly different through the assigning of attributes such as health or movement capability (to *humans* but not to *nature*), and through the boundary-making practices that conceptualised only some places as *nature*. However, the emerging boundaries between *humans* and *nature* were also troubled through the entanglement of bodies in movement as a material-discursive phenomenon, the emergent ethics of care, and the tracing of bodies connecting indoors and outdoors. In this section, we will discuss possible implications from these insights for PEH practices that wish to trouble a separation of *humans* and *nature*.

Thinking with entanglements troubles distinct boundaries between bodies and provokes openings through which other conceptualisations of *humans* and *nature* might become possible (c.f., Isaksson & Weldemariam, 2024; Jukes et al., 2022b; Mcphie & Clarke, 2015; Morse, 2021). This could open for PEH practice to respond differently to othering, or in essence *do* othering differently. If this othering is enacted through agential cuts, then the other is “irreducibly and materially bound to, threaded through, the “self” [in] an entangled relation of difference”

(Barad, 2012, p. 47). This might inspire teachers and pupils to attend to what (and how) bodies come to matter when for example moving over a hurdle, thinking with health as emergent when hiking, or acknowledging the fluidity of indoors and outdoors when seeking shelter. Further, tracing the othering of bodies through explorative and open-ended inquiries (Larsson, 2023) could turn teachers' and pupils' attention to how the conceptualisations of *humans* and *nature* work to include some bodies at the expense of others. What happens with the care and respect implied in a stewardship of *nature* (Mikaels, 2019) when only some places are conceptualised as *nature*? What actions become possible with places that are not conceptualised as *nature* and hence not worthy of that care? What happens when health and movement become conceptualised in relation to *human* bodies only? How do different environments become altered to facilitate *human* movement in the name of public health? What marks are made possible when plant or animal bodies are conceptualised only as nutrients crucial for *human* health? Asking these questions could help pupils develop the ability to "observe and analyse humans' interplay with their environment" (SNAE, 2011a), and support a possible reworking of marks left from practices where bodies are valued differently in a hierarchy of power (Mcphie & Clarke, 2020, 2015), which ultimately poses ethical questions of justice for multiple bodies (Blyth & Meiring, 2018; Jukes, 2021).

We present the questions above without suggesting any answers or proposing specific actions, as these will inevitably be contingent on situated factors. Offering questions rather than answers (c.f., Jukes, 2021) aligns with Murriss (2022) urging educators to "build into their practices opportunities for enquiries to be provoked, nurtured and taken diffractively into new directions" (p. 81). The questions above point to an ethics of entanglements. Hence, PEH practice could contribute to the two overarching goals of the curricula concerning ethics and sustainability (SNAE, 2011a; 2022) by offering "possibilities and obligations for reworking the material effects of the past and the future" (Barad, 2012, p. 47), in this case the effects of environmental degradation following an othering of *nature*. This is a response to the call from EE scholars to conduct education in ways that make it possible to trouble the foundations for environmental injustices and issues of unsustainability (e.g., Brown et al., 2020; Isaksson & Weldemariam, 2024; Jukes et al., 2022a; Mcphie & Clarke, 2020). We acknowledge that this troubling could be done in many ways and in many different fields. In EE and PEH, however, the boundaries around the concept of *nature* have been firmly sedimented for a long time, also implying a separate *human*. In this paper, we highlight the intersection between PEH and EE and argue that they are both suitable and important fields for troubling the *human/nature* divide. Moreover, the phenomena of movement, health and place, around which the three patterns of our inquiry formed, are central issues not only for (Swedish) PEH, but also for (Australian) environmental education (e.g., Blades, 2021; Clarke & Mcphie, 2016; Taylor et al., 2019). Hence, the implications of this paper may reach beyond the Swedish context.

Finally, we do not make any claims about what the PEH policy documents are or intend to be, nor do we suggest that they should be rewritten. We acknowledge the effort that has been put into making them align with the intentions of the school system, and the fact that they are written for *human* education with the purpose of providing a basis for assessing (*human*) pupils. We hope to enrich rather than to reject them, as previous studies have shown their connection to PEH practice to be non-linear and complex, and teachers are left to read between the lines (Backman, 2018). If PEH practitioners embrace the notion that "concepts are specific material arrangements that leave marks on bodies" (Barad, 2007, p. 139), and that words always affect and perform (Mcphie & Clarke, 2020; Olive & Enright, 2021), they might find spaces within the policy documents for reimagining *humans* and *nature*. Indeed, Bozalek (2022) stresses that curriculum is a "reiterative process of re-turning, where word and world are inextricably entangled" (p. 17). This urges PEH teachers to keep re-turning (to) the policy documents for new insights and new enactments. Thus, we consider thinking with diffraction and re-turning a methodological contribution of this paper, not only to research but also to educational practices.

Outroduction

In a world that is iteratively becoming, there were an endless number of entanglements we could have traced to explore how and from what relationality conceptualisations of humans and nature emerged. Moreover, these entanglements would all be entangled with one another: an endless entanglement of entanglements (Barad & Gandorfer, 2021). Tracing this complexity extends well beyond the scope of this paper, so to say something in response to our research questions, we had to follow the trajectories that glowed the most. This inevitably meant excluding others, and we do not in any way claim to have covered every conceptualisation of humans and nature in the PEH policy documents. Thus, there are many interesting connections left to trace and many provocations for further research. How can the openings that we have discussed be enacted in PEH practice? What entanglements of bodies might challenge the human/nature divide in PEH? How can PEH be planned and conducted to allow for these entanglements to become intelligible to pupils? What are the ethical implications for socio-ecological justice from different ways of knowing and being? How can more studies of subject intersections benefit transdisciplinary learning? We humbly leave you with these questions and hope that they will be addressed by other studies and practices.

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