

Materialising Physical Literacy: rethinking physical education

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Thesis submitted for the degree of Doctor of Philosophy

April 2025

Abstract

Whitehead (2010) developed physical literacy (PL) as response to narrow conceptions of physical education (PE), placing importance on embodiment and movement as central to how humans are in dialogue with the world. PL was introduced to two primary initial teacher education (ITE) programmes in Scotland as a different way to approach teaching PE. This research builds on Whitehead's positioning by introducing the work of Spinoza (2002), whose monist perspective entangles more than human – specifically, the material – in worldly practices. My investigation had two aims, the first to find out whether, how and why PL was being enacted by primary ITE students. The second was to invite ways of doing these investigations which chimed with the dynamic nature of PE and PL. Based on a philosophy of immanence, theories of sociomaterialism and posthumanism brought insights into the relations at play as students were becoming teachers. Diffractive thinking informed methodological approaches and analysis strategies by inviting texts, theories, and empirical data, to be read through one another. Somatic practices further fostered analytical thinking with theory-data together, and attendance to emerging differences as actors conjoined. Empirical data came from following three primary student teachers into school placements, and one primary PE specialist, just as COVID-19 restrictions were lifting, which interrupted many practices and also afforded opportunities. Diffractive analyses, guided by posthuman heuristics to unravel translations and trace responses, brought insights into the oftentimes 'scripted' activities of education, such as by reimagining lesson plan templates. PL enriches PE by emphasising the affective and an affirmative ethic towards positive health and wellbeing activities. Significantly, this research highlighted the importance of non-humans as affective agents in PL-PE pedagogies as students were becoming teachers. The processes involved in this research also make significant contributions to ways of doing postqualitative inquiry which notices dis-orderly messiness of the world.

Formal Confirmation of Ethical Approval



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05 November 2020

Dear Gillian,

Re: An investigation of how physical literacy is enacted in primary teacher trainee physical education – GUEP (20 21) 1009R

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Yours sincerely,
Pp.

A handwritten signature in blue ink that reads "Claire Exley".

On behalf of GUEP
Professor Iain MacRury
Deputy Chair of GUEP

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I declare that I have composed this thesis myself and that it embodies the findings of my research. Where appropriate, I have acknowledged the nature and extent of work carried out in collaboration with others included in the thesis. I have not used artificial intelligence software at any point during production of the thesis. I consent to the use of plagiarism detection software.

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Acknowledgements

This research and resources supporting it, were enabled by a studentship awarded by the Economic Social Research Council, via the Scottish Graduate School of Social Sciences. The award included the M.Res. (Education) year from which a community of learners and special friendships grew. Thank you, especially, Claire Ramjan (my postpositivist-no-more sparring partner). I would like to express thanks to the Division of Education, Faculty of Social Sciences, University of Stirling, professional and academic staff, for further resources and opportunities along the way - these enriched the research and brought friendships.

What can I say about my supervisory team!? John I'Anson, who pushed my philosophical thinking into multiple and wondrous rabbit holes (meshworks!) with an infectious endless curiosity; Joe Cowley, the workhorse with an eye on the ball of physical education teacher education in Scotland; and Terrie Lynn Thompson, who is a thingly (in the nicest possible way) force that opens doors to ways of thinking-doing that are novel, creative and oftentimes wonderfully wacky! A thousand times 'thank you', for opportunities—considerations—generosities—humility—positivity—robustness.

Finally, to the actors which-who contributed, especially the helpful human participants, you know who you are, and you are brilliant! To mum and dad, my three lovely siblings, and my 'three phds' – Murray, Hamish and Darcie – done! Finally, to Mike, with all my love and thanks for the pasts, presents and yet to come ...

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List of acronyms

ANT: actor-network theory

CT: class teacher

CfE: Curriculum for Excellence

GTCS: General Teaching Council Scotland

HT: head teacher

INGO: International Non-governmental Organisation

IOC: International Olympic Committee

IPLA: International Physical Literacy Association

OECD: Organisation for Economic Co-operation and Development

PE: physical education

PEPAS: physical education, physical activity and sport

PL: physical literacy

PL-PE: Physical literacy-enriched physical education

PISA: Programme for International Student Assessment

SAoL/SALs: Significant (now Key) Aspects of Learning

UNESCO: United Nations Educational, Scientific and Cultural Organisation

UNICEF: United Nations (international) Children's (Emergency) Fund

WHO: World Health Organisation.

List of entangled publications

- Bartle, G., 2023. An investigation of how physical literacy is enacted in primary physical education. *Qualitative Research Journal*, 23(3), pp. 325-337. DOI: 10.1108/QRJ-08-2022-0117.
- Carl, J., Bryant, A. S., Edwards, L.C., Bartle, G., Birch, J. E., Christodoulides, E., Emeljanovas, A., Fröberg, A., Gandrieau, J., Gilic, B., Holvoorde, I. van, Holler, P., Iconomescu, T., M., Jaunig, J., Laudanska-Krzeminska, I., Lundvall, S., Martelaer, K. De., Martins, J., Mieziene, B., Medoza-Muñoz, M., Mouton, A., Olaru, B. S., Onofre, M., Pavlova, I., Repond, M. R., Riga, V., Salin, K., Schnitzler, C., Sekulic, D., Töpfer, C., Vasickova, J., Yildizer, G., Zito, V., Bentsen, P., Green, N., and Elsborg, P., 2023a. Physical Literacy in Europe: the current state of implementation in research, practice, and policy. *Journal of Exercise Science & Fitness*, 21(1), pp. 165-176. DOI: 10.1016/j.jesf.2022.12.003.
- Durden-Myers, E. J. and Bartle, G., 2023. Physical Literacy-Enriched Physical Education: A Capabilities Perspective. *Children*, 10(9), 1503. DOI: 10.3390/children10091503.
- Durden-Myers, E. J., Bartle, G., Whitehead, M. E., and Dhillon, Karamjeet, K., 2021. Physical literacy and intentionality: embodied beckoning. *Journal of Physical Education, Recreation and Dance*, 92, pp. 42-49. DOI: 10.1080/07303084.2021.1977744.
- Durden-Myers, E. J., Bartle, G., Whitehead, M. E., and Dhillon, Karamjeet, K., 2022. Exploring the Notion of Literacy within Physical Literacy: A Discussion Paper. *Front. Sports Act. Living*, 4:853247. DOI: 10.3389/fspor.2022.853247.
- Milne, L. (student blog sponsored by G. Bartle), 2024. Physical Literacy as a foundation for Physical Education in Scottish Primary Schools. *Journal of Social Science Student Research*, 2.
DOI: <https://doi.org/10.20933/30000107>
- Sport England (2023). *Physical Literacy Consensus Statement for England*. Sport England. (Physical Literacy Expert Panel member, IPLA).

Chapter 1: What do you get when you walk around a primary school physical education lesson?

Background

My way of introducing you to this research is by sharing a walk around a primary school playground (Figure 1 below). Primary school pupils between six and eight years old were swinging plastic golf clubs, rolling hula hoops, and throwing basketballs – a familiar scene – and the walking below involved avoiding crossing play areas, or being whacked by a foam javelin. My purposeful meanderings were part of this doctoral investigation into whether, how and in what ways physical literacy (PL) was being enacted during physical education (PE) teaching practices of primary education student-teachers.

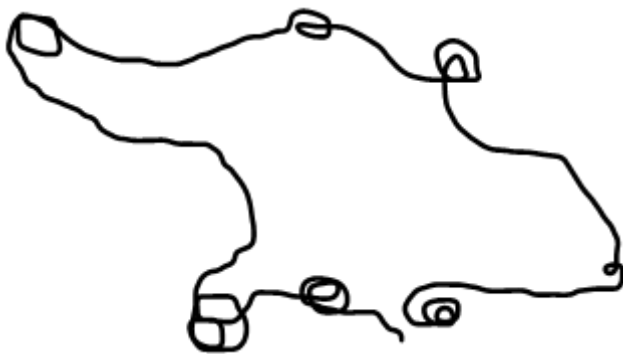


Figure 1 Researcher Walking

A second aim of my work was *how to investigate* PL in ways which chimed with its philosophy – introduced below and developed further in Chapter 2. These two aims were situated in the educational journey of becoming a primary teacher in Scotland. This means learning the ‘how’s and why’s’ about aspects of education, including pedagogical strategies, subject areas of a curriculum, such as PE (Scottish Executive, 2004a), whilst also about how to care for and support pupils, work collegiately with other stakeholders and Curriculum for Excellence (CfE, Scottish Executive, 2004a). Overseeing Initial Teacher Education (ITE)/pre-service teaching/Teacher Education programmes in Scotland are professional standards (values, knowledge, and skills of the profession) which all teachers must have demonstrated before they can register with the General Teaching Council for Scotland (GTCS, 2021). The professional standards (GTCS, 2021) were recently

updated, and this demonstrates the influence of Scottish legislation (*Children and Young People (Scotland) Act 2014*) and reflect wider socio-economic-political influences on education (Biesta, 2022). One key influence is concern about physical inactivity (WHO, 2018; UNESCO, 2023), resulting in Health and Wellbeing and PE becoming core to Scottish education (Scottish Executive, 2004a; 2009). However, primary school teachers continue to reflect on lack of confidence to teach PE (Jess et al., 2016), and lack of time to develop understanding in PE during ITE (Elliot et al., 2013). These factors contribute to the warrant for this research with PL as a different way of introducing student-teachers to understanding PE (Whitehead, 1987; 2001) in schools.

My role in higher education, as a teacher educator, includes designing and delivering PE within ITE. In doing so, I underpin teaching PE with PL informing design and delivery (Whitehead, 2010; Lundvall, 2015). As mentioned above, PL is informed by philosophical interests in mind-body as intertwined and interdependent (monism), appreciating each person's unique physical activity and movement experiences (existentialism) and unique interactions with the world (phenomenology) (Whitehead, 2001; 2010). Ways of investigating PL whilst retaining the philosophies informing it are challenging, and this is where sociomaterial and posthuman sensibilities may offer insights whilst developing unique empirical aspects of my research. As described in the opening paragraph, pupils were playing/learning with all kinds of equipment, research approaches which encapsulate the material mean nonhuman things such as basketballs, hula hoops, lesson plans, and education policy, are foregrounded. Attending to how the social and the material come together or not (Latour, 2005) in PL-enriched PE (PL-PE) required research approaches that could attend to such unique details, and in doing so, disentangle and explore the effects of things observed or discussed. Some parts of this Introduction (Chapter 1) and Chapter 4 have been informed by particular previous work (Bartle, 2023) which focused primarily on methodological developments for this doctoral work. As listed on p. 12, other works exploring philosophy of PL, capabilities approach and PL, curriculum and PL,

and policy and PL were published during this research, and these are entangled throughout.

Foreground

According to Whitehead (2001, p. 131) PL matters because movement is the “conduit to the world” and PL is the literacy through which all other literacies must pass (Durden-Myers et al., 2022). Students becoming primary teachers (classroom/general teachers) develop their confidence to teach PE, and PE is a formative part of an individual’s PL journey (Lundvall, 2015; Rosenberg, 2019; Uljas et al., 2022). For some student-teachers, however, PE remains a minor part of their repertoire when they become qualified teachers (Jess et al., 2016; Randall, 2016). PL-PE might provide a different way of building confidence in future primary teachers which will contribute to how children value physical activities into their futures. To elucidate my concern with how and in what ways PL-PE might be enacting during student teaching practices, the following quote gives warrant to this doctoral thesis. Whitehead (2001, p. 135) notes that,

Clark (1997, p.224) sees our bank of available responses as actually being located in the environment. He writes "The combination of embodiment and embedding provides for persistent informational and physical couplings between John and his world - couplings that leave John's 'knowledge' out in the world and available for retrieval, transformation, and use as and when required." This is an unusual perspective and warrants further attention.

I seek to address the perspective highlighted by Whitehead (2001) to show the sociality *and* materiality around relations between humans and nonhumans in the world – around ‘things’ (Adams and Thompson, 2016, p, 96). In PE, racquets, balls, hoops and cones are commonplace and provoke activities. Things are not inert, awaiting attribution of meaning by the human. In the everyday sense, things can mean something – like a belonging passed through generations of a family. These things are already imbued with meaning, with stories. Things have the capacity to ‘push and pull’ other things, they are dynamic and lively (Bennett, 2010). These

lively relations form the twofold focus of my research: whether, how and in what ways PL-PE was being enacted as students were becoming teachers, and *how* I investigated PL-PE (Bartle, 2023). Three questions guided the research, and I present them here:

1. What relations are in play in student PL-PE practices?
2. How is PL translated through sociomaterial practices?
3. What are the implications of sociomaterial and posthuman understandings of PL?

A note about COVID-19

Five areas of change have emerged from the entanglements of socio-economic-political situatedness of the research period. First, during plans to observe student-teachers teaching PE, COVID-19 became a prominent actor. Second, teaching and learning changed; third, things changed; fourth, research approaches changed; and fifth, ethics became enhanced in relation to my health and the health of others. I would not call this a 'COVID-19 thesis', however, the effects/affects of this situatedness were viewed as an opportunity (Howells et al., 2022) to open up how to investigate student-teacher experiences in teaching PE. New things (hand sanitisers), new spaces (multiple classes outdoors), pathways (such as students completing placement), timings (longer PE lessons), were created. The ethical judgement to enter the school spaces had elevated relevance when two head teachers (HTs) agreed for me to visit their schools after two enforced lockdowns in Scotland (Education Scotland, 2020; Scottish Government, 2021; United Kingdom (UK) Government, 2021). In the very immediate but also sociomaterial sense, COVID-19 was an 'interruption' to normative practices during placements, and during research. I expand on this in Chapter 4, however, visiting schools also raised axiological tensions for me as I followed stringent hygiene measures whilst also appreciating that staff and pupils were re-engaging with teaching and learning in person, from managing education online. The 'methodological meshwork' in Chapter 4 will detail how head teachers (HTs)

provided opportunities for me to share placement and research experiences with schools and participants. During this time, how humans and things (such as COVID-19) were relating brought new insights into the materiality of practices. For now, I introduce related research around PL-PE, then provide the broader context and structures for my study.

Positioning Physical Education

Whitehead (1987; 2001) has posited that PE needs a philosophically positioned and valued entry point to ensure educational approaches to PE are lifelong, empowering, holistic and inclusive. This stance is gaining international credibility. For example, UNESCO has advocated for *Quality PE* (UNESCO, 2015, p. 76) and this includes providing “a curriculum that promotes the development of physical literacy”. To provide what is considered ‘quality’ PE requires teacher education to be central to this charge. Historically, formalised physical activity, PE, has been part of school curricula in the western world since the early 1900s. For example, for girls, Bergman-Osterberg (1849-1915) introduced Swedish gymnastics methods to the United Kingdom (Bloomfield, 2005), and this continued as a way of improving the health of the nation post-World Wars (Dixon et al., 1957). In this regard, current concerns with physical inactivity and resultant non-communicable diseases, such as heart disease, obesity, stroke, cancer, chronic respiratory disease and diabetes (UNESCO, 2015) shows a continuation of how the subject area has become dominated by healthism (Evans, 2004; Matius and Piggins, 2022; Gray et al., 2024). Healthism is not, I would argue, the purpose of PE (Dinham and Williams, 2019), therefore, part of my research is to (re)visit the intrinsic reasons for being active, a formative part of which occurs during PE.

Within this frame of healthism, economic arguments are presented in terms of benefits of exercise and physical activity to alleviate pressures on health care systems (Townsend et al., 2023). For example, it is suggested that Scotland’s National Health Service faces an annual bill of £776 million because of illnesses associated with obesity (Frontier Economics, 2023) and that 67% of adults in

Scotland are obese (ibid.). Globally, economic and political arguments are documented in the Organisation for Economic Co-operation and Development (OECD) publication *Step Up! Tackling The Burden of Insufficient Physical Activity in Europe* (OECD, 2023) and rehearsed in education, economic, political, business, and health arenas of research. Further, research continues to emerge about lower physical activity levels in children post-pandemic (Solway et al., 2022; de Bruijn et al., 2023). Solutions or ‘alternatives’ to ‘not moving’ are mooted across international sectors such as United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2015), World Health Organisation (WHO, 2018), Nike (2013) and the International Olympic Committee (IOC, 2021). National approaches traverse health and education (Hinchcliffe and Wilson, 2021; Education Scotland), with work ongoing through the Active Schools network (sportscotland, 2024), NHS Scotland (Scottish Government, 2024) and enacting the *Scottish Review of PE* (Scottish Executive, 2004b; Evans, 2003; 2004). In some organisations, responsibility of the individual to value physical activity for life is presented (IPLA, 2017). In Scotland, social inequalities compound and obscure roles, responsibilities and contributions to how people view and maintain their holistic health (Hinchcliffe and Wilson, 2021). Understanding *why* PE and PL address issues around inactivity and obesity is not the focus in my investigation. However, I am highlighting where my research is socioeconomically positioned and the wider relevance across stakeholder groups above, and notably, as a sustainable contribution that primary teacher education students could be making when teaching PL-PE.

Further, PE experiences have changed as societies have changed and so demands on primary teachers have altered too. For ITE or pre-service teacher education, there are both predictive and reactive forces working to develop, inspire (Menter, 2023) and confuse next generations of primary teachers (Jess et al., 2024). It seems logical to aspire to providing a future-facing approach to PE, but part of the intention in this research is to think differently about PE embracing past-present and future at once. Further, research which has investigated issues associated with primary PE, has tended to place humans (teachers, for example) at the centre

(Elliot et al., 2013; Gray et al., 2023). I present an exposure of the anthropocentric nature of much research in PL and PE but also challenge dominance of either nonhuman thing or human. I draw on ideas from authors whose work has engaged with sociomaterialism (Latour, 1999a, 2005; Law, 1992, 2004; Barad, 2007), posthumanism (Bennett, 2004, 2010; Braidotti, 2013a, 2019; Adams and Thompson, 2016) and postqualitative inquiry (St. Pierre, 2013b; 2019; 2021) to generate different weavings of PE, PL and research practices.

Positioning Physical Literacy

Although PL has gained in prominence across education and public health research literature internationally (Edwards *et al.*, 2018; Martins *et al.*, 2021; Li et al., 2022), issues around plurality of definitions seem to create confused understanding (Edwards et al., 2017). Where there is lack of clarity on what is meant by PL, those concerned with delivering physical activity across sectors – such as coaches, sports leader, health worker, carer, or teacher – may simply dismiss the idea or not be aware of key aspects of PL (Stoddart and Selanders, 2022). For schoolteachers, lack of clarity means that in assessing PL and its components (if they are separated for assessment purposes) could become inconsistent (Lui and Chen, 2020; Goss et al., 2022), a consideration to which I return in Chapter 8.

Whitehead (2001; 2010) introduced three philosophical tenets which inform PL – phenomenology, existentialism and monism. The phenomenological approach to being in the world includes the idea that human beings are in dialogue with the world (Merleau-Ponty, 2012), and that existentially, this is unique to each person (Rosenberg, 2019). Importantly, for Whitehead (2001), mind and body are not separated, hence the monist influence in PL and PE. However, Whitehead's ontology currently foregrounds humans, and so I seek to extend an understanding of PL that navigates the importance of relations with nonhuman things. Ontological priority in much literature relating to higher education (HE), PE and PL, is given to the human and associated agency of human beings (Orlikowski, 2010; Clarke and Mcphie, 2016), whether pupil, student teachers, teacher, parents, or

education leaders. To include different kinds of actors seems logical, since PE is already enmeshed with education policy documents, PE equipment like hoops and hurdles, space, and other people.

However, my research challenged the premise informing much phenomenological research, that 'truths' are "covered over and hidden" and then 'revealed' as the researcher interprets participant experiences (Crowther and Thomson, 2020, p. 3). 'Revealing' or even 'unveiling' something implies it was always there, waiting to be found by an intrepid researcher. Rather, I suggest that humans are co-creating *with* things, things-with-humans are co-constituting one another (Braidotti, 2019), events, happenings, or activities. To date, empirical research conducted on PL is missing methodological inquiries that chime with its philosophical foundations (Edwards et al., 2017; Shearer et al., 2018; Kwan, 2019). Specifically, little research has been conducted which attempts to look at the practical application of PL in schools by primary teachers (Roberts et al., 2019).

Empirical contribution of this research

There were numerous actors involved in the empirical aspects of this research. To discuss the 'context' for this research requires attending to how social and material actors have been working together to manifest many ideas of context. For instance, for Decuypere and Simons (2016, p. 373), 'context' "constitutes a broader set of relations between very specific actors". So rather than providing an 'overarching' frame or context, I acknowledge that 'settings' are physical places such as a higher education institute, the PE hall, playground, and swimming pool, as well as 'things' like policies and practices. Further, education policies work with structures of buildings and different groupings of people to enact what is recognised as school. Social *and* material actors are coming together creating something recognisable as schools, as PE lessons, as policy, as undergraduate and postgraduate primary education, as lesson plans, as movement over gymnastic mats.

This research took place in Scotland, although there may be implications for wider UK and international teacher education settings. For clarity, teacher education may be termed 'pre-service', 'teacher training', initial teacher education (ITE) and here refers only to primary/elementary stage (ages 3-11 in Scotland). For consistency, I adopt the acronym ITE. Primary education students are otherwise known as pre-service teachers, student teachers, or for research purposes here, student-participants. Students in Scotland become teachers through attending a higher education institution (university), engaging in lectures and periods of teaching practice in primary schools and nursery settings. Teaching practice in schools forms part of the educational obligation for becoming a teacher in Scotland (GTCS, 2012; 2021). Primary ITE prepares students to teach inclusive PE, for example students learn how to adapt the Space, Task, Time, Equipment, People (STTEP model of differentiation, Howells et al., 2018). For children requiring support for complex conditions, schools with adapted facilities and specialist environments like warm pools, provide stimulating environments where movement potentials relative to individual capabilities can be developed (Education (Additional Support for Learning) (Scotland) Act 2009; Pushkarenko et al., 2021). Primary ITE students learn to teach across eight curriculum areas including health and wellbeing (HWB). HWB includes PE (Scottish Executive, 2006).

Primary ITE concerns have been raised about not developing enough practical knowledge or confidence to teach primary PE (Jess et al., 2016; Robinson et al., 2018; Huddleston, 2021). Students experience differences in degrees of feedback on lessons, and opportunities to observe or lead PE lessons (Randall et al., 2016). A lack of confidence (Randall, 2016; Mcveagh et al., 2022) seems to prevail in qualified primary teachers, due to factors including length of time since university inputs (Haydn-Davies et al., 2010), a lack of time allocated to delivering PE during university programmes (Thorburn and Jess, 2008; Harris et al., 2012), limited time for learning how to plan in PE (Fletcher and Beckey, 2023), as well as variable opportunities for practice during placements. A particular study in England found that only half of ITE students had the opportunity to teach PE on placement (Randall and Griggs, 2021).

The inclusion of PE within primary ITE programmes is recognised as important for several reasons (Jess et al., 2024), but overall because it contributes to student understanding of movement in the formative (early) years (Carse et al., 2017; Uljas et al., 2022). Prior to Randall and Griggs (2021), in Scotland, Elliot et al. (2013) found that nearly half of the teachers asked did not feel that their ITE experience prepared them to teach PE in primary schools. However, following the introduction of the Postgraduate Certificate in Primary Physical Education (PGCPPE) (Elliot et al., 2013) and *Basic Moves Programme* (Jess and Collins, 2003; Kirk et al., 2018) around eleven hundred primary school teachers have gained expertise in PE (Carse et al., 2017). Indeed, some of these generalist primary teachers may be confident in leading and developing provision of PE in their schools (Clohessy et al., 2021). Additionally, in line with the policy that all pupils should experience at least two hours of PE per week (Scottish Executive, 2004a), there is arguably forward momentum, whereby multiple stakeholders are addressing concerns about PE teaching in primary schools (Carse et al., 2018). There are some references to PL as a possible way of informing ITE programmes, such as Sprake and Walker (2013). As part of my work, I deliver PL-PE professional learning to in-service primary teachers in one local authority, so there is growing understanding among that primary population. In this wider picture, my research seeks to add to how ITE practitioners can develop a PL-PE approach in primary teacher education, and how students will translate this into practice.

My research seeks to extend understandings of PL, whilst experimenting with a 'methodological meshwork' (Bartle, 2023) that has fidelity with multiple ways of performing PL. Sperka and Enright (2019, p. 170) suggest,

(A)lthough there is methodological innovation happening in PHE [Physical and Health Education] that considers the 'inherently messy and complex' (Hine, 2009; Law, 2004) context in which students and teachers live and learn, there is arguably a paucity of commentary and reflection on these innovations.

To claim that my own research is ‘innovative’, or new, seems to overstate the case or infer that other methods might be somehow inferior (Travers, 2009). I may have addressed a ‘gap’ in literature with methodological approaches which were, are, continue to be, entangled with PL-PE in ways that embrace(d) the messiness of doing research (Law, 2004). Fundamentally, the research develops, extends, and augments recent relevant research approaches that do not accept realist assumptions that the world and practices in it, can be separated out, or that referent and practices can be separated (Barad, 2007; Denzin and Lincoln, 2017). My research also contributes theoretically to understanding philosophical roots of PL (Whitehead, 1987, 2001; Durden-Myers, 2020) in a way that was unique at the time of investigating and writing. This exemplifies that data, discovery, interpretations of events, are always ongoing and dialogical (Crowther and Thomson, 2020).

With clear empirical warrant for my research about PL and PE in ITE, the originality of my contribution is that I augment, extend, yet unpack and seek to find out about the minutiae of relations which are how PL-PE might be enacting. To do this investigating, I introduce several theoretical mechanisms. First, the work of Spinoza (2002) informs monism, and the holistic perspective of PL argued for by Whitehead (2010). I then developed a methodological approach which invokes posthuman and sociomaterial ways of researching and describing the relations among actors where PL-PE might be enacted. These theoretical informants are actors too and will be discussed following a word about language.

Language

Latour (2014) and Whitehead (1938) encourage researchers to increase the research lexicon by being “unabashedly speculative” (Latour, 2014, p. 82). I would like to highlight that the language tools available are a limitation on at least two fronts. First, my own linguistic skills and life experiences are largely informed by Cartesian dualisms which I have continually sought to melt away, through my professional work in PE teaching, and in ITE. Thinking and reading with sport and

PE philosophers (Illundáin-Agurruza, 2014; Martínková, 2011) who focus on holistic approaches to movement, and centrality of human embodiment in physical activity contexts, different tools and words have been introduced through these works to challenge dualist dominance. In the present work, writing with hyphens, the Em Dash (—), '/', bracketed letters (such as co(a)gent) and multiple commas or words listed without commas, are ways of dispelling hierarchical binaries such as mind-body and theory-practice. Adding plurals where they do not usually make grammatical sense is another technique to present more than singular (one-ness) - for example, 'knowledges', 'practice-ings' (Gherardi, 2016). The technique of 'verbing' certain words is to convey the sense of immanence permeating this work – for example 'enact' becomes enacting. It is not always enacting *something*, but 'PL might be enacting' - inherently being enacted but with ongoing connotations rather than closure, such as when one says 'PL was enacted'. Words are sometimes pushed together, as in Barad's (2007) 'spacetimes' and 'ethicoontoepistemology'. In this instance, time and space are not linear ideas, marked by "fixed geometry" of pre-existing points (Barad, 2007, p. 180). Rather they are part of dynamic iterative processes, where things (human and nonhuman) are coming together to enact an event. I zigzag through and across space and time, such as where I have constructed anecdotes from multiple empirical and theoretical data. Uses of such neologisms will become apparent in subsequent chapters. Aside from these technical additions, the uses of metaphor are as heuristic communication device (Steger, 2007). At times, metaphor is used in conventional ways, such as the flow of a river presents the idea of always moving past-present-futures. At other times, metaphor helps with language restrictions – meshwork is mesh rather than net, and such examples become clearer when they are part of the discussion.

I use 'lines of flight' as a way of presenting movements of collections of humans and nonhumans into and from events (assemblages). A further challenge has been to follow philosophical 'lines of flight' wherein past-present-futures are enfolded, entangled with things human and nonhuman (Deleuze and Guattari, 1987; Lather and St. Pierre, 2013). The complexity of Deleuze and Guattari's (1987) 'lines of

flight' are not explored, but for comprehensive study of the three 'lines' see Thornton (2020). Lines are flowing, fleeing, leaking, 'moving beyond' (Massumi in Deleuze and Guattari, 1987, p. xvi). With the challenges of language, I have also sought other ways of researching and presenting the research, for the purposes of retaining honesty and sincerity in how I perceive the world, but also to embrace doctoral thesis expectations. As a way of showing flow between or among things I use multi-directional arrows ($\leftrightarrow$) and in Chapter 6 I present three columns to illustrate the postqualitative call for 'doing' data-with-theory (Lather and St. Pierre, 2013) and 'thinking without method' (Jackson, 2017). Empirical data is shown along with theoretical concepts which underpinned the work, and I try not to separate these processes by applying conventional presentations. One caveat, however, is that I am not seeking to demonstrate some unnecessary "highbrow attitude" but to be practical about what the theories and methodologies mean (Saldaña, 2014). The reader is asked to come with me on this non-linear journey. As we travel, the research changes again, and is indicative of how things are always already, never ceasing, always 'becoming'. The linguistic expansion afforded by multiple techniques are explored in the relevant Chapters, such as in Chapter 5 (Strategies for Analysis) where I discuss metaphors, before the device is used in analysis-discussion chapters.

Theoretical Influences

The work of Spinoza (2002) informed investigation in a number of ways. First, his 'ethology' or One Substance view of the world includes all aspects of human being, as well as a view that human-world are dynamic and always 'becoming'. Whitehead (1938, p. 70) has argued that this sense of monism is at the same time "a multiplicity. There are many actualities, each with its own experience, enjoying individually, and yet requiring each other." Second, he provides a sense of things human-nonhuman always moving. In *Ethics*, Spinoza (2002) describes 'Bodies' as being either at rest or in motion but that neither state occurs without another body determining the state. Thus, "(T)he human body needs for its preservation a great many other bodies, by which, as it were [quasi], it is continually regenerated" (Spinoza, 2002, p. 255). Bodies have experienced things past, and are affected by

one another now and into futures, memories are made and stored as bodies move through time and place (Whitehead, A. N., 1938; St. Pierre, 1997). Residual affects or ‘traces’ may remain throughout and in bodies, and so connections persist, but they can be severed or ‘decompose’ or ‘recompose’ (Lupton, 2018). Third, he develops the human need to exist through an active sense of self-preservation, what he terms *conatus* (Spinoza, 2002, p. 283). Developing this, Latour (2014) has provided substantive ideas which informed how I worked with humans and nonhumans, with theory and data, to retain Spinoza’s sense of past-present-future motion whilst investigating PL-PE. The word ‘becoming’ has been drawn St. Pierre (2013b) and Spinoza (2002) and is in opposition to the fixity of the term ‘being’. ‘Becoming’ is inherently dynamic, incomplete, future-facing, immanent. The influences of Spinoza are further explored in Chapter 3 where I build on current philosophies informing PL.

Posthumanism and Sociomaterialism

Methodologically and theoretically, posthumanism and sociomaterialism also inform this investigation. More than one theoretical perspective is included to promote a pluralist approach that avoids colonisation by one framing (Jackson and Mazzei, 2012; 2013). The influence of post-qualitative writings provides linguistic resources with which to articulate the messiness associated with ‘living in the middle’ of research (St. Pierre, 1997; 2019; 2021). For example, informed by Law (2004) and Ingold (2006), I introduce the phrase ‘methodological meshwork’ (Bartle, 2023) in Chapter 4, to encapsulate multiple contributors/contributions interwoven during methodological pursuits, such as theory—education practices.

As mentioned above, the ideas expressed in current literature and approaches to research in PL and PE seem predominantly humanist, and this is where I make a different contribution to understanding PL. In this space I introduce posthuman sensibilities to shift from human-centric concerns. For example, PE is often associated with instrumental ends to secure its place, or value, on school curricula (Kirk, 2010). Pupils might learn how to design a fitness programme, and although

not wholly irrelevant, the end point relies on propositional knowledge and understanding which is valued more than tacit knowledge – the latter is sometimes called ‘know-how’ (Ryle, 1949; Reid, 1996, 2013; Breivik, 2017). During this production into curricula there is an accompanying devaluing of the embodiment. Although Whitehead (1987, 2001) convincingly embraces the embodied ontological approach to challenge the Cartesian binary dominating PE, the anthropocentric still infuses her work. To be clear, this is not a “non-anthropocentric” perspective which would be retention of a dualist position (Joronen and Häkli, 2020). In other words, the human is part of worldly practices without being dominant over all other things. This is a challenge to Eurocentric, western ways of thinking ontologically and epistemologically, and is about human-nonhuman ‘becoming together’ (Bawaka Country et al., 2016), which I discuss in Chapter 3.

Sociomaterialism overlaps in many ways with a posthuman account, and these terms are explored more fully in Chapters 3 and 6. In some instances, the terms become interchangeable, but this is something I have left open, until the Conclusion. An initial consideration is that the social and/or with material as ‘worlds’ might be (re)conceptualised if merged, I include posthumanism as a way to *reduce not remove* the importance attached to ‘human’. Further, ‘human’ and ‘social’ might not be interchangeable since a human body has its own materiality that is not entirely reliant on social aspects of life. However, I want to show how things nonhuman and human are effecting/affecting and being shaped in a multi-directional way (Thompson and Adams, 2020). Latour (1992) observed that things are sometimes notable by their absence in social science research. This adage is followed here, where PE is part of the learning and teaching of primary ITE programmes. In the PE literature, reference has been made to things such as PE equipment but usually in relation to pedagogical models, such as teaching games for understanding (Stolz and Pill, 2013; Barba-Martín et al., 2020) rather than detailed interest in the actual things/artefacts/objects/bodies around PE in primary ITE. Part of the intention here then, is to attend to the detailed, nuanced practices that include the social and the material because the latter concerns have

often been sidelined or omitted (Law, 2007). Hence the sociomaterialist sensibility offered in this investigation shows social and material conjoined. Research designs which are materialist call for “the concepts of the actors to be stronger than that of the analysts” (Latour, 2005, p. 30). An overarching goal of this doctoral thesis is to let the things speak for themselves and to show that “we are never alone in carrying out a course of action” (Latour, 2005, p. 44). That is, the golf club, student teacher, hula hoop, curriculum document, research article, tennis ball and line drawing, can be actors involved in co-creating PL-PE.

Introducing posthumanism and sociomaterialism means attributing status to nonhuman ‘things’ as they make contributions to the worldly relations ongoing in PL-PE contexts as human beings do. Rather than ‘uncovering truths’, to investigate how and in what ways PL was enacted during student-teacher PE lessons, the importance of things/objects/nonhumans, was relevant. There is a performative aspect in PE and throughout my research approaches. I have sought to show the ‘workings’, ‘doings’, ‘practising’ (Gherardi, 2016) or *practisings*, trials and errors of carrying out research, whilst being mindful of binaries such as mind-body, theory-practice, which, it is argued, do not exist. By engaging in research which expects a dynamic, fluid, social context, Latour (1999, p. 19) states, “(T)o have transformed the social from what was a surface, a territory, a province of reality, into a circulation, is what I think has been the most useful contribution of [actor-network theory] ANT”. The researcher can adapt to the multiple configurations wherein PL may/may not be circulating, with implications for understanding these as multiple realities (Mol, 2002), and these understandings are explored in Chapter 8. Following the sentiment of Latour (2005), I hope that the exposition here is as interesting as the actors themselves made it.

This study’s purpose and significance

My aspiration is to ‘shake the tree’ (Gough, 2006) of the dominance of androcentric/anthropocentric/western/neoliberal/ research perspectives and methodologies in PE, ITE and PL. Outcomes from previous research and

approaches to education experiences in ITE, which direct ways forward in addressing physical inactivity and related diseases, have not been successful, as seen by ongoing interventions to help people 'get' healthy. I cannot claim to have a panacea to global health issues, but posthumanism and sociomaterialist approaches are opening other ways of thinking and doing PL-PE. Perhaps at the primary school ages, and with student-teachers, some dispositions to moving might become more positive and nuances of physical activity choices, understood. PL-PE is a way for educators to support all student-teachers to become confident and safe, by embracing a more holistic approach than might currently be experienced in primary ITE. Thus, future primary teachers may become knowledgeable about ways of challenging narrow conceptions of health and PE (Quennerstedt, 2019). Embracing human and nonhuman through sociomaterial and posthuman research approaches illuminates the political contribution of things – from everyday things to specific things in PE. The importance of investigating PL-PE in animated ways is an original contribution to methodological approaches. Next, I present the structure for this doctoral thesis.

Structure of the thesis

The structuring of this thesis aligns with the research processes of reading, field visits, and analyses. However, during the whole process, reading-thinking-writing practices were ongoing and interwoven, with some chapters not following what may be termed conventional positivist-postpositivist formats. For example, theory-data are presented together; there is not one analysis chapter but three chapters where data-analysis-discussion are intertwined. The ideas informing structural choices are explained in each chapter. Chapter 2 provides background about the place of PE in formal schooling, and in-depth discussion on premises underpinning PL. Chapter 3 provides my philosophical positioning as a researcher, both for this research design as well as how I developed a different approach to PL. Chapter 4 introduces my 'methodological meshwork' which embraces theory and methodology as being entangled. Chapter 5 exemplifies the strategies I used whilst doing theory-data-analysis. Chapter 6 develops theory-data-analyses through following the actors. A second analysis chapter, Chapter 7 attends to

different lines of flight which have come from following the actors. Chapter 8 develops the idea of multiple spacetimes where students are becoming teachers in PL-PE. I conclude in Chapter 9 with discussions on implications of the research processes, and with practical suggestions for PE, ITE and PL, and wider considerations. There follows further exposition of each chapter.

Initially, in Chapter 2 I situate developments in PE internationally and in Scotland. Approaches to knowledge and understanding of what, why and how to teach PL-PE present both an opportunity and challenge (Fitzpatrick, 2019) for primary ITE students. Building upon the information provided in this Chapter 1, I discuss PL and its emergence internationally and in Scotland, from research, practice and policy perspectives. There is critique of current practice in primary ITE based on the overarching theme that student teachers are not developing confidence to teach PE in schools. In addition, I suggest that recent calls for 'radical change' to PE curricula and pedagogy (Kirk, 2010; Beni et al., 2022) might be partially addressed through a PL approach to teaching PE. To do this, I introduce the work of Spinoza (2002) whose idea of *conatus* and One Substance seem congruent with how social and material are inseparable in practices such as teaching and researching with PL-PE. Two key theoretical ways in which I augment *how* to understand PL as well as *how* to investigate PL-PE are introduced. Posthumanism and sociomaterialism form the cornerstones of my significant and unique contribution to investigating and developing PL-PE.

Chapter 3 presents philosophy informing the research approach. I argue for a broad sociomaterialist understanding of the world, along with posthumanism, as ways of challenging anthropocentrism and showing relations among nonhuman and human actors. Postqualitative inquiry encourages flexibility of research design and analysis, and so acted as a way for me to challenge more conventional research paradigms. I introduce diffractive thinking as it informs diffractive methodology as a way of attending to the entanglements of social and material (Barad, 2007; Fox and Alldred, 2021). Entanglement here, is more than being

intertwined, it is “to lack an independent, self-contained existence” (Barad, 2007, p. ix), which has implications for how individual things might be construed. Different temporo-spatial ways of coming to understanding the phenomena of PL/PL-PE may be performing across (perceived) boundaries of time and space (Barad, 2010). The idea of PL as multiple is introduced as it allies with the onto-epistemological perspective informed by sociomaterial and posthuman approaches to the research.

Chapter 4 introduces the methodological approaches developed from philosophies which challenge anthropocentrism, and which are “commensurate with the phenomena being studied” (Adams and van Manen, 2017, p. 781). An ethnographic approach was taken to ‘oversee’ how to embrace human and nonhuman things, as well as past, present and future understandings of PL-PE. To retain an open and holistic attitude, eschew binaries like theory-practice, data-theory, a ‘methodological meshwork’ (Bartle, 2023) was developed to collect and connect multiple theoretical and methodological ‘doings’ or practisings. The methodological encounters neither prioritise or dismiss the human, but include data sources such as field visits, interviews, artefacts, Twitter/X social media posts, and lesson plans. My research practisings and ethical considerations are also entangled in this chapter.

In Chapter 5 the strategies for analysis are introduced. These include somatic exercises (Kieft et al., 2019) to enact relations at work when thinking with theory and data. Diffractive analysis (Barad, 2007) provides ways of challenging linear (re)presentation of ‘doings’ and continues the methodological concern with embracing the entangled messiness of research. I detail several heuristic devices with associated prompt questions, from the work of Adams and Thompson (2016). Based on one of these heuristics, COVID-19 is situated as an overarching ‘breakdown’ which initiated different ways of ‘doing empirical philosophy’ (Law, 2009). Further heuristics include writing anecdotes which may help disrupt research and provide ways of experimenting with what lines of flight may be

flowing from assemblages (Masny, 2014). ‘Follow the actors’ (Latour, 2005) and ‘unravelling translations’ (Adams and Thompson, 2016) provide means to analyse empirical-philosophical data by tracing whether actors might be co-creating aspects of PL-PE or not. Ideas inherent in tracing practisings among things human and nonhuman, such as ‘translation’ (Callon, 1986) and ‘knots’ (Ingold, 2013) in a meshwork, are explored. The analysis techniques are very much attuned with the idea of relational practisings, and lead to three analysis-discussion chapters.

Chapter 6 is the first analysis-discussion chapter which disrupts linearity of text-based doctoral theses. I present three columns to ‘do’ data-with-theory and encourage the reader to zig-zag around the text, as I discuss data with sociomaterial and posthuman theories. The strategy to *Follow the Actors* (Adams and Thompson, 2016), guides analysis by allowing data which glows or created wonder (MacLure, 2013a), to lead thinking with narrative. The effects of actors, including me as researcher, on things which are excluded or hidden, as well as included and visible, are diffracted through theory and other things in the entanglements (Barad, 2007). Diffracting helps avoid the linearity associated with representing the effects of differences of things on one another. As such, philosophical ideas are seen as a “creative force ... a multiplicity, a becoming with history” (St. Pierre, 2019, p. 7). Posthumanism, and sociomaterialism are included not to ‘find’ a pre-existing framing of a concept (Latour, 2005) – in this case PL – but as actors included in the entanglements where PL may or may not be enacted.

Chapter 7 is a second analysis-discussion chapter wherein *Unravelling Translations* and *Tracing Responses and Passages* are two guiding heuristics (Adams and Thompson, 2016). Heuristic 2, *Writing Anecdotes* becomes prominent here. Anecdotes are amalgamations of multiple data, ways of storying empirical with theory/philosophy (Crowther et al., 2017). Nonhuman things lead the narrative in familiar presentation format in this chapter, but with the amalgamation of images of empirical data from across spacetimes contributing to the analysis-discussion. It becomes apparent in this chapter that relations are being done *through*

movement, and that theory-research approaches have surfaced these practisings. The co-agentic nature of things-humans demonstrates the (co)emergence (Michael, 2004) of aspects of PL-PE and other education practisings.

Chapter 8 is the third and final analysis-discussion chapter. Here, PL as multiple and students becoming teachers emerge from the data-theory as key ideas. A consistent approach of entering the middle of data-theory is continued through rhizoanalysis (Masny, 2013, 2014). Diffractive thinking informs analysis (Fox and Alldred, 2021) throughout these three chapters, for example, by surfacing how student practices in PL-PE can be read through previous experiences. Experiences from other spaces and times inform how students might be doing PL-PE differently. Empirical data continues to be presented through anecdotes and with visual presentations. These strategies are detailing the fluidity of how things are pulling/pushing/leaking from multiple meshworks and enacting PL-PE. Sociomaterialism foregrounds how political actors are fostering relations and for students becoming teachers, there could be benefit from understanding the (co)agentic (Michael, 2017) activities of things.

In the final chapter, Chapter 9, five key areas are concluded, with three contributing to PL and students becoming teachers, and two points showing how to honour the philosophies informing PL during investigations. The five areas are drawn from theory and empirical data and presented as evidenced ideas for PL-PE futures and research approaches. Conclusions, and some emerging opportunities arising from this study are discussed.

In the following chapter, therefore, recent background to PE, curriculum, and current understandings of PL are introduced, situating my research. The role of ITE within Scottish education locates the research, and philosophical-theoretical approaches which extend how I investigated PL are introduced.

Chapter Two: Physical Education, Physical Literacy, and Theoretical Contributors

In this chapter discussion follows three sections. First, I review physical education (PE) and the more encompassing term health and wellbeing (HWB) in international and Scottish contexts. Literature published in English but from around the world, informs discussion on educational and health concerns. Scottish education and PE cannot be removed from this wider discussion. Second, developing information presented in Chapter 1 (Introduction), I provide a deeper discussion about physical literacy (PL; Whitehead, 2001; 2010; 2019). Third, I introduce theory from Spinoza, and show how posthumanism and sociomaterialism make a unique and significant contribution to understanding PL. By the end of this chapter, gaps in both theoretical understanding and empirical data will have been identified, providing warrant for the guiding research questions presented in Chapter 1 and repeated at the end of this chapter.

Curriculum and PE

The purpose of education curricula might be something like this: for states or nations to provide guidance on what is believed to be worthwhile knowledge for that context including diverse histories, cultures, values and ‘not yet’ futures (Lundgren, 2015). There are variations of this notion around the world, but in westernised, anglophone contexts, the tendency has been to develop what children ought to/should be learning (Priestley, 2011). Global influences on curriculum developments includes trans-national concerns such as human rights, children’s rights, sustainability, and the work of international education organisations, such as the Programme for International Student Assessment (PISA), which compiles international comparisons (Priestley et al., 2021). These international concerns are part of the complex web of how to understand what might constitute a ‘good’ education curriculum. Recent focus for curriculum (re)development and design does seek to challenge linear hierarchical approaches (Priestley et al., 2021), including that relating to PE (Penney and Alfrey, 2022).

Language about ‘modern curricula’ however, seems to retain a sense of ‘evangelising’ (Priestley, 2011, p. 225) about what experiences pupils ‘should’ gain

during their time in schools. Policy documentation supporting the intended outcomes from schooling are part of that which circulates power from governing to governed (Lundgren, 2015; Colebrook, 2017). Indeed, Humes (2022) has suggested that those working in governance in education in Scotland are caught in their own 'iron cage' of bureaucracy, unable at various turns, to get free from constraints. The multi-faceted collection of actors that are considered in 'curriculum making' (Priestley et al., 2021) include not only government but also schools, teacher education institutions, ongoing professional learning, available resources, teacher values, and professional bodies such as The General Teaching Council for Scotland (GTCS, 2021). This ongoing interplay is a fluid and yet arguably still hierarchical collection of actors whose roles are already determined and difficult to change, such as explored in Fenwick's (2010) actor-network theory (ANT) investigation of standards in education. Although there may be efforts to develop distributed leadership (Forde and Torrance, 2021) and remove/reduce hierarchical power structures, effects of the latter still filter into classrooms as teachers and pupils work to satisfy demands of curriculum content, assessment, reporting (Humes, 2022) and pursuit of standards (Fenwick, 2010). In education policy about health, wellbeing and/or PE, the discussion is very much rooted in some of the broader/national curriculum concerns but there are attempts to be 'creative' or 'transformative' in what Penney and Alfrey (2022) term health and PE (HPE).

At the level of policy, Penney and Alfrey (2022) reflect on the negotiated enactment of curriculum by different actors in HPE. There appear to be many examples of calls for alternative ways of enacting PE, but this is accompanied by the realisation that 're-languaging' policy does not equate to changes in practices (Ball et al., 2012) of, in this case, PE in schools. At the practical level in schools, a recent scoping report (Hooper et al., 2023) suggests that PE teachers and leaders share many views on why the subject might be presented as 'core' to the (in this case, English) national curriculum. Some recommendations from this report reiterate issues such as needing better facilities, and 'buy-in' on the worth of PE by Government, senior management in schools, and parent/carers stakeholders.

Curriculum development in Wales recently included teachers as contributors to policy (Hizli Alkan and Priestley, 2019), including PE teachers seeking the subject as core to Health and Wellbeing, as is the case in Curriculum for Excellence (CfE) in Scotland (Scottish Executive, 2004a). These last two similarities were driven by Donaldson as lead consultant in each national case (Donaldson, 2011; 2015). Many ways of justifying PE's place on curricula remain with the association between improved health and economic, environmental and political gains. How PE is measured/assessed/valued appears to be via cognitively biased methods and outputs in line with the wider education directive.

One of the dominant features of education is that 'cognitive capital' (Braidotti, 2019) predominates neoliberal concerns and acts as currency, whilst disqualifying activities such as those experienced in physical and other performative practices of human life (Reid, 1996; Bailey, 2020). This is reflected in PE curricula of, for example, Australia, England and Scotland, where PE is one of a suite of examinable (senior phase/high stakes) subjects whose cognitive capital or propositional knowledge is taught, tested and reported in measurable ways (Thorburn, 2007; Lundgren, 2015). The focus is on an epistemology reliant on propositional knowledge where instrumental ends are prioritised (Patterson, 1997; Bleazby, 2015). PE has been discussed in relation to a multitude of ends, such as: for improving health, post-war(s) (Dixon et al., 1957; Kirk, 2010), as well as the current physical inactivity and obesity pandemic (WHO, 2018; One Health Initiative, 2024); for developing sport techniques, and fitness (Kirk, 2010); as being 'person centred' and developing moral capacities (Carr, 1992; McNamee, 1992; Parry, 1998); for developing aesthetic qualities (Reid, 2008); for the 'soft' skills developed through teamwork (Barker and Rossi, 2011); for cultural practices (McNamee, 1998); for outdoor education and nature perspectives (Lyngstad and Sæther, 2020). It is paramount, however, that authors do not overclaim the contribution of PE to education (Bailey et al., 2009). Suffice to say that many conclusions about the contribution of the subject present the holistic development PE affords – that is, it encompasses all learning domains (cognitive, physical and affective) (Bloom et al., 1956; Krathwohl et al., 1973). Many contributions are based on pupils' 'doing'

and becoming *with* the world, with critical reflection on the value of physical activity experiences (Reid, 2013). Where their own experiences of PE at school were largely positive, it was mentioned in the Introduction that primary teachers (pre-service and in-service) are more likely to feel somewhat confident to teach PE. There are many, however, who are not confident and do not feel competent to teach PE in Scotland.

Scotland, Curriculum and PE

Scotland is one of four jurisdictions which make up the United Kingdom (UK). Scotland's education system has been largely independent from England, Wales and Northern Ireland since the UK was politically 'formed' over 300 years ago (Menter and Hulme, 2011). Watson (2019) notes that Scotland retains a more egalitarian perspective and confidence in its education system than the rest of the UK. After re-establishment of the Scottish parliament in 1999 education and working and pay conditions of teachers and leaders became the focus of a review (*McCrone Report*, Scottish Executive Education Department (SEED), 2001; Horrell et al., 2012). CfE (Scottish Executive, 2004a) emerged from national consultation during this period of devolution when priorities had to be considered. Although Scottish education is different from other UK and western anglophone education systems, the wider context is still of political narratives driven by global neo-liberal ideology (Sahlberg, 2011; Lundgren, 2015). The Organisation for Economic Co-operation and Development (OECD, n.d.), for example, continues to increase global country membership but the majority remain from the 'global north'.

Education data collected by the OECD perpetuates hierarchical structures by including what Priestley et al. (2021) term macro (whole education system), meso (education institutions) and micro (individual teachers and students) levels of indicators about performance outcomes, which lend themselves to international comparisons. For Priestley et al. (2021) curriculum is about sites of activities rather than specific actors like an institution, where curriculum development is being enacted. Thus, the OECD's PISA could be said to legitimise bypassing national

government from its global comparison tables to influencing school-level priorities, and these “have very real effects on teachers’ practices through the ways in which pupils are taken apart and re-assembled” (Watson, 2019, p. 417).

For purposes here, work to produce critical discourses in PE (Evans, 2003; Gray et al., 2022), shows cultural nuances in curricula around the UK, which could mean viewing curricula as advantageous sites for change. If CfE is enabling teachers and learners more autonomy than other curricula around the UK, there is scope to develop responses alongside subject-matter, in “unforeseen directions” (Standish, 2007, p. 168). For example, at primary school level, and including student-teachers, changes might be feasible and realistic whilst also being influenced by international, multi-cultural PE landscapes. The variety of actor interactions seems opportune for worthwhile ‘curriculum-making’ (Humes and Priestley, 2021). However, as outlined below, there may be difficulty balancing autonomy with variability.

Core values of CfE were developed from the Scottish Parliamentary Mace (wisdom, justice, compassion and integrity) and are embedded in the ‘four capacities’ – successful learners, confident individuals, responsible citizens, effective contributors (Britton et al., 2019). The four capacities provide curriculum development guidelines for school leaders and practitioners (Scottish Executive, 2004a). Capacities are either viewed as too vague, or helpful if viewed as interrelated, as a collective allowing fluidity of ways for pupils to develop (Bailey, 2004). Further guidance is via eight curricular areas and related ‘Experiences and Outcomes’ (Scottish Government, 2008a), for teachers to facilitate connected, cohesive learning across the curriculum from ages 3-18 (Scottish Executive, 2004a). It is suggested that the CfE framework is less detailed and prescriptive than previous curriculum advice (Scottish Executive, 2004a). The explicit desire to provide teachers with the time to act autonomously and to engage in dialogue with colleagues, is claimed to place pupils at the heart of teaching and learning (Priestley, 2011). However, the OECD (SEED, 2007) expressed concern that too

much 'variability' in Scottish education could distract from measuring outcomes. For example, Health and Wellbeing (HWB) 'Experiences and Outcomes' do not show progression routes (Scottish Government, 2009a). Further, if measuring outcomes is 'desired' then ironically, pupil results become numerical data for purposes different to those of 'child-centred' learning ideals.

There have been significant challenges to the design of CfE, stemming from a reduction in the curriculum being informed by educational theory (Priestley, 2011; Priestley and Biesta, 2013), philosophical discussion about the nature of knowledge (Humes, 2013) or phenomenologically (van Manen, 1978, 2012). Arguably, educational theory previously provided sound basis for curriculum development across the UK. Scottish education theorist Stenhouse (1969, p. 126), for example, trialled a 'process' model where curriculum consisted of "(A) democracy ... a dialogue between informed views ... open but disciplined discussion rather than formal instruction". Teachers acted more like facilitators whilst pupils were encouraged to discuss broad societal issues such as gender or war. Experiences in the classrooms were dynamic, unpredictable, and free flowing. Discrete subject areas were replaced with imaginative and critical approaches to investigate social concerns. Within the same timeframe, in 1968 the International Baccalaureate Organisation (IBO, 2017) was founded and there are resemblances between the IB curriculum and Stenhouse's (1969) teaching philosophies which are based on developing pupils' capabilities to engage in critical inquiry. Remnants of Stenhouse's process curriculum project are perhaps not very prominent, whilst the IB continues to grow around the globe, albeit in only a few schools in Scotland (IBO, 2017).

The curriculum approaches of Stenhouse and IB do appear in CfE *Building the Curriculum 3* (Scottish Government, 2008a, p. 9) which asks teachers to provide "space for imaginative teaching that can capitalise on approaches which make learning relevant, lively and motivating". At the same time, outcomes prevail as the aim of the curriculum is to "prepare all young people in Scotland to take their

place in a modern society and economy” (Scottish Government, 2008a, p. 3). At the heart of this is the phrasing the pupils will develop “knowledge and skills for learning, skills for life and skills for work” (Scottish Government, 2008a, p. 4). The ordering of the phrasing emphasising ‘life’ in the middle of ‘learning’ and ‘work’ may be for alphabetical rather than hierarchical purposes but it shies away from any idea that the purposes of curriculum (and education) are any less economically driven.

Hirst’s (1974) forms of knowledge theory, arguably derived from Plato (1974), delineated a clear conceptual framing for the curriculum in the late 1970s. Accordingly, each subject is based on the internal logic of each ‘form’ – such as the logic of the sciences with empirical, experimental methods (Hirst, 1974). The forms and subject areas were nested in economic and political circumstances of that time (Watson, 2019), just as CfE seems to move an idea of curriculum beyond/away from provision of knowledge. A somewhat similar goal as philosophies of Stenhouse (1969) and IB (IBO, 2017) programmes, CfE seeks to ‘help’ learners develop the four broad capacities (Scottish Executive, 2004a). However, tensions are surfaced at the juncture of claims of a less prescriptive curriculum design and lack of theoretically informed curriculum change (Priestley, 2011; Humes, 2013). It is acknowledged that the new curriculum in Scotland is theoretically weak, perhaps because dominant discourse remains with a “benign neoliberalism” (Watson, 2019, p. 392). Far from being benign, teacher autonomy may still be bound to outcomes which drive the national curriculum (Scottish Government, 2008a). It appears that similarities to the broader, dynamic, pupil-centred, interdisciplinary philosophies of IB and Stenhouse, for example, do not extend much beyond CfE’s four capacities or perhaps the suggested interdisciplinary approaches to learning (Scottish Government, 2008a; Humes, 2013).

Prominence given to ‘skills’ in many recent curricula developments (such as Welsh curriculum, Welsh Government, 2021) is a move away from content or knowledge-based curricula (Standish, 2007; Priestley, 2010; Shapira and Priestley, 2018). Most

recently, however, Scotland is undergoing a Curriculum Improvement Cycle (Education Scotland, 2024) which asks what is meant by knowledge. Discussion of hierarchical and horizontal knowledge remains. Thus, linearity in how 'progression' is understood through levels 0 to 5 of the CfE (Priestley and Humes, 2010) is also retained. Further, assessment still seems to drive the curriculum (Hayward and Hutchinson, 2013). Assessment as driver of curriculum is not a new phenomenon, and efficiency of teaching with focus on end products (such as exams) suggests an instrumental end. As mentioned above, this is particularly the case for the body, wherein feelings may be consciously suppressed or ignored as pupils seek to pass exams (Shusterman, 2012). However, suggestions that the CfE is atheoretical may be tempered if teachers can understand and interpret documentation in ways which demonstrate how practice is or has changed – perhaps in a phenomenological way, as hinted at by Standish (2007). A phenomenological approach has led to broad understandings of 'pedagogy', as developed from the lines of thought of Merleau-Ponty, Dilthey and Nohl (van Manen, 2012) including, for example, a 'lifeworld' approach to how curriculum is experienced. Thus, accounts of curriculum are less dominated by positivist, behaviourist conceptions of what is important (van Manen, 1978). Further, Stenhouse (1975) advocated that teachers remain the only ones who can actualise meaningful change in the curriculum.

Rather than foreground discussion on curricula driven by provision of knowledge, and a certain kind of epistemological stance, ideas about knowledge(s) are developed below from the point of view of placing ontology at the heart of the matter. This shift merges epistemic and ontological, to 'onto-epistemological' (Barad, 2007), to further articulate the entanglement of things such as knowledge and performative activities – ideas which are further discussed in Chapters 3 and 6. Posthuman and sociomaterial approaches challenge a static understanding of knowledge and ask questions about knowledge(s). My research recognises the dynamic and fluid ways of knowledge-making among humans and nonhumans in relation to PE. By providing a strong theoretical foundation upon

which student-teachers might build, PL might be a way of negotiating these tensions in the context of PE at least.

Health and Wellbeing, Physical Education, and Curriculum for Excellence

Discourses on health and related concepts such as health literacy, physical (in)activity, PE and PL have found prominence in international non-governmental organisations (INGOs) such as the WHO, (2018); United Nations Convention on the Rights of the Child (UNCRC, n.d.); IOC (2021); United Nations Education, Scientific and Cultural Organisation (UNESCO, 2015) which reports on global health and PE provision; and the OECD (2023) which also produces health statistics. Even with this international set of policies and legislation driving national interventions or approaches, physical inactivity remains high, with ramifications being an increase in non-communicable diseases which are often life-limiting (OECD, 2023). Inactivity and other related health issues like poor dietary conditions are not confined to western communities, but with additional poverty and culturally related constraints, the aforementioned documents tell of a global pandemic.

Within the current narrative of global social, political and economic concerns associated with decreased physical activity and rising obesity (Currie et al., 2015; Corbin, 2016; Gray et al, 2021; Townsend et al., 2023), there has been increased legislation, policy (Horrell et al., 2012) and research pertaining to the Scottish context (Gibson et al., 2019; Townsend et al., 2023). The relationships between holistic and ongoing health, such as healthy weight, active lifestyle, balanced diet (Gibson et al., 2019), are developed from birth, through parent/carers modelling and care, and thereafter include involvement of education provision. In western contexts, PE in the nursery/early years and primary education age range (3-11), is acknowledged as being highly important in shaping ongoing physical activity behaviours (Carse et al., 2018) and attitudes towards lifelong physical activity (Rudd et al., 2020). As part of early physical activity experiences, movement competence tends to be the central tenet in developments to encourage, maintain and improve physical activity participation. Success and continued participation,

however, require emotional/affective engagement and knowledge and understanding about how and why to remain physically active throughout life (Whitehead, 2010).

There remains a paucity of longitudinal empirical evidence from young children (aged 3 for example) to adulthood (Miller et al., 2024) about choosing to remain active, but in primary PE specifically, meaningful experiences such as those involving pupil choice, are important motivating factors (Beni et al., 2017; Ní Chróinín et al., 2023). What counts as ‘meaningful’ could be considered a subjective question meriting multiple responses. Shusterman (2012) suggests that the human body provides a basic ‘instrument’ for all human activity but is also the centre for defining differences.

Meaning relies on a network of practices, competencies, and activities that provide the necessary contextual background for making sense of things and actions ... (and) ... has a salient somatic dimension (Shusterman, 2012, p. 50).

PE provides opportunities for learners to explore movements and develop understandings about their own bodily capabilities, thus an approach to teaching and learning that recognises the embodiment is central (Ivinson and Renold, 2021; Howells et al., 2022). Limitations of considering embodiment have been addressed by Durden-Myers and Bartle (2023), who investigated PE, PL and Nussbaum’s (2011) capabilities approach, from a posthuman perspective. I develop an augmented/extended posthuman perspective of embodiment in the section on PL below.

With specific regard to Health and Wellbeing (HWB) in Scotland, the *Getting it Right for Every Child* (GIRFEC, Scottish Government, 2008b) model of practice, legislated through the *Children and Young People (Scotland) Act 2014*, informs HWB indicators. The policy intention is that that GIRFEC and CfE are agents, used together by professionals to ensure a co-ordinated and collaborative approach to

every child's wellbeing. Thus from international to local policy, HWB (and PE) practice in schools is informed by the same key messages relating to health. However, as noted by Gibbons (2018), the emphasis on product or outcome driven policy does not seem to result in qualitative improvements in relational or care aspects of education. Efforts to tackle health and wellbeing issues continue, and the discourse in policy understandably seems to encourage schools to pursue a healthism 'crisis discourse' (Horrell, et al., 2012). This pursuit, however, has not clarified what constitutes a 'healthy person'. Current conceptions of health found in PE literature are categorised by Gray et al. (2022, p. 1166) as "public health, health and wellbeing, health as citizenship" and what these authors identify in Scottish policy as a 'care' discourse. This last, however, often aligns more with self-respect, individual rights and responsibilities associated with neoliberalism. Elsewhere, Noddings' (2006; 2015) 'ethic of care' which is reciprocal, between pupil and teacher, and assumptions made vice versa, is also reflected in some Scottish policy as calls for "learning community ... in which everyone can make a positive contribution to the wellbeing of each individual" (Scottish Government, 2009b, p. 3). Of deeper concern perhaps, is that much policy (Scottish Government, 2024) and recent research (Gray et al., 2021) suggests focus remains on health outcomes.

In addition to categorisation as a core element in CfE, recent research also shows that PE retains its traditional content such as multi-activity/games (Kirk et al., 2018), gymnastics, and national dance (Carse et al., 2018). Thus, interpretation of the CfE 'Experiences and Outcomes' (Scottish Government, 2009a) - that is, what pupils should experience and the expected outcome in understanding in PE, seems to have resulted in a twofold application of them. On one hand, the subject narrows focus to address multi-dimensional health issues whilst on the other retains its traditional sports/multi-activity content (Kirk, 2004; Gray et al, 2012). The latter point has been noted by primary teachers as they reflect on "sports discourses and practices" in ITE which have resulted in them learning "on the job" (Elliot et al., 2013, p. 758). Positively, there seems appetite for improving quality of teaching PE. By introducing PL in my practice with primary ITE students, I

address calls for ‘radical change’ to PE curricula and pedagogy (Kirk, 2010; Beni et al., 2022). However, PE remains situated in the prevalent discourse and is not disrupted or deconstructed in a way which might invite alternative thinking about the subject (Fitzpatrick, 2019).

Missing from much policy seems to be a desire that educational philosophies be proactive rather than responsive/reactive to societal contexts. Proactivity could mean time and practice are devoted to learning how to think about alternatives in life situations (Larsson, 2019), for pupils to develop aspects of their futures and feel a readiness to think, debate, create and make. How some pupils are encouraged to respond within inequitable time and/or place is one criticism levelled at education. Indeed, aspects of a capabilities approach (Sen, 1999; Nussbaum, 2000; 2011) provide ways in which to critique the notion of equality/inequality because some people may not be able to actualise addressing the inequalities with which they live (Robeyns, 2017). World-centred discussion attempts to draw from this and provide ideas for a freer, inclusive education (Freire, 1972; Biesta, 2022) but these are global equality issues as much as they are local, and beyond the scope of this doctoral thesis. Freire et al. (1976) began much of the work seeking communities of practice, and these ideas are evident in some recent cross-UK PE research (Gray et al., 2023; 2024).

Guiding policy in PE, Education Scotland (Education Scotland, 2014; 2017) documentation identifies four areas of Key Learning in PE (until recently known as Significant Aspects of Learning, SAoL/SALs) (see Table 1). These are: physical competence, personal qualities, cognitive skills, physical fitness. The last seems problematic as it separates components underpinning fitness (such as strength, endurance, flexibility) from the physical competence category, of which these are inherent elements. Seen as addressing ‘health’ of children, physical fitness may also become a focus in primary PE but such focus on health only becomes problematic if accompanied by a limited understanding of ‘health and fitness’ (Gray et al., 2012; 2024; McEvoy et al., 2015). Arguably, such an interpretation

embraces a scientific and potentially reductionist perspective which objectifies the learner. For instance, by measuring levels of fitness and eating habits, the body is treated as a learning ‘tool’ or ‘machine’ which can be ‘made healthy’ (Evans et al., 2008; Williamson, 2015). Here, focus is on ‘end-states’ such as ‘being physically educated’ or ‘good at sport’. Conceiving learners in this rather technical sense may be unproductive at achieving wider health-related goals (Martínková, 2011). Consequently, research is required which attempts to provide convincing alternatives to how to think about and practice ‘healthy’ PE (Kirk, 2004; Jess et al., 2011; Quennerstedt, 2019). These factors add warrant to investigating whether an understanding of PL will open up different approaches for how primary ITE students teach PE, in part by challenging narrow conceptions of health and PE.

Table 1 PE and PL, Key Aspects

Key (Significant) Aspects of Learning in PE (Education Scotland, 2014; 2017)	Key elements of PL (Whitehead, 2001, 2010) and domains of learning
Physical Competencies	Physical Competence (physical)
Physical Fitness	
Personal Qualities	Confidence (affective)
	Motivation (affective)
Cognitive Skills	Knowledge and Understanding (cognitive)

As highlighted in the Introduction, the *Scottish Physical Education Review* (Scottish Executive, 2004b) stated that all primary school children should experience at least two hours of PE per week. Further, the series of *Building the Curriculum* documents (Education Scotland, various dates) work alongside GIRFEC (Scottish Government, 2008b) to inform how students learn to teach, as well as their in-service teaching practices. Specifically, intended ‘Experiences and Outcomes’ guide curriculum planning with further detail provided by *Benchmarks PE* (Education Scotland, 2017). Benchmarks present Key Learning in PE (SAoLs) at developmental levels and these support progression in learning and assessment (Gray et al., 2021). Importantly, benchmarks are not to be used as checklists, but there might be concerns that this is sometimes how they are used by class teachers in PE lessons/assessment (Hayward and Hutchinson, 2013).

Other Recent approaches to PE

Developing holistic approaches to teaching PE has affinity with the German and Nordic concept of *Bildung* (Lundberg, 2015). *Bildung* is an orientation towards self-educating and perhaps paradoxically, education provides the external encouragement for individual 'self-cultivating' (Wibowo et al., 2023). The interaction between curriculum and teaching in *Bildung*, is associated with lifelong development. Importantly, for PL-PE, this includes development of all learning domains referred to in Table 1 above, and as being continuous throughout life, as ongoing "'formation' (*Bildung*) of the child, directed towards meeting an unknown future" (Lundgren, 2015, p. 789). The similarities with Whitehead's (2010) PL are helpful as each idea – *Bildung* and PL – is contributing to broader ongoing, lifelong, and holistic wellbeing. The content in PE and PL is not focused on specific sports, but is wider than the performance oriented, competitive contexts. Movement and experiencing movements that are varied and promote different embodied responses from pupils are encouraged in holistic approaches – such as expressive movements, moving for health, cooperating in playing games, and experiencing competitive activities (Wibowo et al., 2023). The idea of becoming, rather than more static being, is developed in *Bildung* and PL as each embraces the idea of pupil development in PE as being fluid, dynamic, and ongoing into possible futures.

Other suggested futures for PE include working to have its contribution to lifelong physical activity valued and implemented in curricula, by co-creating PE experiences with pupils or student teachers (Larsson, 2019; Beni et al., 2020). A 'salutogenic' approach to PE offers "relational conceptualisations of health and wellbeing", which are developed with regard for pupil context (Alfrey and Welch, 2021 in Gray et al., 2022, p. 1164), rather than focus being on outcomes of unhealthy lifestyle choices (such as noncommunicable diseases). The salutogenic approach still seems to be caught in domineering neoliberal individualisation mechanisms (Riley and Proctor, 2022) which, for example, restrict what teachers can do in bounded school timeframes. It takes time to experience movements

which contrast with skill-based approaches by engaging “(S)ynaesthetically, as in amalgamating the visual, inaesthetic, auditory, and olfactory senses, in reading the specific, meaningful details” of different environments (Lloyd, 2011, p. 85).

Indeed, as iterated by Whitehead (1987), developing the ‘whole’ child is not achievable in a few PE lessons, even with skilled pedagogy and good relations among teachers and pupils. In the context of physical *education*, learning and flourishing tends to be developed alongside reflection and a sense of purpose or intent (Reid, 2013). Reflection and evaluation of movement skills relies on the capacity to draw on the neuro-computational, cognitive, aspect of learning. This reliance does not preclude the necessity of experiencing moving but includes taking account of pupil/personal choice and what movements might be found to be meaningful (Beni et al., 2017) for individuals at an ontological and ethical level, rather than solely epistemological basis (Kirk et al., 2018). Debate about theory-practice and inherent hierarchy of mind over body, or indeed, existence of “pure mind and pure body” will be assumed to be dispelled (Kretchmar, 2007, p. 376), and not recounted from here on. Indeed, Reid (2013, p. 931) states that,

the idea that there is a genuine philosophical problem about cognition in physical activity is itself a dubious one, inasmuch as it reflects epistemological views which are rooted in the metaphysics of mind-body dualism.

Dewey (1988) also sought language which would lessen the dualism by using the term ‘body-mind’ to express wholeness. The example also shows how authors and researchers have grappled with limits of the written word to discuss connected aspects of how humans (and here nonhumans) flow with things in the world. Interrogating aspects of PL, whilst arguing for their entanglement, is a heuristic device (Cairney et al., 2019a), not a claim of things being separate. Whether the neurological-computer model or the embodiment idea, each falls short of the fuller accounts of the environment and more specifically, things in the world, in a way which become clearer during this doctoral investigation.

My Contribution

My investigation is about an alternative philosophical understanding of features of learning to move, wanting to move, knowing why moving is valuable for life, all of which might inform futures of PE (Whitehead, 1987; 1990). An alternative perspective that I argue for during this investigation is whether PL (Whitehead, 2001; 2010) offers a way for ITE students to deeply understand what, why and how of teaching and learning in primary PE. However, I also introduce theoretical perspectives which challenge anthropocentrism of current understandings of PL-PE. As stated earlier, humans remain central to much research in the field of PE and PL which limits alternative ways of conceiving PE. Braidotti (2019) and many others refuse the anthropocentric to introduce other species (Nussbaum, 2011) and material things (Bennett, 2004), as entangled in relations in a world of which humans are only a part. Sociomaterial accounts of activities, or events, means agency is not the sole purview of humans but can be attributed to nonhumans also (Callon, 1986; Barad, 2007). Further, viewing PL-PE from a relational perspective will be shown to extend where physical literac(ies) might be influenced and influencing experiences of primary ITE students learning to teach PE.

In this section I highlighted the need for what Penney and Alfrey (2022) refer to as creative readings of education and curriculum policy by bringing PL into the futures of PE in primary ITE. The approach is not limited to a narrow conception of health and PE (Quennerstedt, 2019) which tends to mind-body dualism and is engulfed by neoliberal instrumental ends. Further, PL does not reenact 'traditional' games-based approaches, with which children in primary school cannot necessarily engage, since these require quite developed capabilities to participate. If confidence, motivation to play, knowledge and understanding about physical activity, and physical competence are to be developed, then a more holistic approach, beyond merely fundamental or core skills, is needed. Without falling into the 'beatific' idealist narratives (Quennerstedt et al., 2021) which raise PL to heights that cannot be addressed in the confines of primary schooling, PL does offer an alternative way of learning to teach PE.

One caveat is that I introduced and critiqued the place of PE across curricula internationally, albeit with a recognised western, anglicised bias. This is in part because the literature is in English thereby limiting how I can understand the experiences of student teachers and what PE looks like in areas of Asia, Russia, Africa and so on. From Chapter 1, it was clear that primary teachers and primary ITE students deserve more, and better-quality education experiences to feel confident and be competent at teaching PE in primary schools.

In the next section I augment how PL is currently understood by introducing sociomaterialism and posthumanism. In doing this, PL becomes entangled with things and humans in the world, therefore challenging anthropocentric concerns. It seemed a logical step since, in PE, playing with things in different environments is central.

Physical Literacy

To address several of the ‘calls’ summarised in the previous section, I present an overview of PL and the philosophies which inform it. The three philosophies directly address how the human body is perceived/conceived in PE discourses and present a different way of ‘doing’ PE in primary ITE. A common critique of PL is that its philosophical roots are difficult for teachers to understand in a way that might inform PE practice (Robinson et al., 2018), so I explore these roots and seek to show how involving other theory could augment/distribute/enlarge much of the philosophy already informing PL. I open with the definition of PL often cited in research because it was developed by Whitehead (2010) after her extensive work on embodiment and PE (Whitehead, 1987; 1990). How and why a definition might be a useful starting point is discussed. I heed the words of hooks (1991) who warned of presuming theoretical expertise whilst exploring a phenomenon/phenomena, and in the process assuming a ‘caretaker’ role over these theories. The purpose of my exploration is to investigate whether theoretical lines informing PL are entering and leaving the student-teacher

experiences as they learn to teach primary PE. There are implications for teachers in-service because if, as student teachers, they have developed confidence, then this may lessen current demands for professional learning in PE. Implications beyond this may seem to be speculative, but these will be explored in later chapters. After recent and current research into PL has been discussed, the research questions driving this doctoral work are restated. I then show how these were addressed in a way which chimed with philosophies/theory expressed here.

The International Physical Literacy Association (IPLA, 2017) defines physical literacy as “the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for physical activity for life”. The definition is relevant because it is based on the work of Whitehead (1987; 2001; 2010). Whitehead (2001) conceptualised contemporary PL based on her philosophy of PE (1987; 1990). The IPLA definition is stipulative, fixed, static, and affords power to a (de)finite idea(l) of what is meant by PL. Indeed, “the possession of a term does not bring a process or practice into being” (hooks, 1991, p. 3). A definition can ‘black box’ an idea, closing it in, rendering processes of ‘doing’ PL “invisible” and not contestable (l’Anson et al., 2017). My research seeks to follow the where-what-how of PL-PE (or not) as processes which are not evident in a fixed, closed, definition, nor waiting to be ‘revealed’, as explored in the opening chapter in relation to phenomenology. Perhaps other kinds of definition are more accommodating, for example, Bailey (2022, p. 173) explores types of definition, suggesting that descriptive definitions (“this is what PL means”) take time and consensus to be adopted into both practical and academic communities, and indeed, that a consensus may not be reached. Consensus is often apparently achieved via production of a policy document, such as the education documents associated with CfE (Scottish Executive, 2004a; Education Scotland, multiple dates), Scotland’s multi-stakeholder promotion of physical activity (Scottish Government, 2024), or consensus statements on PL (Sport Ireland, 2022; Sport England, 2023). Production of a written document exerts a power about ways in which PL might be enacted but could also be a baseline for understanding PL in different ways. The latter could help practitioners encourage physical activity

experiences which, for example, are more than fundamental movement skills, as alluded to above as being problematic because the sole focus is on physical competence. Baugh (1997) refers to Deleuze's thinking, that multiple applications or understandings of a concept do not empty it of its meaning, and this opens the way for multiple enactments of PL, an idea to which I return in Chapter 8.

Whitehead, and Premises that inform PL

As a starting point to explore PL Whitehead's (2001; 2010) work is key, as her considerable (re)development of the idea in contemporary society shows (Cairney et al., 2019b). PL now has notable reach around the world (Whitehead, 2019; Carl et al., 2023). At the heart of Whitehead's (1987) conceptualising of PE and subsequently PL (1999; 2001), is the centrality of embodiment. PL is based on a post/anti-Cartesian monist perspective of the human being in which mind and body are not separated, thus the human is referred to as embodied (Whitehead, 1987, 2001, 2007; Rosenberg, 2019). At the core of the 'embodiment' is a concept of the 'human being as moving being' (Whitehead, 2001; Martínková, 2011; Merleau-Ponty, 2012). For Whitehead (2010), in separating mind from body, the body becomes secondary in an individual's pursuit of a good, healthy life. This disregards what she believes is the nature of being human – that we are embodied. Whitehead (2010, p. 22) states that

(D)esignating our embodiment as purely an object or a machine is unacceptable and insensitive, disregarding and trivialising a key dimension of ourselves and one which, for many, is a highly significant aspect of the reality of life.

In referring to the 'embodiment', Whitehead means the potential of human beings to inter-act with features in the world via movement (Whitehead, 2010, pp. 202-203). Here, the use of 'inter'- action, for instance, belies Whitehead's desire to move away from dualist language common in western writing. 'Inter' which suggests 'between', commonly manifests as presenting two or more groups or things (intercollegiate, international, interracial). Groups of things or people are separated to bring them together in a way which highlights the identity of

homogenous groups – such as different nations or teams. In Chapter 3 I bring in the prefix ‘intra’, following Barad (2007), where a body or thing is always already a hive of activity. The example highlights difficulties with language which, at times, is not helpful in overcoming assumptions about ‘the body’. As a further example, Whitehead (2010) notes that humans ‘do’ things to the body, such as wash ‘it’, make ‘it’ jump higher. Whilst objectifying the body, such terms also move away from the “I am my body” perspective advocated in PL (Whitehead, 2010, p. 23). Language can objectify, reduce the notion of human intentionality and any sense that movement is core to world-making practices.

Whitehead’s conception of embodiment is firmly rooted in the phenomenology of Merleau-Ponty (2012) who placed motility as prime way in which human beings come to know the world. Motility is accompanied by perception and so for human beings to perceive and act with things around them, humans need to move. From in utero human beings are animate with/in/from the world/environment (Whitehead, 2010; Nagy et al., 2021). The ‘affordances’ offered to the human by things in the environment are “opportunities for action” (Gibson in Whitehead, 2007, p. 286), suggesting that some things will encourage or prompt movement in the human, rather than simply exist. For example, on perceiving stairs an infant may seek to climb them. It seems appropriate that PE affords pupils opportunities to engage in meaningful and multiple movement experiences to develop holistically (Kretchmar, 2000). It follows that the more varied the environments experienced by individuals the more at-home-in-the-world a person might become (Whitehead, 2010). In the constant dialogue between human-environment, Merleau-Ponty suggests that this ‘fleshy’ part of (inter)action (Mensch, 2010) is facilitated by embodiment. The ‘gap’, as represented by the flesh between ‘transactions’ or different kinds of human-nonhuman actions, might provide the basis for discussion about flow of learning. For instance, ‘gaps’ might be opportune places for learning connections to be made, so inhabiting what are fleshy parts of the materialist’s network. In his phenomenological account, Merleau-Ponty (2012) suggests that the embodiment is known prior to other things in the world (Whitehead, 1987; Mensch, 2010) but that this knowledge only becomes richer

and helps create a sense of self as actions with things occur. Indeed, Merleau-Ponty (2012) suggests that unless objects are ‘taken up’ then the relation between human-object lies latent. To ‘take up’ an object, a human being has to perceive the thing prior to acting with it, leading Lloyd (2011, p. 86) to suggest that humans become “physically active in an animate world”. The nature of embodiment as referred to by Lloyd seems to miss the point that as embodied, human-as-moving-in/with/through-the-world are already animate, or to create a sense of the ongoing – *animating*.

Developments in neuroscience support the phenomenological perspective which challenges separation of mind and body, yet fall foul of the internal-external, subject-object binaries (Reid, 2013). It is not helpful, for example, to liken the central nervous system to a computer, controlling movement from within and providing ‘outputs’ (Reid, 2013). The argument presented by Sheets-Johnstone (2015) makes more sense. She suggests that it is *whilst experiencing* that one is acting or doing, in the holistic sense to which advocates of PE aspire. For instance, when walking, the experiencing of walking provides kinaesthetic feedback, such that a person can tell whether they are walking at a slow or a fast pace. The person does not experience the neurological message-sending from cerebral cortex to relevant muscles. The message transmission is experienced *in the moving*. Riley and Proctor (2022, p. 2) similarly, are concerned that the “universalising functions of developmentalism” whilst apparently placing child at the heart of the matter, are not *experienced by* the child but are assumed qualities derived from neoliberal systems and structures.

Separating *experiencing moving* from ‘the moving’ is falling into the Cartesian trap and the unity of ‘knowledges in moving’ are not foregrounded as relevant or important (Sum and Whitehead, 2021). As a further example, a person experiencing fast paced walking might not ‘have a sense of self’ walking unless the rhythm is broken (Sheets-Johnstone, 2015). Movement is just that, talk of embodiment is not needed because doing so is close to suggesting that the body

is a receptacle to be filled with parts (cognitive, neurological, physiological). Indeed, Sheets-Johnstone (2015, p. 33) calls the term ‘embodied’ a “lexical band-aid” to reassure people that movements, thoughts and so on, are not without a ‘body’. Some conceptual misunderstandings also occur where embodiment is viewed as an ‘outcome’ of the school subject of PE – for example, by Lambert et al. (2022) who suggest that teacher educators, for example, could take a more ‘embodied approach’. Whitehead (1987; 2001) writes that embodiment is not a learning intention whilst Merleau-Ponty (2012) says that it is not a separate ‘thing’, and both say it is a way of describing human being as monist. Thus, in PL-PE pupils *are* embodied.

In PE the importance of movement cannot be disputed, but the purposes of movement and the influences of socio-political contexts drive what is experienced in school curricula, as explored earlier. One of the foundational elements of PL is that subjective experience – the ‘lived body’ – is recognised as educationally legitimate (Whitehead, 2007). The “embodied dimension ... is the very fabric out of which life is fashioned” (Whitehead, 2007, p. 294). For Larsson (2019, p. 166, emphasis original), “physical education-as-embodied exploration emphasises what there is to explore, discover, practice and *know* in moving”. Moving is not viewed as beneficial for other ends, although this does not deny the potential and actual benefits of moving, such as maintaining healthy weight. Larsson (2019) elaborates on the educational benefits during what are always embodied explorations, suggesting teachers might discuss wider social issues during PE, such as gender, sexualised bodies, class or race. Sheets-Johnstone (2015) warns however, that the term ‘embodiment’ (and derivatives) should not be thought of as a ‘ready-made’ preconceived, static container into which phenomenologists place mind-body as a way of removing any binary. Moving seems entwined with how to describe embodiment – at one and the same time, motility and ‘I move’ precede ‘I can’ and ‘I do’ (Sheets-Johnstone, 2015). Phrases such as ‘I can...’ and ‘I can do...’ tend to neoliberal influences in education, where learning intentions are stated *a priori* as determining desired experiences and outcome(s) (Scottish Government, 2009a). ‘I move’ is enlisting a whole range of conceptual

understanding (Sheets-Johnstone, 2015), such as ‘how far away is the target’, and the everyday ‘how near is the door handle’?

Key Aspects of PL

To unpack what is meant by PL, I remove the lexical band-aid for heuristic purposes and am mindful that PL’s strength is the intertwined, interdependent, inextricably linked elements when experienced holistically (Cairney et al., 2019a). Key elements of PL (Whitehead, 2010) are explored briefly below, bearing in mind that everyone is on a PL journey from birth or even pre-birth (Nagy et al., 2021) to death. Key elements are motivation, confidence, physical competence, and knowledge and understanding, along with valuing physical activity throughout life (Whitehead, 2010; Gleddie and Morgan, 2021). It becomes clear from discussion that follows that these elements are inextricably interlinked, and, indeed, entangled.

Motivation informs many pedagogical strategies seeking to encourage pupils to experience positive exploration of movement in different environments in PE and PL. Experiencing different environments and diversification of movement activity options may enhance progressive and positive lifelong physical activity journeys (Whitehead, 2010; Wormhoudt et al., 2018). Motivating people, in this case pupils, to want to play or participate in physical activities relies on ways in which teachers (student-teachers) design, develop, and deliver PE lessons. If a lesson is predominantly teacher-led then children may feel constrained, which could lead to lack of capacity to think-move as well as reducing opportunities for creative responses to tasks (Rudd et al., 2020). In the PE context, providing tasks which demand relational interactions between pupil and equipment seem to benefit individual creative and executive function development (Haerens et al., 2013; Rudd et al., 2020). Open and flexible pedagogies thus provide opportunities for multiple response options for pupils as they adapt and respond to tasks (Araujo et al., 2010). Researchers are also seeking pupil perspectives, finding that pupil choice and experiencing joy during movement, may contribute to feelings of

autonomy and relatedness, and therefore motivation as well as confidence (Haerens et al., 2013; Lee et al., 2017; Ní Chróinín et al., 2023). In addition, provision of multiple movement experiences wherein spaces, tasks, equipment, and people are changeable, is contributing to knowledge and understanding of what one can do (Cale and Harris, 2018) and to improved affective learning, such as feelings of wellbeing, and development of capabilities like risk management (Strafford et al., 2021).

The reduction, or limiting, of prescription and structure is sometimes seen as a positive pedagogical strategy (Jess et al., 2016) but at times, tasks may demand prescription to clarify a teaching point before a more complex skill might be successfully performed. This makes sense if pupils are not yet feeling confident, able, safe, want to act autonomously, or feel intrinsically motivated. Pupils might also be motivated by external sources (Haerens et al., 2013), which Rudd et al. (2020) note do invite responses and interactions from individuals. External sources could include teacher suggestions, peer group encouragement to achieve a goal, environmental factors in school or from home-family life (Cairney et al., 2019a). Level of external structure/support is important along with recognition that more 'command' styles of teaching are perhaps less conducive to pupils being motivated (Kretchmar, 2008; Haerens et al., 2013). However, human behaviours might better be placed at "*the between*" of intrinsic-extrinsic motivation rather than at either extreme of external/objective or internal/subjective (Kretchmar, 2007, p. 378, italics original). By foregrounding pupils *with* things-in-PE in this 'between', the scope for non-deterministic responses to movement problems in PE becomes less about the pupil and more about the whole (social and material) context. For student-teachers, having an understanding that what motivates pupils and contributes to building confidence comes in many forms, but working to foster choice about how where with what and whom to move, seems a good start to providing PL-PE (Lundvall, 2015), only if motivation and confidence are two of the four inextricably linked aspects.

In relation to physical competence, PL is sometimes seen as synonymous with fundamental motor skills (FMS) or similar acronyms like the 'ABCs' (Agility, Balance and Coordination) of PE (Shortt et al., 2019). Primary ITE students may learn that "equipment manipulations and play space" adjustments are "advantageous to performing functional movement skills" (Rudd et al., 2020, p. 6). However, these both reduce PE to being *only* about physical competence. This aspect is key to development of physical capabilities, but physical competence cannot be developed in isolation from affective and cognitive learning (Cairney et al., 2019a; Gleddie and Morgan, 2021). Education Scotland (2021a, p. 6) cites the *Better Movers Thinkers Resource Package* where it is claimed that PL is, "(T)he acquisition and development of a range of attributes and qualities that support the child to move with competence and confidence in a wide variety of physical activities". An evaluation (Dalziel et al., 2019) of this pedagogy in PE found that physical coordination and cognition were significantly improved but a dualist foundation remains inherent. What might be considered important elements of the IPLA (2017) definition are omitted – such as motivation and valuing physical activity for life. Education Scotland's (2021a) resource is a pedagogical approach, whilst PL it is suggested, is a lifelong "disposition" (Whitehead, 2010, pp. 12 and 163). An example might help here: physical competences such as running, climbing, jumping, landing, hanging, vaulting, rolling, to negotiate environmental features/things will be developed in the activity of parkour or free running. In addition, parkour affords experiences of a more holistic kind because attention, perception, intentional action, responses to other people, are also demanded whilst negotiating equipment or environment (Stafford et al., 2018). The skills and experiences from parkour can also be performed in/transferred to any other physical activity context (Stafford et al., 2018; 2021).

Experiencing many different movement practices through something like parkour, means moving with/in/around the things in the setting. Things might provoke a wide range of responses. So, although practice and habit-forming through repetitive movement patterns are important for improving physical capabilities (Aggerholm et al., 2018; Breivik, 2017), parkour invites problem-solving

approaches whilst moving. Not only is this relevant for developmental physical progression, but other aspects of PL are entangled, such as motivation and confidence. If a child does not feel confident or willing to complete a physical activity challenge, motivation may spiral to amotivation, and further improvements in physical abilities may be delayed or stop. Further, experiences during primary PE may develop or impede participation in later childhood and into adulthood, with health consequences – positive or not (Cairney et al., 2019a; Ní Chróinín et al., 2023). Although physical competence is part of PL-PE, it is never alone. PL is an expression of the interdependent, intertwined body-mind activities which make up moving, thinking, feeling, holistically, as presented diagrammatically in Figure 2.

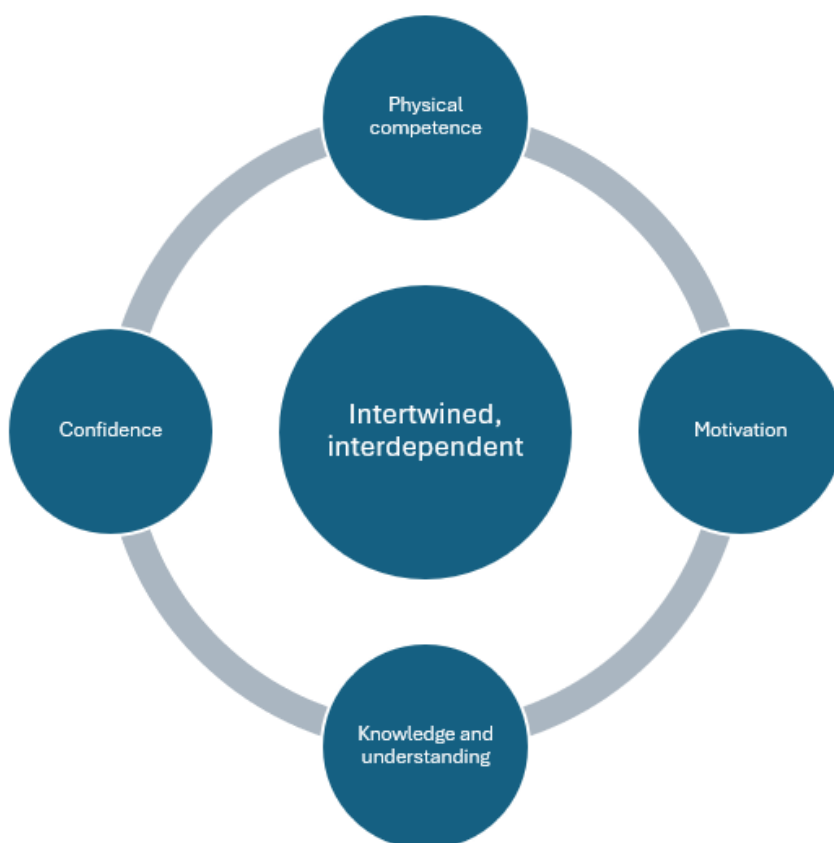


Figure 2 Aspects of Physical Literacy (Whitehead, 2010)

Kretchmar (2005; 2007) used the metaphor of water to describe the moving parts required for successful ongoing human movement, using water as subject matter because there are no discrete parts to moving. He states,

our subject matter is water, the ambiguous water of skilled movement. Locations upstream represent work on the origins of this phenomenon – the more microscopic, genetic, and chemical kinds of analyses that help us understand water. The deeper waters down by the bay symbolize whole person movement and cultural forms of physical activity (Kretchmar, 2007, p. 381).

Further, movements downstream are affected by aspects upstream and vice-versa. Existentialism as a philosophy informing Whitehead's (1990; 2001) concept of PL, is encapsulated in the idea that wherever student-teachers or pupils are placed, looking up and down stream whilst being immersed in the stream, are all considerations as they develop knowledge and understanding about their moving *through* moving (Whitehead and Sum, 2021). The genetic or chemical to which Kretchmar refers are physiological, biomechanical, intricate biological workings which are also important facets to moving, especially for understanding more advanced performance or competitive purposes. Merleau-Ponty's (2012) analogy with a river encapsulates Kretchmar's (2007) point also – that space and time are not linear. The flow experienced 'now' is always past-present-futures and "these nows, not being present to anyone, have no temporal character and could not succeed one another" (Merleau-Ponty, 2012, P. 435). There is no 'essence' of being but rather a sense of perpetual becoming (Rosenberg, 2019). This introduction of the idea of becoming, is relevant not only for PL and PE, but will also be explored later in this thesis (Chapter 8) in relation to how students are becoming teachers.

Existentialism is one of the philosophies (along with phenomenology and monism) that literature suggests presents challenges when 'translating' (in the everyday sense of that word) PL into practice and are often missing from discussion in policy and research (Edwards et al., 2017; Hyndman & Pill, 2018). My research adds to that by Durden-Myers (2020) which has shown how these philosophies can be accessible and 'translatable' thereby contributing to student/teacher understandings of PL. Some other understandings are presented next.

Multiple Interpretations of PL

Versions of PL are possibly most evident in recent education or sport policy documentation from around the anglophile world (SHAPE America, (n.d.); Sport Australia, 2019; Sport for Life Canada, 2023; Sport Wales, 2023; Carl et al., 2023b). However, an extensive literature review of PL in Global East cultures (including mainland China, Taiwan, and Hong Kong) shows emerging interpretations from non-English speaking countries where PL is being included in policy and practice (Li et al., 2022). Indeed, Li et al., (2022, p. 245) propose the following understanding of PL, situated in their geographical and cultural locales:

PL is the integration of physical, perceptual, cognitive, psychological, and behavioural capabilities, echoing with the need for an active, healthy, and fulfilling lifestyle, which involves continuous positive interactions with the environment and embodied engagement in physical activities for life.

This working understanding from non-western countries is remarkably similar to that of the IPLA (2017). However, Li et al. (2022) suggest that accounts of Confucianism, Buddhism and Taoism were important contributions to this and other (Sum and Whitehead, 2021) understandings of PL in different cultures and countries. For example, “Tao’s *xiuyang* philosophy for health and spiritual preservation” (Sum and Whitehead, 2021, p. 144) resembles PL’s lifelong and holistic approaches. Further research from areas around the globe (especially the African continent), with empirical and qualitative bases, is called for to address ongoing ‘blank spots’ in PL research (Carl et al., 2023b). There are also (mis/other) interpretations, as evidenced in some empirical research which has sought to find out how and if theory of PL is understood in specific contexts. These contexts include special educational needs (SEN) schools (Coates, 2011), where PL was described as physical competencies, reading the environment, and knowledge about being active for life. Explicit mention of social or affective aspects (such as motivation and confidence) was missing from Coates’ (2011) initial discussions. In Gavigan et al.’s (2023) intervention in primary schools in Ireland, the focus was on implementing fundamental movement skills. Not until the findings were shared

did Gavigan et al. (2023) note that aspects such as enjoyment and motivation were evident. Differences in how PL is being understood are not necessarily problematic, unless there is no evidence of the philosophical which informs the contemporary idea. Otherwise, it becomes another way of describing physical activity which does not heed warnings about ineffectual PE, for example.

The interpretation of PL which replicates reductionism such as was noted in the PE discussion above, has contributed to warrant for my research, although it is not my concern to unpack various policy claims about what is mean by PL, because during interpretation, events, activities or actors, are altered/altering. In the case of PL, recent reviews of literature suggest that there is a lack of definition clarity, and this makes PL difficult to operationalise (Edwards et al., 2017; Shearer et al., 2018). As noted by Baugh (1997) above, I suggest that this is not a concern, but that empirical work is making significant contributions to how primary teachers (Durden-Myers, 2020; Durden-Myers and Mackintosh, 2024) and student teachers (Uljas et al., 2022), can come to know how relevant aspects of PL might be beneficial (whatever that means) to pupil movement experiences. The struggle with definition and providing evidence-based empirical data is 'reverse engineering' PL (Jurbala, 2015) since PL is not fixed, and might look different in health, education, sport, family and probably all instantiations of it (Young et al., 2022; Bailey et al., 2023).

There are two senses in which multiple interpretations of PL are relevant here. First, education policy – just like any other document, interview transcript or image – can be interpreted by people in multiple ways. In this first sense, multiple (re)interpretations of contemporary PL are emerging as people 'make sense' of it in their own contexts (Robinson et al., 2018; Young et al., 2021; 2022). Moreover, authors and practitioners alter PL to 'fit' a certain context or expectation, thereby manifesting a more powerful policy, or institutional influence of a *certain* version of PL. Second, and relevant for the sociomaterial and posthuman sensibilities which I adopt in this research, is that heterogeneous actors (people and things)

work together to enact (co-create, perform) concepts or policy-practices, and human-nonhuman relations are acknowledged as ongoing, fluid (Hardman, 2019). Thus, creating a 'concept' of PL never ceases or rests on one meaning.

Rather than being concerned with definitions, a focus on “how movement does relationships” (Riley and Proctor, 2022, p. 1) might direct other thinking about PL. Multiplicity (Mol, 2002) is also further explored below, and in Chapter 8, as a way of seeing PL without compromising the philosophies with which it is entangled. In the sociomaterialist approach, PL is being ‘translated’ (in an ANT sense, Callon and Law, 1982; Latour, 1999a) *whilst* associations are being made. Translation becomes “a key metaphor for thinking about relations” (Felski, 2016, p. 751), connection or the processes working as heterogenous things co-create what might be(come) recognisable features of PL. Felski (2016, p. 752) makes the point that rather than ask whether policy has been translated or enacted in practice, it is a case of “gauging the uses and merits of specific translations – which involve losses and gains and misunderstandings, but also the possibility of new affinities and attunements.” More is said on the idea of translation in Chapters 3, 5 and 7.

To investigate the how trainee primary teachers might translate the concept of PL into primary PE teaching practices I repeat the three research questions, originally presented in Chapter 1:

1. What relations are in play in student PL-PE practices?
2. How is PL translated through sociomaterial practices?
3. What are the implications of sociomaterial and posthuman understandings of PL?

In the next chapter I outline my contribution to and critique of Whiteheadian (2010) PL by introducing Spinoza’s (2002) work on ‘ethology’ as a way of attending to relations among things in the world. Although monist, human embodiment is a focus in Whitehead’s philosophical position, whilst Spinoza accommodates the

material as well as the human in his perspective. I address sociomaterial and posthuman perspectives which helps defer privileging humans at the expense of nonhuman things (animate or not). Finally, in the next chapter I elucidate the idea of diffractive thinking, steeped in the work of Barad (2003, 2007), which has informed methodology and analyses in my work.

Chapter Three: Theory and Philosophical Foundations Informing the Research Approach

Here, I introduce key theoretical contributions which were informing the research approach. It is worth saying at the outset that theory and empirical data were entangled as it was my intention to show how these are not separable. Discussing theory in this chapter, and empirical data in the next is a heuristic device to help communicate the temporary detangled aspects of the research. Building on previous chapter introductions to the work of Spinoza (2002), and to theories of sociomaterialism, posthumanism and diffractive thinking, there is further discussion on how these contributed to the ontological, epistemological and ethical underpinning of my research approach. Combined, these theories are my original contribution to the field of PL, since they inform another way of understanding PL. Lines of thought from sociomaterialism and posthumanism are explored as each line can, arguably, be followed from Spinozist (2002) ideas of One Substance wherein Bodies (human-nonhuman) are connected and contribute to *conatus*, the ongoing desire to exist. Sociomaterialism helps to illuminate the connectedness of things, whilst posthumanism challenges anthropocentrism and human exceptionalism. Diffractive thinking is also in service to moving towards a non-linear perspective on space and time, wherein things/events are always immanent, again taking cue from Spinoza's One Substance ethology (Deleuze, 1988; l'Anson and Jasper, 2017; St. Pierre, 2019). The differences between diffractive thinking in methodology and analysis (Fox and Alldred, 2023) are also explored. It is clear that theories are not presented as linear, as somehow building one after the other, they are entangled throughout this research and ways of understanding PL/PL-PE.

The theories outlined above informed the ontological, epistemological, and axiological research philosophies entangled in my methodological approach. These philosophies are discussed, and I show how they challenged aspects of more conventional research paradigms, for example, by helping retain a sense of movement, dynamism and fluidity, of things "in the making" (St. Pierre, 2019, p. 6), chiming with PL. The ongoing aim of exploring methodology is to address calls for qualitative researchers to articulate their positionality, include methodological literature and contribute to different ways of doing research (Koro-Ljungberg et

al., 2013). I open with some reflections on my own positioning amongst things of this research.

Researcher entanglement

As education professional and as researcher I am 'already in the middle' (St. Pierre, 2019), and I consider myself always 'becoming'. To use the word 'becoming' is following St. Pierre (2013b) whose critique of ontology embraces a sense of immanence. St. Pierre (2013b, p. 652) prompted me to 'think' "the world differently", for example, by experimenting with how connections are creating possibilities. Connections mean that the singular 'I' does not make sense as things (including me) are already entangled, or perhaps 'I' am an 'assemblage' of things (Strom and Lupinacci, 2019). An 'assemblage' is a gathering of heterogeneous things, to the level of particles, and these are "connecting, disjoining and conjoining with one another" and "every assemblage of particles produces a different world" (Olkowski, 2011, p. 127). This is ongoing activity. Through this connectivity, 'I' does not disappear, but I becomes no less or no more important than other things (St. Pierre, 2013b). I am already immersed in worldly goings-on, as northern, white, European, female, mother, sister, privileged, of a certain societal time in Scotland. There are things which impacted a comfortable childhood, such as lots of playing in the countryside, eating garden produce grown by mum and grandad. This embedded an ongoing sense of respect for homegrown and homemade things, values instilled since childhood. 'Physical literacy' was not a phrase I heard whilst growing up but was very much enacted and entangled in my environment from birth to now, and ongoing.

In a sense, time as nonlinear is enlivened by this exposé of my own growing up. Each of Bennett's (2005, p. 445) aspects of what an 'assemblage' is, is exemplified in the "ad hoc" 'growing up' descriptions I can provide. For example, unequal power distribution becomes apparent where some actors (wall, strawberries, my brother and I) converged to create what Bennett (ibid.) calls "countercultures" (do not climb the wall to eat the strawberries destined for selling). Some of the

research choices and understandings developed along the present line of flight are diffracted through growing up with the land, food, play, parenting and family, as well as experiences as a teacher of PE, with an interest in philosophy of education.

In third year of the Bachelor of Education (B.Ed.) in PE, I was inspired by a lecture about knowledge and what it is. After a break, the lecturer returned to speak about knowledge and what it is. The first lecture was knowledge as propositional (know-that), and the second was knowledge through doing (know-how), and this blew me away whilst throwing me into a state of unrest (I thought I understood the first half well!). The inspiration led me years later to pursue a Master of Philosophy research degree (Patterson, 1997) investigating PE, epistemology and assessment. During this time, the phenomenology underpinning Whitehead's (1987) ideas about embodiment in PE helped challenge the dominance of theory over practice, of Cartesian mind-body hierarchy and how this affected assessment in Scottish PE. However, my current contribution, to include sociomaterial and posthuman influences, means a revised, renewed entanglement of lines.

I have been shifting from a "one-world" view (Law, 2011, p. 3) to thinking of realities as multiple, and that realities are not merely different perspectives of 'one thing' but as practisings (Gherardi, 2016). Practisings are contingent, dispersed, continually rearranging and yet they also develop clusters of activity which becomes recognisable (Bueger, 2014). Potential researcher bias including gendered, ethnic, political experiences that I have had of-in PL and PE practisings could be addressed because all of this is brought into the research assemblages (Crowther and Thomson, 2020). Ongoing reflexivity helped surface the effects of my influence on the research. Any preconscious 'fore-having' (Heidegger, 2010; 1927/1962 in Crowther and Thomson, 2020) or preconscious intentionality (Merleau-Ponty, 2012) linger with/through/in the research, rather than being 'bracketed' out, as in Husserl's phenomenological approach (Bednall, 2006; Crowther and Thomson, 2020). Bringing to the fore preconscious multi-layered understandings about PL and PE, whilst doing this research, made it possible to

open out research and researcher. Thinking of realities as being multiple invites different *becomings* (Mol; 2002; Law, 2011). I too, was-am becoming-with differently understood or re/per/formed PL. That there is ‘yet to be’ further understanding of PL-PE, is a way of thinking about the worldly connectivity among things human-nonhuman, ideas which I have generated after phenomenology. I outline this move with-from Whitehead and Merleau-Ponty, which offers a different way of thinking about PL-PE informed by Spinoza.

Moving from Phenomenology to a Spinozist-informed Physical Literacy

For Merleau-Ponty (2012, p. 214) the embodiment is complicit in forming relations among things as it seeks out, perceives, and is called to by a “vague beckoning”. How the embodiment is involved in perception, or pre-operative perception, is described as an inner happening. Although things seem not to possess conscious intent according to Merleau-Ponty, he does not understate the importance of nonhuman things. For Merleau-Ponty, human—thing inter-dependent relationships are intimate, as exemplified in his example of blind person-conjoined-with-cane (Merleau-Ponty, 2012, p. 430). Whitehead (1987, p. 66) describes this as a ‘dialectic’ between the ‘sensed’ and the ‘sentient’. Earlier in Chapter 2 this dialectic relationship was outlined as having a ‘gap’, between the thing being perceived or sensed, and the person doing the sensing. Perhaps, however, there is not an inert space, or void, but some-thing, because of the beckoning or callings of things. Some-thing(s) create(s) meaning which, of interest here, is entangled with moving human. In this view, things seem not to be waiting to be ‘sensed’, things are active agents in relations. For Merleau-Ponty (1968) this was the ‘flesh’ of the world. It is worth quoting at length here, although I return to this notion at future points in this research. The flesh is not analogous with human tissue but rather is how Merleau-Ponty (1968, p. 248) discusses human being—world relations, saying,

we are already *in* the being ... that we *are of it* ... That means that my body is made of the same flesh as the world (it is perceived), and moreover that

this flesh of my body is shared by the world, the world *reflects* it, encroaches upon it and it encroaches upon the world (the felt [*senti*] at the same time the culmination of subjectivity and the culmination of materiality), they are in a relation.

Here, although the ongoing 'dialogue with the world' may be foregrounded on human intentionality and perception, the 'in-between' or gap seems not to exist, and relations are more circulatory, ongoing. It is at this juncture that, for example, by inviting other things into the dialogic 'assemblage' (Law, 2004), human is decentred. Taking such a view of PL extends Whitehead's (1987, p. 24) perspective of the world which she sees "is an issue of the relationship between the perceiver and the perceived". In her view of PE and PL, this appears to be very much a relationship directed by the human actor.

As an educationalist, Whitehead (2007, p. 295) hopes that PL might go some way to putting the "individual back at the heart of the enterprise", rhetoric which is also prevalent in Scottish *Curriculum for Excellence* (CfE, Scottish Executive, 2004a) policy (Britton et al., 2019). The dualist ontology and epistemology confer importance on the human as knowing whilst other things are 'objects of knowledge', and by inference the latter things are passive. The passivity of things was, however, challenged by Whitehead (1987) when she described the phenomenological position that things 'beckon' and therefore, appear to be engaging in dialogue. Law (2004, p. 134) goes further than this, stating that "(E)verywhere is agency ... and since agency is everywhere, nothing is constructed and left to be. The universe is filled with activity", with multiple human-nonhuman dialogues. As an example, alongside humans and things like equipment in PL-PE (racquets, balls, nets), there are intangibles (Ingold, 2013) such as joy of effort, crafting a successful pass, developing spatial awareness (imagine 40 six-year-olds running around outside in Figure 1 with which I opened!). For these situated workings to manifest as recognisable PL-PE assemblages, the examples mentioned here bely "the agency of non-humans such as bodies, artefacts, and spaces" (Pellegrini and Parolin, 2021, p. 2), emotions and feelings.

On his critique of phenomenology, Harman (2009) similarly suggests, that seeking knowledge in the world from only human intentionality does not allow things agency – the world is bracketed out. Phenomenology's limit might be its concerns with the 'lived experiences', immediate and present concerns of individual participants (usually human) (Larkin et al., 2006; Lather and St. Pierre, 2013). From the humanist perspective, it also seems redundant to say 'lived' experiences since what other kinds are there! It could be posited that I am entangling Merleau-Ponty's (2012) phenomenological 'dialogues'-with-the-world with Latour's (2005) work on realism which removes human-only intentionality and sees the relations among things/actors as creating realities/events/activities/assemblages in non-abstracted ways (Harman, 2009). Finally, critics of phenomenology and Latour's realism – both of which seem concerned with the 'actual' rather than virtual – suggest thinking about past-present-futures (St. Pierre, 2013b). Thus, a constant motion of forces more akin, I would argue, to Spinoza's *conatus*, support the idea of *becoming* (St. Pierre, 2013b), the not yet, as things-human/nonhuman are constantly enrolling in activities such as creating PL assemblages. My fusion of Spinoza, Latour and Merleau-Ponty also presents a move away from representational philosophy (St. Pierre, 2013b) towards speculative, lively ontology (Bennett, 2010), wherein things human-nonhuman are dynamic, in perpetual creation of events and activities.

With specific reference to education settings, the fusion of Spinoza, Latour and Merleau-Ponty encourages a relational approach, and ways of knowing/becoming which move away from western, paternalist views of learning – including a *decentring* of the human (Mannion, 2019). This is not to reduce humans as rational and moral beings, apparently bound by "freedoms" which perhaps other living things do not have (Brinkmann, 2020, p. 12). Rather, it is to include nonhuman, for example, other animals, that from an animist perspective, also demonstrate empathy and care (Conty, 2022). Indeed, dogs as companions in classrooms and schools have been shown to effect calm due to chemical-hormonal responses in

the students, thereby enabling them to continue to be present (Grové et al., 2021). Although not immediately relevant to the direction of my investigation, it might be worth retaining a humble attitude towards other species, including plant life, because many of the things involved in PE lessons have traceable histories to other life (football leather, cricket bat wood, grassy playing surfaces, fruit trees for Indigenous games, rubber). In bringing other theorists and ideas into the humanist approach to PE, there is justification for instating an 'assemblage curriculum', or "'more-than-human' pedagogies" which account for sensory experiences (Lorimer, 2005 in Mannion, 2019, p. 5), the affective (Burkitt, 1999), which could begin from the perspective of the embodiment.

As was outlined in Chapter 2, embodiment is central to Whiteheadian (2001) PL, meaning that human-as-moving is "fundamentally inextricable from how the human being exists in the world" (Martínková, 2012, p. 174). To decentre the human, or demonstrate its embodied entanglement in/with/through the world, Dale and Latham (2015, p. 167) suggest that:

human and non-human materialities are inescapably and intimately connected, following the work of Karen Barad (2003, 2007). These entanglements are heterogeneous, interdependent, co-constitutive and dynamic.

In the current study, my significant contribution is to make explicit that which is not prevalent enough in Whitehead's account - that is, the nonhuman things with which actions and relational occur. A 'something else' (Massumi, 2002) entered my understanding of Whiteheadian (2010) PL and created another line of flight into posthumanist thinking. By challenging human centric and (in western thought traditions) binary interpretations of the world, I do so with Whitehead but in a different way, entangling Spinoza and including sociomaterial and posthuman sensibilities. The second contribution that I make is *how* to investigate (Koro-Ljungberg et al., 2013), in this case PL-PE practisings, in part by putting to work sociomaterialist, posthumanist ideas in diffractive methodology and diffractive

analysis (Barad, 2007; Fox and Alldred, 2021, 2023). First, I introduce Spinoza to PL.

Entangling Spinoza and PL

Reading Spinoza with education in mind means imagining the human as immersed as part of things in the world, or to paraphrase Spinoza (2002), ‘humans as part of nature’. As introduced in the Introduction of this doctoral work, Spinoza (2002, p. 252) suggested that “Bodies are distinguished from one another in respect of motion-and-rest, quickness and slowness, and not in respect of substance.” The quickness or slowness is a ratio, for Spinoza, and one which is kept balanced in pursuit of ‘health’ or “*hilaritas*” (ibid., p. 343). In speaking of bodies and minds, Spinoza (2002, p. 280) is not creating a binary, but rather that they are “one and the same thing” constantly seeking to “persist and be active in self-preservation”, or what he terms “*conatus*” (ibid., p. 283). Later, he adds that “... the conatus to preserve itself is nothing but the essence of a thing ... which, insofar as it exists as such, is conceived as having a force to persist in existing” (ibid., p. 334). Being of One Substance and desiring to exist, Spinoza’s monist perspective includes bodies acting from imagination as well as external things, all acting on one another, conjoining in creations of existence. Influences of Spinoza’s monism can be seen in the work of A. N. Whitehead (1938, pp. 29-30), for example, who expresses similar ideas, saying that

(t)he body is part of the external world, continuous with it. In fact, it is just as much part of nature as anything else there – a river, or a mountain, or a cloud. Also, if we are fussily exact, we cannot define where a body begins and where external nature ends.

The continuity, however, is not smooth but bodies are more or less restful or in motion, where adjustments of force affect liaison with other actors (Latour, 1993a). One can imagine a powerful river and adjustments of paddling action by the kayaker. The paddle—water—human—kayak relations are enacting successful movement down the river. Similarly, digital tools like ‘Fitbits’ and other wearable devices demonstrate ‘distributed embodiment’ (Lupton, 2018) where relations

among tools with human data prove difficult to separate also. In these examples, Bodies/things are entangled, and have fluidity, ideas which are being examined in relation with PL and this research.

For Spinoza, bodies are in dynamic relations, wherein mind-body do not pre-exist one another but remain imaginary, immanent, unless *affected* by one another, and this includes sentient and non-sentient things (Le Grange, 2018). Making sense of a situation relies on the ability to be affected and affect other bodies (meaning things and people) in a specific environment. Gatens and Lloyd (1999, p. 100) reflect on the prominence Spinoza gives to contingencies of space and time in the development of an individual's capabilities, saying,

(e)thology describes the various powers of being in relational terms by treating an individual as a fully integrated part of the context in which it lives and moves.

Here, bodies are of one 'plane' in constant motion, with differing affective capabilities in circulation (Deleuze, 1988). Bodies are not restricted to human flesh and as in the examples just shared, could include things like kayaks, books, aeroplanes, other humans, digital devices, plant cells, and so on. Making sense of a situation is a dynamic process relying on other bodies which together, create communities (Mulcahy, 2012) - such as pupils solving a movement problem. Thinking with Spinoza, different approaches to education might be provoked (I'Anson and Jasper, 2017; O'Donnell, 2018). For example, when experimenting how to send a shuttlecock across a net to land in between white lines whilst holding a long-handled racquet, humans are among finite, possibly vulnerable, bodies or things, continually (re)creating (re)connections and relations – the success or otherwise of sending the object reliant on particular connectivities. Assembling together might create badminton rallies, with success looking like continuous sending-receiving the shuttlecock across the net with a partner. All things (Spinoza's Bodies) contribute to the success or otherwise, of the movement challenge. Although the (human) affective domain is also prominent in

Whitehead's (2010) PL, Spinoza's work is connecting the material, nonhumans, as affective contributors to human experiences (l'Anson and Jasper, 2017).

A Spinoza-informed perspective for investigating the body and movement includes the emotions and imagination as active agents in making sense of the world. Like Whitehead (1987) and Merleau-Ponty (2012), Illundáin-Agurruza (2014, p. 45) refers to an

integrated body-mind: a conglomerate where physical, emotional, and intellectual facets blend ... that this embodiment is active. It is tethered to movement in that learning originates with bodily motion.

Motion, or motility, also underpins Spinoza's ethology through *conatus*, and his idea of "becoming-singular" (O'Donnell, 2018, p. 823). As fully immersed in the world, Spinoza's individual is becoming-singular if educational experiences are recognised as being collective connective relations amongst bodies. This is different from the phenomenological expressions of Merleau-Ponty, Whitehead and Illundáin-Agurruza because Spinoza's philosophy puts human-nonhuman in one plane where everything is immanent and possibilities are open.

Further, Spinoza's work includes an affirmative "ethics based on the transformation of negative into positive passions" (Braidotti, 2005, p. 19). This idea is relevant to health and wellbeing and PE in Scottish education since it is embedded in the pursuit of ongoing good health/*hilaritas*. For Spinoza, all bodies or forces are progressing, 'future-bound' in their becomings (Braidotti, 2005), including teacher, pupils, other things, artefacts, gestures, habits (Mulcahy, 2012). Experiences in PL-PE and PE in the affirmative sense, are towards wellbeing, not away from ill-health, as conceived by neo-liberal measuring outlined in Chapter 2. Although seeking positive affect and effects during PL-PE, there is a lasting effect/affect on bodies whether positive or negative, and all encounters with other bodies leave 'traces' on another body, again showing that becoming-singular requires collective relations (Zourabichvili, 2020). Traces remain even if bodies

move away from the actual encounter (Ingold, 2016). Walking through snow, for example, leaves visible footprints, and sounds or ideas of where the feet compressed the snow can be imagined and remembered even when the snow has melted (Lloyd, 2011). Taylor et al. (2016) suggest that human bodies experience a cumulative affect and gain historical knowledge through the sensational journeys they take. For Whitehead (M.E., 2010 and A.N., 1938), and Spinoza, these are embodied existential knowledges not solely epistemological because the experiences rely on affects and emotions relating among bodies (Gatens and Lloyd, 1999). Energy from affect also ‘travels’ through things so highlighting space and time as these are part of ongoing affective networks (Mulcahy, 2012, p. 11).

Indeed, Spinoza’s ethology suggests that bodies are acted upon and within, in multiple ways, and that one cannot “pre-order a given encounter” (I’Anson and Jasper, 2017, p. 68). This is significant for certain types of schooling where reliance on policy to inform and guide pedagogy seems to require, for example, *a priori* identification of Health and Wellbeing ‘Experiences and Outcomes’ (Scottish Government, 2009a). As a move away from measuring with normative benchmarks, a Spinozist-informed approach to PL-PE might incur an ipsative ‘charting of progress’, relevant according to pupil progress and subjective to everyone (Whitehead, 2010). Progress in physical activity may, therefore, be charted by ‘what-how-why’ things have been performed, *a posteriori* (Green et al., 2018) connecting pupils into movement futures.

Synaesthetically, as in amalgamating the visual, kinaesthetic, auditory, and olfactory senses, in reading the specific, meaningful details in the trace one leaves behind thus stands in contrast to the typical skill-building, exterior emphasis on movement taught within the physical education context (Lloyd, 2011, p. 85).

Thinking with Spinoza (2002) provides warrant for challenging some teacher/policy perceptions of PL-PE by encouraging (re)turning, noticing, how relations with heterogeneous things usurp human as central. Spinoza’s notion of *conatus* and his ethological relationality, where individuals are already entangled

in animated enmeshed worlds provide theory for 'Extension' (Spinoza, 2002) of Whiteheadian (2010) PL-PE. Emerging physical activity experiences is not an individual human affair, it is always already multiple bodies entangled in conjoined activities.

Sociomaterialism

As stated in the introduction I have been influenced by Spinoza (2002) and have enlisted two theoretical positions in which traces of Spinozist thought are evident. Sociomaterialism and posthumanism have informed both my reading of PL and *how* I conducted the research. Spinoza's *conatus* as perpetual desire to exist and the monist view that all Bodies are part of One Substance were particularly relevant for this study. My research acknowledged human and nonhuman things – a social and material "fusion" (Orlikowski and Scott, 2008, p. 456). Anthropocentrism and human exceptionalism are challenged, and the theories informed methodological and analytical approaches to my research.

The sociomaterialist turn has been referred to as materialism, new(neo) materialism (Fox and Alldred, 2017), material feminism (Alaimo and Hekman, 2008), digital materialism (Adams and Thompson, 2016), actor-network theory (ANT, Callon, 1986; Latour, 1999), cultural historical activity theory (CHAT, Fenwick et al., 2011), and "critical Spinozist materialism" (Braidotti, 2023, p. 98). As an umbrella term, sociomaterialism draws attention to "as many actors as feasible" in the research environment in its complexity (Felski, 2016, p. 749). The researcher sensibility is to attune to the particular, to attempt to bring to light things not usually 'seen', perhaps ordinarily invisible (Adams and Thompson, 2016). As discussed above, sociomaterialists present human and nonhuman actors in the same ontological plane. The idea of making things-humans equivalent is present in the sociomaterialist, ANT, notion of 'symmetry' and refers not to the epistemological concerns with knowledge and where knowledge is produced, but rather with the ontological (Callon, 1986). I adopt this positioning as it 'erodes' "ontological distinctions", removing hierarchy of human 'above' other things and

sees different 'kinds of actors' creating stable (or not) events, documents and institutions (Law, 2007, p. 8). 'Flattening' ontology like this does not mean that differences among things are not acknowledged – such as between human, car, tennis ball, rabbit (Bennett, 2010). Rather, it is to remove hierarchy, which in turn suggests ecological openness (Braidotti, 2023). This resonates with a Spinozist (2002) perspective of monism, wherein One Substance world seeks ongoing existing (Gatens and Lloyd, 1999). However, translating different ontological actors is a precarious endeavour because “humans are always in composition with nonhumanity, never outside of a sticky web of connections” (Bennett, 2004, p. 365). Where assemblages might be stable or leaking, or breaking down, forms the nexus of my interest in how-where PL might be enacting (I refer to the section on language in the Introduction, where my occasional 'verbing' of enact infuses it with a sense of immanence, without enacting something else). Finding stability to investigate PL-PE in amongst many moving feasts was one of the aims and doing this investigating 'on the move' so to speak involved embracing the messiness.

How did I investigate what I call a complex 'meshwork' (Ingold, 2006a)? Law's (1992, p. 380) advice is to lay aside assumptions, start with “a clean slate. For instance ... interaction”. Law's proposition is to investigate the power of relations holding, in this case, PL-PE stable, without focusing on 'a' or 'the' definition of PL, for example (IPLA, 2017). For this kind of inquiry, there also occurs a 'diversifying' (Law, 1992) of actors involved in creating or destabilising a situation, lesson, event, policy. The concern is not with who or what is most powerful but with *how* some kind of ordering comes about when human and nonhuman things have certain effects/affects on one another - how they are in relations (Callon, 1986, 1999; Latour, 2005). Fundamentally, this is dynamic ongoing doings and not a set of fixed end products. For example, *Benchmarks PE* (Education Scotland, 2014) is a policy document held together by many actors: Education Scotland webpages—PE teachers—pupils moving—General Teaching Council of Scotland—thinking skills. (Re)moving actors will have an effect/affect on the network of where-how the policy is being performed (Bodén et al., 2019) and so my interest in PL is wider than seeking to provide a clear definition. I was interested in how actors related,

how connections were held together or not, how actors communicated and whether ‘translations’ stabilised instances of PL-PE. Sociomaterialism provided ways of investigating how actors make and unmake and remake ‘fields’- that is,

what actors achieve by scaling, spacing, and contextualising each other ...
“Breaking with the “macro” versus “micro” divide, ANT sensibilities recognise that not only the researcher engages in “scale-making.” Actors themselves invest and struggle to create the “contexts” in which they act (Blok, 2010) (in Baiocchi et al., 2013, p. 337).

However, this does not nor cannot mean including all actors. Methodologically, my research “draws attention to practice, that is, what people do with things” – or what things and people do together – and so “must discern how best to observe and analyse this interactivity without diminishing the nature of the thing or the activity” (Michael and Munday, 2014, p. 145). In PL-PE, negotiations among human and nonhuman are inherent, such as environmental factors like the terrain, things thrown, caught, balanced on, or moved around.

In seeking to find out who or what is enacting in PL-PE, it is important to recognise that “neither humans nor matter pre-exist their relations” (Bodén et al., 2019, p. 3) and so negotiations among things are already ongoing. The relevance of these relations became a feature of my research as things ‘pushed back’ (Latour, 1992) influencing and informing ongoing negotiations with humans and other things. Things work in a relational interdependence fundamental to the pedagogy of PE and PL-PE. Thus, my research approach in this investigation brought together the ontological and epistemological – being and knowing – into Barad’s (2007; 2012) neologism ‘onto-epistemology’. In this way, I am trying not to foreground myself or humans as the starting point. Neither have I chosen a ‘lens’ through which to observe the empirical and give focus to theoretical data. From the outset I have let the ontoepistemological happenings become sensible (materialise) during my investigations. Indeed, Barad (2012, p. 19) argues that “ontology is the “theorizing of what is” by materializing things in a certain way”, and so PL-PE is not fixed but emerges as actors enact certain practisings. As such, policies, definitions, teaching

practices are challenged as ontologically pre-existing their relations. Barad (2007, p. 185, *italics original*) captures the importance of how researcher, the ‘apparatus’, or any matter in the world are already entangled, through another neologism “*ethico-onto-epistem-ology*” which is inclusive of possible effects and affects of all actor relations. These ideas are discussed next and returned to in analysis—discussion chapters.

There are key ideas within sociomaterialist approaches to the world. I introduce these here with the caveat that terms/ideas/phrases/concepts/language are entangled throughout the remainder of the doctoral thesis. ANT’s ontology of ‘flattening’ the social world (Latour, 1999a; 2005; Law, 2004), where human-nonhuman are in symmetry, was introduced above. Symmetry challenges anthropocentrism and representationalism by seeking connectivity, ‘associations’ (Latour, 2005), ‘collectives’ (Bryant, 2011), among things human and nonhuman. Such a perspective is not yet apparent in PL literature (Hyndman and Pill, 2018) which is dominated philosophically, by phenomenology. Indeed, Latour (1999) asserts that phenomenology is founded on human intentionality only, whilst science deals with the rest of things in the world, thus seeming to reinforce the dualism of human-nature. Hence flattening the ontological hierarchy and seeking connections among things human-nonhuman, in one plane, is a way of making visible how PL-PE is being enacted (or not). One criticism of investigating the world by claiming symmetry between human-nonhuman is that human subjectivity is too reduced (Braidotti, 2019). However, since my research was with students becoming teachers, their subjectivity came alongside the important ethical and political roles that nonhumans play in human-nonhuman encounters (Braidotti, 2019). There is further discussion and critique of sociomaterialism as research sensibility in Chapter 6 where I present theory—data working together. Key terms associated with sociomaterialism have been introduced in this chapter (such as ‘assemblage’ and ‘symmetry’) and these and others are discussed when applied in following chapters.

Posthumanism

Posthuman thinking has lines which come from Spinoza's (2002) idea of *conatus* which inherently means humans and nonhumans are 'One Substance' "immanent to itself" (Braidotti, 2019, p. 34), (re)creating self-with-other. Posthuman is not a lineage from human, as 'descended' from humans, or as an evolving version of human, thereby being no longer human (Braidotti, 2013a; Holm, 2016). Difficulties in conceptualising what is meant by posthuman are perpetuated when attempting to define the term (Thompson and Adams, 2020). Indeed, evaluations of posthuman are not possible since inherently, posthumanism is an immanent status, bringing pasts and futures in the entangled presents (Davies, 2018). This section builds on the Introduction chapter where posthumanism was discussed as being theoretical and methodological actor.

Human activities are sometimes associated with negativity – such as industrial, productive, and consumerist goings-on, actions towards other species, and ecological degradation (Haraway, 1992; Ulmer, 2017a). Within the category of human, multiple oppressions and exclusions of peoples, animals and things have emerged, hence the many lines of thought composing *posthumanist* thinking, such as "anti-humanism, new materialism, Indigenous epistemologies, anti-anthropocentrism, science and technology studies (STS), and more" (Strom and Lupinacci, 2019, p. 113). Posthumanism seeks to overcome or challenge binaries which are often exclusive – for example, pupils with ready access to technologies and some not. Posthumanism provides spaces in which to disrupt power relations, such as showing hierarchies in education where teachers implement curriculum-related tests even if those teachers disagree with the testing. In addition to posthumanism as theoretical approach in research, it is also in relation with methodology. Ulmer (2017a, p. 834) suggests that:

posthumanism thus argues that because we are always already interconnected with our environments, methodological thinking should respond in kind by fostering similar interconnections.

As a theoretical contributor and as connecting with methodological positioning and practices, posthumanism becomes multiple because it embraces outcomes of the research and offers ways of accounting for the “the involvement of researcher” (Thompson and Adams, 2020, p. 338). There are then, ethical components entangled in posthuman research (Ulmer, 2017a). The ethical importance of relationalities among people, plants, water, air, rocks and so on, provides an augmented way of doing research, and why I adopt Braidotti’s (2013) Spinozist ecological, critical posthuman approach. PL research has opened other ways of designing and developing PE, but by being critically involved – including critiquing how the human retains a significant role in PL – posthumanism provides opportunities to think differently about PL-PE. For example, as noted in Chapters 1 and 2, recent reviews of literature (Edwards et al., 2017; Shearer et al., 2018; Pushkarenko et al., 2021) show that research into PL has tended to focus on defining PL. Primary PE has been largely overlooked, and students becoming teachers through a PL approach to PE is similarly scarce. In this landscape, therefore, a posthumanist approach was unique because it involved social and material, human-nonhuman. Further, in the *doings* of posthuman research, I moved beyond field notes and transcripts (Koro-Ljungberg et al., 2018) to include other sensory components – such as sound, kinaesthetic feedback, somatic experiences, both during empirical data collection and analyses. There is more on this in Chapters 4 and 5.

Posthumanist inquiry (Ulmer, 2017a) resonates with how I investigated PL, as well as how I followed what were “complex choreographies of knowledge practices” (Adams and Thompson, 2016, p. 110). Sociomaterialism includes recognising how multiple actors work to co-create events, or not (Nail, 2017). Both these approaches became ways of investigating whether, how and why PL-PE was enacting, as well as developing *how* to do these investigations. For example, the flow of actors in a network-assemblage (Latour, 2005) may be from many spaces and not always visible, such as Scottish curriculum policy or university PE lecture content. Such policy or lecture materials retain anthropocentrism in as much as humans were involved in the creation—writing of them, and they represent

privileged types of knowledge (Taylor and Fairchild, 2020). Thus, it is relevant and important to include both human and nonhuman actors in this research inquiry. Latour (2014, p. 100) noted that,

(A) nonanthropomorphic character is a character all the same. It has agency. It moves. It undergoes trials. It elicits reactions. It becomes describable... and ... the human character is just as open to inquiry, to shape changing, as that of a nonhuman.

Where texts such as education policy might provide clarity or guidance, a challenge to the dominance of text – a kind of ‘view from somewhere’ (Haraway, 1988) – is afforded by the posthumanist approach (Geerts and Carstens, 2019). The posthuman approach invited a way of investigating PL-PE holistically, by including things as a way of getting outside “anthropocentric, humanist ontologies” (Thompson and Adams, 2020, p. 338). Further, aligning with a sense of immanence, I sought not to rely solely on text to ‘re-present’ ideas and data, with the motive to engage the importance of movement. For example, visualisations become “descriptive objects in their own right” (Decuyper and Simons, 2016, p. 378). The diagrammatic is way of bringing word and image to play in an ‘active’ way of *presenting* the relational (ibid.). That is why I opened this doctoral work with the diagram of my research-walking, it shows the posthuman in action. The posthuman diagram brings multiple spaces and times together into one artefact. As I noted in the opening paragraph of this doctoral work, most people can remember playing outside at primary/elementary school and so memories are entangled in how you are reading about PE and PL just now. Other examples of embracing sensations of movement include a walking interview, where sound and wind were affective data. I embodied analysis through movement and so tried to reduce the haunting of qualitative data that positivist desires for reliability and validity press upon researchers, to show data as moving and immanent (Koro-Ljungberg et al., 2018). The somatic exercise described in Chapter 5 enacts the entanglement of theory—affect—data—researcher—analysis.

To further challenge the anthropocentric associations of the word 'data' with research (St. Pierre, 2013a; Standish, 2016), the ways in which I have researched *with* student-participants as well as theory/literature have broadened/augmented/distributed text, transcripts, and observations. I also (re)considered the word 'data' and I use other terms, like 'information', but have not discarded the term data because the positivist epistemology associated with 'data' can be undone by doing research which demonstrates the multiple understandings in the world and types of 'data' from the world (St. Pierre, 1997; Koro-Ljungberg et al., 2018). It is important to note also, that since my interest is in the relational, and in posthuman research ethics applies to things also, the ethical is implicated throughout (Todd, 2003; Standish, 2016). Hence the relevance of discussion and consideration of posthumanism as theory and as contributor to the methodological approach. I return to posthumanist theory in Chapter 6. Next, I outline a further conceptual informant, diffraction (Barad, 2007), which is woven into theoretical, methodological, and analytic approaches.

Diffraction Thinking

Diffraction is a methodological and analytical way of challenging linear understandings and re-presentation of the world in research (Barad, 2007). The idea of diffraction might be traced back to Spinoza's ethology as discussed earlier, wherein a One Substance ontology includes things human-nonhuman, perpetually acting in/with/through the world (*conatus*). Spinoza's account of 'time' becomes relevant as he suggested that imagination can move time around (you could return to school playgrounds for example) – so PL is enacting here, there, and over there. Time is not linear, it is how humans imagine diffracted aspects of existence to be "part of the very fabric of our experience of particular things" (Gatens and Lloyds, 1999, p. 30). Diffractive methodology and analysis are moves away from linearity towards immanence. Posthumanist and relational research approaches share a 'speculative onto-story' (Bennett, 2010), making it possible for researchers to consider "where the *effects* of difference appear" (Haraway, 1992, p. 300, italics original). Haraway's (1992, p. 322) work on ways of "considering the relations of difference among people and among humans, other organisms, and machines"

used terms like “promising monsters” or ‘cyborgs’ to embroil human-culture-nature-politics ontologically and show diffracted notions of human. The feminist critical materialism from which Haraway’s ideas emerge are developed by Barad’s (2007) understanding of diffraction.

Barad (2007) developed poststructuralist ideas of Haraway and Foucault with her interpretation of physicist Niels Bohr’s experiments to show how particles flow through slit/no slit apparatus, designed during the early 20th century. The particles travelled through the slit in unpredicted ways, passing linearly as well as in wave-like patterns. Ordinarily, the travelling direction of particles was presumed linear, but through this experiment, physics showed that some can diffract without the linear direction – into shadowed areas, going round obstacles. These happenings led Barad to conceive differences in the way matter engages in ever-changing entanglements of the world, and the inextricable involvement of the researcher in the experiment or ‘performances’ (Barad, 2014). The importance of the origins of diffraction are that Bohr then Barad introduced the idea of ‘phenomena’ (Barad, 1996) – where instances of things coming together perform that ‘thing’ into existence. This is in contrast to things pre-existing, objectively, out there, externally, waiting to be ‘discovered’ by researchers (Lenz Taguchi and Palmer, 2013). Criticism of this leap from physics to social research include Barad’s acceptance that Bohr’s experiment did not involve as yet unknown variables (Fox and Alldred, 2021). However, strengths of diffraction include challenges to reflection (Barad, 2011), to critique of representationalism (Somerville, 2016) and to the reproduction of ‘sameness’ in research since diffraction offers researchers ways of making parts of entanglements explicit. In practice, this means examining research assemblages or events in many ways, diffracting readings through other information or data, some of which might not be visible. In education, things like policy texts, researcher experience, pupil movements, theories, observed behaviours and so on, can be brought into the fold with diffractive thinking (Fox and Alldred, 2023). How this differs from multiple methods is that spacetimes, histories, politics, multiple theories are interwoven, not ‘applied’ and represented as *fait accompli*. Things remain (a)live(ly).

Diffraction has been incorporated most recently into research which has (re)turned to 'matter' (Fox and Alldred, 2021). In educational research, this includes new feminist material thinking (Lenz Taguchi and Palmer, 2013; Alaimo and Hekman, 2015) and feminist accounts of physical activity (Markula, 2023), hence the relevance of sociomaterialist and posthumanist approaches foregrounded in my investigation of PL-PE.

I employed both diffractive methodology and diffractive analysis to respond to critique that research has tended to be focused on the analysis phase, thereby ignoring diffracting methodological practices (Fox and Alldred, 2021). My enactings of research design in posthuman, sociomaterialist and diffractive ways, applying an understanding of Spinoza's (2002) monism and dynamic *conatus* with PL, show how diffractive methodology has been incorporated from the start of my research. I would argue that I am providing an example of diffractive methodology because design has been dynamic and multiple – through different practisings such as a somatic toolkit (explored in Chapter 5). I have been reading things through understandings of PL, philosophical writings, theories, my experiences as teacher, and affects. I have been diffracting research approaches through theories, insights from data, and other discourses-materialities. In short, everything in the 'research assemblage' with accompanying intentionality (whether human or nonhuman) is included (Fox and Alldred, 2021; Markula, 2023). After all, whilst investigating PL-PE I am also developing *how* to do, and how I have done this, thereby being open and transparent about my part in the research. As ethicoontoepistemologically entangled in the research, my responsibilities were to acknowledge effects/affects of diffractions on the research—theory—data. This included emotions alongside theory—data as an 'affirming' methodology (Bozalek and Zembylas, 2017). For example, the effects/affects on my relations with PL were always changing because 'I' was also affected by and during the research (Michael and Munday, 2014). Further, this is an example of how diffraction differs from reflection, where the latter assumes an

'I' (researcher) separated from material and matter (Lenz Taguchi, 2010; 2013). As above, in the section 'researcher entanglements', 'I' am already in the research and not separate.

In both diffractive methodology and analysis, researcher positioning is entangled and rather than be criticised for placing perspective into the entanglement, it is to be lauded that diffractive methodology fosters transparency. The PL-PE research assemblage could be read if diffracting observations with policy and my understandings of PL – but it is the differences that are highlighted when storying with diffraction, where multiple accounts can be held at the same time (Law, 2004). Diffractive theorising does not (re)produce sameness but embraces difference by refusing to reduce data to codes or themes which hides some data (Taylor and Gannon, 2018; Kuntz, 2020). Ethically, diffraction encompasses the mess of sociomaterial assemblages and so does not 'normalise' or drown out difference.

Enacting Diffractive Thinking

There are three ways in which the idea of diffraction was-is-will be relevant in this research. First, methodologically, diffractive approaches embrace how empirical, experiential, and theoretical data enact this investigation. In Chapter 4 it will become clearer how matter that is not always 'seen' in the shadowy places informing a research event or assemblage is being diffracted and so, in part, can be surfaced. Second, diffractive analysis will be further discussed in Chapter 5 but it remains important to note that being with the entanglements of research, researcher, research data, theory, participants, things, the researched, meant diffracting rather than reflecting these things, to reduce (re)producing 'sameness' (Haraway, 1992; Ulmer, 2016). Thus, the strategy for analysis included flows of information from multiple sources and times, diffraction in practice. Diffraction as analytic approach is another way of 'attuning' to data-theory (Fox and Alldred, 2021). Third, Fox and Alldred (2023) call for research which applies diffractive approaches whilst being mindful of how social science research addresses policy

and practice productively. Some recommendations provided in the concluding chapter (9) are presented and deemed to be productive for how to do research as well as understanding PL-PE, education, and wider practices.

Returning to the first approach mentioned above, diffractive methodology provides a way of attending to “specific material entanglements” for learning about phenomena in the world (Barad, 2007, p. 88). Drawing on the work of Haraway, Barad (2010, p. 254) urged me to think about PL being in multiple spaces and times at once (spacetimes). Temporality is disrupted because data—theory were intertwined with conversations from the past, and the not-yet. PL is diffracting through, for example, British army officer Walter Strickland (1940) who used the term in a report about Indigenous dance experiences, and through concerns with “physical illiteracy” in post-war population (MacIntosh in Dixon et al., 1957, p. 205), through Whitehead’s (2001; 2010) justification of her use of the word ‘literacy’, diffracting also through UNESCO (2015), and through Durden-Myers et al. (2022). PL’s “heterogeneous history(ies)” (Haraway, 1997, p. 273) have been, are and will be across spacetimes, “threaded through one another” (Barad, 2010, p. 254). The example of diffractions here shows multiple lines/threads, the non-linearity of spacetimes, and ‘knots’ (Ingold, 2013) where actors have assembled to stabilise PL or indeed, physical illiteracy. These stabilised events or assemblages are always temporary but in some spacetimes adhere enough to fix PL, such as the IPLA (2017) definition which pervades recent research literature. The idea of PL as multiple is revisited and expanded in Chapter 8. The next part of this chapter presents the philosophical foundations of the methodological approach.

Philosophical foundations of the methodological approach

In this section, the logics presented by theoretical influences expressed above are put to work in a methodological sense. I discuss my ontological-epistemological positioning and explore how this effected/affected what was methodological, but with analysis always in mind. That is, I was doing theory—data—analyses to

encapsulate the entanglements of all aspects of research. Spinoza, posthumanism, sociomaterialism and diffractive approaches are woven through the (almost) postqualitative inquiry which I now introduce. The following chapter then provides detail on *how* theory—data—analyses were enacting my ‘methodological meshwork’ (Bartle, 2023).

Rather than declare an either/or constructivist/realist research perspective (Latour, 1999), it will have become clear that a different way of investigating PL/PL-PE was required. Constructivist ideas rely on a twofold reality – a metaphysics wherein discourse, language in particular, re-presents a pre-existing reality (Barad, 2003; Hollins et al., 2017). In chapter two, discussion on embodiment in PL and PE, where ‘I move’ precedes how humans are animate (Sheets-Johnstone, 2015; Conty, 2022), I introduced my ontological perspective that realities are ever becoming, enacting, performing, multiple (Mol, 1999, 2002; Michael, 2017). Hence there is an important shift to an ontological-epistemological-axiological entanglement as better description of worldly doings. Extending ideas from phenomenology to include sociomaterialism and posthumanism becomes possible because although at first the ontological starting points of each might appear to be different (Adams and Thompson, 2016), the argument that there are multiple already ongoing worldly doings removes such perceived barriers. In denying a dualist perspective on reality, I would describe my investigation of PL-PE practisings as “understanding thinking, observing, and theorizing as practices of engagement with, and as part of, the world in which we have our being” (Barad, 2007, p. 133). Ontology is already part of the ongoing world (Barad and Gandorfer, 2021). For instance, there is no separate referent for a pupil doing physical activity. PL entails ‘thinking-doing-connecting-feeling’ (Sport England, 2023), through ‘functional’ to ‘flowing’ movements (Lloyd, 2016), *all at once*, and researching PL foregrounded dynamic, fluid ways of inquiring.

The ontological and epistemological are travelling companions, so overcoming binaries commonplace to many research processes, such as data collection before

analysis. A series of philosophical and empirical stances which inform conventional qualitative studies have been challenged. St. Pierre (2019) for instance, suggests that logical empiricism and phenomenology attempt to identify epistemic objects. This is at considerable variance with the approach taken here, which is concerned with investigating the entanglements of relations which may or may not be enacting PL-PE. Different interpretations of my investigations will occur throughout and after the doctoral thesis has been created, and a plurality of interpretations is expected (Crowther and Thomson, 2020). Moreover, onto-epistemological entwining of things, participants, me, shows the 'already immersed' 'field' of research where ideas of same/other, inside/outside (St. Pierre, 2017) do not make sense. The idea of "thinking without method" (Jackson, 2017, p. 666) provided a perspective to investigate relational spaces as events were occurring in the already dynamic area of PE and PL-PE. I think this helped avoid the in/outside binary because I had an awareness of how events were unfolding, being enacted, becoming.

Any search for an all-knowing objective 'truth', what Haraway (1988, p. 584) called the 'god trick', would have been futile, which is why 'becoming' as a verb, a doing word, reflects the always-partial business of trying to understand the practices of students becoming teachers. As Haraway (1988, p. 586) said,

the knowing self is partial in all its guises, never finished, whole, simply there and original; it is always constructed and stitched together imperfectly, and therefore able to join with another, to see together without claiming to be another.

To avoid closing off or generalising, I sought to understand how PL was being 'stitched together' during the "messy practices of relationality and materiality of the world" (Law, 2007, p. 2). Teaching and learning are messy activities, which positivist research approaches may seek to measure and quantify. Deemed not appropriate for my own research, quantitative approaches arguably 'oversimplify' and are not particularly helpful in exploring "complex and unpredictable" assemblages (Luke, 2022, p. 1012). The positivist's search for 'truth' involves

removing extraneous influences to control the variables of interest and their effect one on the other (or not). In such control, the nuances of how things (human-nonhuman) are relating (or not) are removed, sterilised, the messiness is cleaned up (Mercieca, 2011).

Ontology as becoming rather than 'being' is a challenge to the idea entailed in the latter, a fixed-ness. Things are already imbued with 'intra-activity' (Barad, 2007) and are becoming or "coming-into-being" ontologically (Joronen and Häkli, 2017, p. 564). Joronen and Häkli (2017) argue for the term 'being' but base this on the way in which 'events' are already ontologically creating. Rather than a way of 'answering' questions about realit(ies), ontology is an openness, a questioning of how events are being enacted. Indigenous work has also referred to the idea wherein "(C)o-becoming is ... ontology within which everything exists in a state of emergence and relationality" (Bawaka Country et al., 2016). 'Everything' has always referred to human and nonhuman in Indigenous living, and so the posthuman and sociomaterial discussions in my work are acknowledged as not new. As explored in this chapter, ontology is entangled with epistemological concerns and axiological foundations, as I have followed already emerging meshworks wherein PL-PE may be enacting. Therefore, use of the phrase *becoming teachers* should not be viewed as only pertaining to human activities. Shifting from PL singular to PL multiple has meant that ontology is not a foundational, fixed perspective on 'reality' but an openness to how multiple PLs have been enacting – or not – through emerging relations.

A postqualitative attitude towards researching, rather than focusing on product, exemplifies a "process ontology" (Ulmer, 2017a, p. 837). With ontology and epistemology entwined, there is a move beyond "standardized methods (which) do little more than provide a false sense of security that knowledge is stable, or even knowable" (ibid., p. 838). For example, in Chapter 2 I introduced the definition of PL (IPLA, 2017), and this might be a thing which is partial, and 'has an opinion' (Adams and Thompson, 2016). For sociomaterialists, a definition might

also be an assemblage and so a definition of PL would be an assemblage of heterogeneous actors, none of whom is acting alone (Law, 2004; Nail, 2017; Oosterhoff et al., 2023). Importantly, assemblages are where “things create people as much as people create things” (O’Donnell, 2018, p. 825). If things are always in ‘processes’ (not ‘a process’), this reinforces the point that events or assemblages are fluid, dynamic and are therefore, always immanent (Nail, 2017; Alirezabeigi et al., 2020). As outlined in the theoretical explorations earlier in this chapter, a sense of immanence challenges representationalism.

(Re)presentation and Performativity

To resist reproducing ‘sameness’, reduction or categorisation, ontology and epistemology are informed here, by poststructural ideas which challenge representationalism (Barad, 2003). Sociomaterialism and posthumanism might reject poststructuralism and social constructivism because in the latter two, mind is placed above body, discourse remains privileged (MacLure, 2013a; Koro-Ljungberg et al., 2018). Even with the challenge to institutional power, humanism seems to pervade poststructuralist thinking, with discourse at the heart of constructions of the body, for example (Barad, 2003). To be non-representational is to move beyond what Barad (2003; 2007) refers to as the ‘epistemological mirror’ of research, which seeks to provide a clear representation of the social context, whilst not providing more than is seen. Sociomaterialism and posthumanism invite practices, relations, associations, affects, resonances, and actions that together challenge representational research. Thus, multiple ontologies make sense, yet this does not equate to subjectivism in a relativist way (Somerville, 2016). My perspective on ontology and epistemology is that neither precedes the other, and that knowledges are *being enacted*, are *in the making*, and are dynamic. There remains some contradiction since the idea of reducing the power of text is juxtaposed with aspects of thesis writing, such as reviewing literature, written by humans (Law, 2004; Taylor and Fairchild, 2020). There is no denying the need for understanding and stabilising how humans communicate, and live, and so language is not the key issue (MacLure, 2013a). To account for

linguistic and material mechanisms in how research is most often presented (written text), I viewed these as entangled in a flat, non-hierarchical ontology to lessen or avoid the 'standing over/for the world' (MacLure, 2013a) often attributed to words alone. Thus, other ways of investigating how PL may be enacting in PE, became part of the experimentation during my research, ways that worked alongside words, and although quite difficult there are instances where this has been achieved. These will be explained at relevant places throughout the following chapters.

As a way of challenging the power of words to represent things in a pre-existing reality somewhere, Barad (2003, p. 802) summarises a performative approach, saying that,

(t)he move toward performative alternatives to representationalism shifts the focus from questions of correspondence between descriptions and reality (e.g., do they mirror nature or culture?) to matters of practices/doings/actions.

However, differences between enact and perform surfaced as I explored what these terms meant. 'Performing' suggests that there exists a backstage where 'real' or abstract things are, whilst a version of this is 'performed' (Michael, 2017, p. 121) for an audience of some kind. 'Enacting' seems to ally more with the idea of a thing always becoming with nothing hidden in the background. Law (2004, p. 56) states,

(E)nactment and practice never stop, and realities depend upon their continued crafting – perhaps by people, but more often (as Latour and Woolgar imply) in a combination of people, techniques, texts, architectural arrangements, and natural phenomena (which are themselves being enacted and re-enacted).

I tend to prefer terms 'enact, enacting, enactment, enacted' throughout this doctoral work. As a note, at times, I refer to a physical activity 'performer' – for instance juxtaposed with a 'supporter' of a handstand or similar. I see no

‘backstage’, Forms of knowledge (Plato, 1974), where ideal or “real reality is hiding” (Mol, 2002, p. 32). Thus, assemblages are presented in text here, and the text has sought to hold the heterogeneous actor-networks as they occurred/were occurring. The doctoral text is, therefore, a brief snapshot since things have not necessarily stopped enacting (here, and as expressed in the Introduction, I am ‘verbing’ the term to avoid providing closure – as might be read in ‘enacting a forward roll’). There is ongoing dynamic connectivity, relations are always playing, as I have tried to convey throughout doing this research.

Connections/relations among things human and nonhuman are the focal point of sociomaterial sensibilities, and by moving from child-centred education (anthropocentric perspective) to more-than- or post-human, world-centred education (Biesta, 2022), different knowledges and lines of thinking may become possible (Pennycook, 2018). I developed methodological ways in which to embrace the messiness of research practisings where I experimented and improvised, enacting an (almost) postqualitative inquiry (St. Pierre, 2021). To challenge the grip of positivist and post-positivist research structures by eschewing *a priori* methodological ideas (Lather and St. Pierre, 2013; St. Pierre, 2019) was, however, deemed not possible. Rather, I have shown how sociomaterial, posthuman and diffractive theorisings help retain maximum flexibility in research design and openness to the possibility of “making methodology anew” (Taylor, 2017, p. 322). ‘Practisings’ incorporate the sense of moving that I seek to maintain in this research, and compliment PL-PE where movement is literally fundamental to students becoming teachers.

Movement is also ‘literally’ present in the ways methodology and analyses have been performed or enacted - for example, I used a *Somatics Toolkit* practice to guide thinking with theor(ies) (Spatz, 2019). Making methodology anew has provided a four-dimensional (4-D) perspective of assemblages since it has involved merging of or diffracting of information from different spacetimes. This has been more than human *view-points* since organic and inorganic bodies have been

involved. I relied on digital co-researchers, for example, to highlight and cut and paste aspects of data—notes—sketches—readings and was bound by the laptop—Word functionalities. Every actor who enabled different ways of ‘seeing’ was also ‘partial’ (Adams and Thompson, 2016, p. 111) but multiple contributions helped show connections and relations among things.

There was a continuous tension between ‘social’ in the conventional sociological sense, and its inherent relations with nonhuman things. Primacy of human intentions and actions could have meant at best reducing the work of nonhumans (Harman, 2009). At worst, things are removed from having agency, yet events or assemblages are collections of all manner of actors. *Conatus*, this sense of ongoing dynamic relations among things human-nonhuman serves to highlight how the world is ‘unorganising’ things in the ‘betweens’ (Whitehead, 1938) or similarly, that ‘in-between’ bodies is a hive of ‘intra-activity’ (Hultman and Lenz Taguchi, 2010). In other words, each body, each thing, is multiple, is an event or an assemblage, processes, ongoing and emerging. For example, in PE a ball is at once a sent and being sent object, with human foot, head or hands relating with it. Thus the activity is ball—hands *in relation with* direction, force, partner, and so on. This is what Barad (2007, p. 33) means when she talks about ‘intra-action’ – that things do not “exist as individual elements”, but are already full of activity, whether human body, ball or single cell. Encounters such as between pupils, things, task, place and space (in PE) are never individual experiences, there are spaces where the individual encounters ‘other’ actors – human or nonhuman – as ‘mutually entangled agents’. At one and the same time, individuals are singular and multiple – being affected and affecting in encounters with others, where new knowledges or meanings emerge. The singular here, is not an isolated individual but one existing in relations and shaped by meetings with others and other things, other bodies. Encounters are based on experiencing differences and the collective learning or changing that ensues will be affected by affordances brought to this realm of activity (PE/PL-PE).

This seems to be where ontology and epistemology meet, ontoepistemology (Barad, 1998) eschews one paradigmatic claim about reality over another. “We don’t obtain knowledge by standing outside the world; we know because we are of the world” (Barad, 2007, p. 185). Possible implications for PE include thinking about different ways of producing knowledges, such as challenging the prevalence of negative experiences. For instance, if movement is not meaningful for a pupil, or for students becoming teachers, outcomes might include low confidence, misunderstandings of PE, and ultimately, non-participation in physical activity. Body(ies) in this way of becoming “has the capacity to mis-recognise its becoming and see itself as being or identity” (Colebrook, 2000. P. 88). I refer to Spinoza’s (2002) idea of *hilaritas*, as discussed at the beginning of this chapter - bodies are sites of political becoming. Different knowledges, differences in how pupils and students experience PE become important, since “(W)hat something *is* is given through its activity of differentiation” (Colebrook, 2000, p. 87).

Chapter Summary

It may already be apparent that I position myself as a researcher not bound by the positivist perspective that things exist independently of other things and people, and that these are what a researcher ought to be accessing ‘out there’ in the world (Crotty, 1998; Bodén et al., 2019). Two points were unpacked here; first that things exist independently, and the second was *how* to do the investigative research in these cases. The empirical methods of collecting data are one way to investigate whether, how and why PL is being enacted in student-teacher PE practices. Further, as soon as the researcher engages in the investigation, whatever method is used to gather data is affected by the dynamic and changing landscape of interactions (Law, 2004). The “performativity” of method means that it might surface not only the present text, but also that which precedes and is hidden in *production* or practices of the assemblage being investigated (Law, 2004, p. 144). Importantly, the conceptual work which has informed my research provided spacetimes for teasing out and loosening a meshwork of things, things like student, policy, playground, COVID, golf club, university. The effects of relations

among human-nonhuman things are made visible as the research-researcher-researched are emerging together (Bodén et al., 2019). Materiality is embedded in social-cultural ongoing relations in-with-through-of the world (MacLure, 2013a). Thus multiple ontoepistemologies informed my research.

This chapter has made the case for how my theoretical approach to investigating PL-PE has been congruent with but also extended the philosophy upon which Whitehead (1987) based her development of PL (Whitehead, 2001; 2007; 2013). Spinoza-informed posthumanism and sociomaterialism provide solid grounding for the methodological approaches outlined in the next chapter, wherein I discuss methodological choices and processes in creating a four-dimensional investigation of PL.

Chapter 4: Methodological Meshwork

Preface to the Chapter

My approach to the methodological meshwork somewhat follows Suits' (1979, p. 17) deconstruction of what constitutes a 'game':

(T)o play a game is to attempt to achieve a specific state of affairs, using only means permitted by rules, where the rules prohibit use of more efficient in favour of less efficient means, and where such rules are accepted just because they make possible such activity.

Or, "playing a game is the voluntary attempt to overcome unnecessary obstacles" (Suits, 1979, p. 17).

The point is that the ethical, ontological and epistemological benefits, developments, understandings and rules should not limit *how* to investigate PL-PE in ITE. Rather, and as outlined in Chapter 3, ethico-onto-epistemological relations are in and of themselves outcomes. Journeying with philosophy, theory and empirical data are discussed in this next chapter. The means and ends (of the methodology in this case) are inseparable (Suits, 2014), yet rule bound – just like games and sports where "permitted means are of less scope than the possible means" (Suits, 1979, p. 17). The choices I have made might not be the most 'efficient' but again, that is not the point and the methodology in this research aimed to challenge what is considered permissible and perhaps extend that which is possible. Just as games are created when factors are placed in the way on purpose, so too was this doctoral work. The factors may have been too restricting or not restricting enough. Some factors needed re-visioning in response to the pandemic and resultant impacts on ITE practisings. Other factors included timeframe, funding, ethical agreement, and personal application to the tasks. Ultimately, entering into the spirit of conducting research ethically, with reflexivity and desire to challenge obstacles and respond to opportunities, required a 'lusory' attitude (Suits, 1979). The current chapter outlines my lusory attitude – that is, how I agreed and enacted certain 'rules' of research, seeking to extend, challenge, distribute, develop theory-practice of methodology whilst I investigated PL-PE.

Introduction

This chapter entangles theory and philosophy from the preceding discussion to show how this influenced methodological choices. To that end, I open by recapitulating how posthuman and sociomaterialism disrupted anthropocentrism and why this was relevant to the ‘methodological meshwork’ and empirical contribution of this doctoral work. To try and encapsulate the complexity of the research methodology, ethnography supported the overarching approach to the research, which was with an attitude towards doing postqualitative inquiry (St. Pierre, 2019). The presentation in this chapter opens in conventional linear text, however, I then ask the reader to view the methodological meshwork in the many colours/flavours that were experienced during this research. A summary of data sources and types of data can be read in Appendix A. Inspiration for experimental presentation was taken from Lather’s and Smithies’ (1997) *Troubling the Angels* and from Mol’s (2002) *The Body Multiple*. Lather and Smithies (1997) present women’s quotations as data, with inserted text boxes of medical and factual information, or the authors’ reflective accounts. Mol (2002) splits the textbook pages horizontally, the bottom half is then split into two columns. The top half presents the empirical praxiographic fieldwork which enfolds-unfolds alongside lower columns of theory. Each example could be symbolic of theory holding aloft practice. I am not convinced that that is the case because researcher intentions are clearly stated – that is, who-what is/are speaking (posthumanism) and the intricacies of experiences are presented without hierarchy, and the conversations in each case (as well as my own) are left open.

This chapter is a:

point of departure...a fight against methodological timidity...to embrace experimentation, to view the impossibility of empirical research as a creative opportunity (rather than a damming condition), to unsettle the systematicity of procedure, to re-configure (rather than mimic) the lifeworld, and in sum to learn to fail, to fail better (Vannini, 2015, p. 319).

To present the theoretical work and the *ethos* of my research (Lather, 2007) that has been explored in Chapter 3, the text below shows theory—discussion written in (standard) one column. The two column presentations are entry points – my way of springboarding from the network of ANT to a four-dimensional connectivity, as introduced in Chapter 3. Meshworks present fluidity of the empirical-theoretical methods. Detailed steps and processes of how the human participants came to be entangled in the research, with thanks to university ethics committee and other gatekeepers, are included. Together, this and the next chapter detail the research practisings, the messiness of which I have sought to retain - such as lines of theory, lines of ethnography, lines of analyses, doings of postqualitative inquiry. First, I provide brief exposition of the chapter title.

Guiding Theory

In Chapters 2 and 3 I disrupted anthropocentric foci in PE and PL by drawing on posthuman and materialist thinkers such as Bennett (2004; 2010), Braidotti (2013a; 2019), Callon (1986; 1999), Latour (1999a, b; 2005) and Law (1992; 2004). For methodological purposes, sociomaterial posthuman approaches are envisioned by what I have termed a ‘methodological meshwork’ (Bartle, 2023). A meshwork analogy illustrates the messiness of ‘bundles’ of lines signifying relations among things (Ingold, 2013; 2016). In line with recent developments on ANT, a ‘mesh’ captures non-linear, ‘entangled lines’ and “trails *along* which life is lived” (Ingold, 2006, p. 26, italics original) rather than network which suggests point to point connectivity, ‘technical’ systems like electricity or the world wide web (Latour, 1996: 2005). The methodological meshwork is my way of showing the entangled *becomings* of research – for example, through what are in many respects, conventional methods of data collection (digital interviews, observations, reading), along with somatic embodied methods of working with data—theory (Shusterman, 2012; Kieft et al., 2019), and analyses as ongoing throughout the research. It is my way of doing (almost) postqualitative inquiry (Lather and St. Pierre, 2013) because there is not a prescribed process or planned structure to where/when to ‘do’ analysis or reading - they occurred as/when

required (St. Pierre and Kuecker, 2024). This chapter is presented as meshwork, and the reader is asked to follow the lines of research, researcher, and researched whilst layers of methodological experimentation are unfolded.

The ‘theory of method’, methodology (Collins and Stockton, 2018), is substantive narrative weaving through and driving this research, with one destination being the production of this doctoral thesis, wherein certain technical performances are expected, just like Suits’ (1979; 2014) games that prefaced this chapter. Rather than refusing to be bound by *a priori* methodological theory/ies in the design of the doctoral work, my own stance on inviting multiple ontoepistemologies is a theoretical position in itself. As outlined in the previous chapter, ontology, epistemology and axiology have informed methodological processes. Just as constitutive ‘rules of a game’ are conjoined with a ‘lusory attitude’, intrinsically related but not mutually exclusive (Suits, 1979), engaging philosophically is an ethical practice (Kuntz, 2020). As contributing to the methodology, *reading* philosophy (St. Pierre, 2024b), doing conceptual work (Lenz Taguchi and St. Pierre, 2017; St. Pierre, 2019) has been foregrounded – the theoretical journey has been expounded in depth in previous chapters. It is clear that epistemological concerns with knowledge production or positivist methodological influences are replaced with ethicoontoepistemological entanglements. Thus, instead of rejecting some ideas outright, by removing outliers for example, or merely re-presenting what has gone before, I am thinking-with and diffractively, so building on what has come before and-with what is yet to come, “stimulating dialogue between convergent and divergent points of view” (Geerts and Carstens, 2019, p. 919). Thinking-doing this research has also been inherently ethical throughout.

Axiological concerns were a feature not only prior to and during empirical data collection but cannot be removed from any aspects of doing educational research (Standish, 2001). Moreover, ethicoontoepistemological encounters with, through and in the world, are “a deeply ethical matter” (Barad, 2007, p. 185). As Greets and Carsten (2019) also note, this includes ethical matters wherein the relations

involve suffering of human and nonhuman species, the seen and unseen. The reading of Indigenous ethics (Buissink et al., 2017), of 'ethical wayfinding' (Knight, 2021) and ethics of 'caring relations' (Noddings, 2015) inform(ed) my approach. It was of fundamental ethical importance for me to acknowledge more-than-rationality as a way of investigating, and that care, kindness, respect for things past, and not yet, were included in my research practisings.

Enacting an ethic which tries to account for more-than-human was-is not easy, hence my need to circulate back and forth with readings (St. Pierre and Kuecker, 2024), interpretations, thinking with others – diffracting. Materialist thinkers such as Barad, Braidotti and Haraway encourage inclusion of affective, as was clear in discussion with the work of Spinoza in Chapter 3. In a posthumanist sense, thinking with Indigenous approaches to research and ITE moves beyond my human-centrality, takes in the local and global of assemblages (Buissink et al., 2017). Māori values, which acknowledge how my own practices are not mine alone, influenced my research conduct and so too in post-data collection thinking. For instance, throughout multiple (re)readings and bringing together of notes, sketches and transcribed interviews, I reflected with an attitude of respect and care towards those data. It is not an overstatement to say that research practisings impact(ed), and are impacting more widely (Buissink et al., 2017) than the localised student placements observed by me. Temporally, my ethical entanglement with events/happenings/assemblages is ongoing and is revisited and alters, such as by recounting it here. I continue to feel and enact compassion and respect by writing and sharing analyses with integrity.

Permissions 1

Seeking permissions is an established ethical procedure, which began with Approval from the University of Stirling General Ethics Panel (GUEP) on 5th November 2020 (see Front Matter).

An additional COVID-19 Risk Assessment was also compiled and agreed by a Faculty Lead. This accompanied the Fieldwork Risk assessment, which involved acknowledgement that I would

observe governmental and any further guidance about the pandemic, from local authorities or schools, and individual class or student teachers. Supervisory discussions informed the university ethics procedure, but ongoing awareness and reflexivity was heightened at various stages – such as seeking permissions from school head teachers or whilst arranging visits to schools via email. ‘Praxis’ of ethics was an ongoing meshwork of responsibility, as multiple considerations were being practiced and ‘crafted’ (Tolich and Tumilty, 2020). Drawing on past ethics training and ongoing professional experiences of reviewing ethics for research students and staff colleagues, I felt agile and informed to conduct research ethically. As a philosopher of PE and sport, values informed my understandings and sensitivity to participant, institutional and environmental fluctuations. The ethical issues being created during my research were new for everybody and effects/affects of COVID-19 are entangled in all aspects of my research. A point worth making briefly is that institutional ethics panels may have had prior experience considering

social science research which took place during the HIV and AIDS epidemic of the 1980s. Such principles as justice, respect for autonomy and beneficence have been suggested alongside what Walters (1988, p. 602) calls something like “mutuality, solidarity, or community” as further considerations. I would reflect that this last idea was interwoven from when I began thinking about recruitment onwards. Both procedural adherence and my participatory development in the broadest ethical sense were important. The British Educational Research Association (BERA, 2018) guidance included transparency, trust, care, and overall responsibility to participant, self, community, funder (ESRC), institution, and supervisory team.

Once students had consented to participate, I contacted the two local authorities (LAs) in which student participants would be placed. Before any research is permitted in schools in Scotland, the local education authority must provide consent and often have their own requirements. On accepting my request to approach head teachers in primary schools, one LA director mentioned that they “follow-up a

sample of research projects with the schools or establishments involved” (Director of Education and Lifelong

Learning). It remains to be seen whether they contact me or identify and read this thesis.

Ethnography

Whilst ethnography may simply be “writing about the people” (Ingold, 2014, p. 385), it has many guises (Hammersley, 2018). Given the sociomaterial, posthuman perspectives that my research embraced, to be inclusive of things human and nonhuman, some ethnographies would not have been appropriate. Still, ethnography as multiple may assist with research assemblages since ethnography is itself an assemblage and fluid, helpful in seeing the “relative messiness of practice” (Law, 2004, p. 18). For example, as a ‘thin’ methodological paradigm, Hammersley (2018, p. 7) suggests all types of ethnographical research may be encompassed at various points during a research process. I have included elements of auto, digital, educational, institutional, multi-sited, performance, ethnographies. The postqualitative inquiry connected to my research sits well with the idea of a flexible inclusive ethnography, in which different material things or actors contributed via observations, provocations by other actors, contemplations, through their effects or affects. This is in addition to words and images, reflections and interpretations by human actors. Thus, *posthumanist institutional ethnography* (Taylor and Fairchild, 2020) could be added to Hammersley’s long list and is a welcome theoretical addition since it presents an entanglement where human is purposefully displaced from the centre.

The core feature of ethnography is observation, but I sought to offer a version of experiences of reality that are as loyal as possible to the context, the embodied, sensory and affective experiences, and the negotiations and intersubjectivities through which the knowledge was produced (Pink, 2013, p. 35).

As noted here, Pink's version of ethnography encompasses the invisible and the 'immaterial', which is something I did, for instance, by noting the effects of and reflection on feelings when student-participants negotiated hot weather and pupil activity levels. The ongoing performative elements creating research assemblages remind me of choreographing dance with pupils, of composing musical scores, where multiple lines are moving. Silences, stillness, and crescendos are happening at the same time. The observation may be a situated, spacio-temporal performance, in following actors, however, effects and affects of activities continue across multiple spacetimes. For example, the hula hoop appears in multiple in the analyses—discussion chapters. Sociomaterialism has facilitated this divergence of one actor as multiple. As mentioned already, humans are one actor "in a cast of many" (Ulmer, 2017a, p. 833) and actors (like the hoop) are sometimes not 'seen' during an actual observation. This is a move beyond Pink's (2013) 'reality' to *realities*, a further feature of the four-dimensional methodological meshwork wherein diffractive thinking helps bring together things from-across-to spacetimes (Barad, 2007). Other ways of finding out why or how PL and/or PE might be understood differently were opened up through these ways of thinking-doing.

An apparent weakness of ethnography is the inability to generalise to larger populations (Hammersley, 2018) but as with qualitative research more generally, this is not necessarily the goal. Sociomaterial approaches are similarly criticised (Mitchell, 2020). However, the methodological approach here, sets out its own scope or reach, which although seeming to be particular to PL and ITE students, will still generate thinking about wider implications, such as for health education and other research into practice-based activities. I am seeking descriptive detail to then explore connectedness among actors, the relational. The goal is not to generalise to larger populations, to reach some endpoint, but to critique effects when actors are/were enacting differences in PE/PL-PE. Further, sociomaterial and posthuman approaches mean being able to interrogate everyday education events such as PE lessons, in some detail. Specifically for my research, having postqualitative, sociomaterialist and posthumanist sensibilities meant being able

to respond to situations as they emerged, as ‘adaptive ethnography’ (Hine, 2015). For example, the effects of COVID-19 were accommodated during the empirical data collection period. Rather than seeking to justify generalisability of qualitative research to align with the positivist paradigmatic dominance, it is more relevant to say that research is an iterative cyclical re-generating of knowledges (Guenther and Falk, 2019). For example, some of the methodological choices made during my research might be relevant for other practices relating to researchers, students, teachers or policy writing, again showing the importance of the not-yet or yet to be.

Highlighting *practices* in PL and PE suggests an ethnography which inherently embraces these also, and here, it is worth introducing the term ‘praxiography’ (Mol, 2002). Praxiography is an approach which fosters exploration of data rather than explanation (Mol, 2002). Praxiography functions as an holistic embrace around the practices and the ethnographic research which awaits what might be about to happen – what is immanent. Rather than the *ethno*-graphic concern with culture, praxiographers are interested in practices/practisings/praxis, and this includes nonhuman things (Mitchell, 2020). Praxiography also pushes against positivist separation of theory from practice (or theory from anything) (Bueger, 2014). Further, reflexivity on how heterogeneous actors are making connections, or associations, through practices, is the praxiographer’s attempt to throw lights into areas not yet known or illuminated in detail. Praxiography makes sense in relation to my desire to include multiple lines of data flow, and not to represent data as static. I introduce the term praxiography here but do not claim to have followed this kind of study from the outset. However, the term has been useful in clarifying that my research is immersed in practisings and not necessarily cultural aspects of PE and PL. In the end, it seems I may also have written a praxiography!

Recruiting students

To share information about the study to potential participants, for

Workshop 1 23 undergraduate students who had completed the IPLA Physical Literacy Foundation Course

were invited by email, and 5 attended online via Teams. Each student had accepted the meeting and returned signed electronic consent forms. Being online and having the students share concerns about how they were feeling this year, altered the ethos. The affective domain entered the online spaces and became tangible (Ward, 2018). The students were coping with undergraduate assessments, placement preparation, living with the COVID-19 pandemic, some at parent/carer homes, some in flats near the university. Students did not experience any on-campus teaching and learning, so my research activity request was probably far down the list of priorities. Indeed, this exacerbated researcher feelings of guilt in relation to seeking Local Authority (LA) and HT consent to enter schools during a time of significant challenge.

During the first online meeting/workshop/focus group, the research options available were discussed. Very much an open discussion with cameras and microphones on, students asked questions and suggested in which activities they would be comfortable and realistic participating. Two

students immediately offered to be visited because they knew they would be teaching PE. However, one of these student placements was in a higher Tier (with tighter COVID-19 restrictions) than my own and I was not allowed to travel into that area. Remaining flexible in where I might visit was an important consideration but was not something I could over-think due to my own family concerns and work-life adaptations. Whilst I could be ready to travel at short notice, I was realistic about the possibility of only a few schools/teachers/students being available and willing to receive a researcher.

A second local authority (LA 2) was contacted once students had started placement, and it became apparent that very few participants would or could have me visit them in schools. LA 2's response included a check that I could work with children (Protection of Vulnerable Groups (Scotland) Act 2007), which I can. With travel restrictions in place, I was allowed to travel between the two LAs at the time of gaining consent for the research. Both LAs provided written consent for

me to seek further agreement from relevant HTs.

Student school placements began before Christmas 2020, but I wrote in my research notes (20th December 2020):

Well this has gone a little pear shaped with lockdown two!

The General Teaching Council for Scotland (GTCS, 2020) advised all students to engage with Scottish Government COVID-19 guidance, follow LA guidance and to contact school in advance of placement starting. Schools would provide guidance about risk assessments. All student teachers were asked to download the *Protect Scotland* Application for mobile devices (NHS Scotland, n.d.) and were welcome to defer placement if the risk was too high personally or for a member of their family (Students' University Communication).

Permissions 2

Where I secured permission to enter a primary school during a brief release from COVID-19 lockdown, I was highly conscious of my movement across land from home to a school and all that was between. I did not stop elsewhere, I sanitised hands more than once, wore a mask, and maintained distance from others. The relief of being granted a visit was not as important as protecting those in school, and thankfully, we were outside for PE on days where air was

still, and sun was shining! Both students and I were visitors to schools, and the shared community of practices which grew in localised PE events were especially precious during these times. As post-pandemic research continues to show (Solway et al., 2022; de Bruijn et al., 2023), children's movement experiences were curtailed during lockdowns and have not returned to pre-pandemic levels. This is detrimental to their journeys towards holistic wellbeing.

Researcher guilt was something I wrestled with, leading me to search previous literature on this topic. For fear of sentimentality, I am mindful of dwelling on these feelings. However, I think it is important to drive for 'slow ontology' (Ulmer, 2017), afforded by an ethnographic research approach, and highlight what Mamali (2019, p. 242) calls "embodied" reflexivity. This is different to theoretical reflexivity which is part of student-teacher and researcher development. For instance, concerns of researcher bias and ethical conduct are partly influenced by outcomes such as publications and doctoral completion. Ethical praxis was more important for me at the point of 'lockdown two' than the epistemological. With that consideration, I did not seek approval from HTs to ask for consent from parents or carers to take photographs during PE lessons. I am pleased with this decision since often classes were merged for PE, and parent/carer consent would have been an inappropriate pressure for school staff and carers. Photographs of equipment at the side of one participant's lesson were allowed. I had considered placing disposable cameras in plastic bags for teachers to use, but given the changing nature of the lessons, I decided not to ask. To overcome not having images of activities, I made notes of activities and annotated sketches of outdoor lesson areas (such as Image 3 below), and these became helpful memory prompts during analyses.

Ethics and walking

In seeking ethical permissions, I had intended to literally make a walk-through of the PE/PL-PE assemblages at five-minute intervals, taking a still picture each time. However, the five-minute interval would have been problematic in part because classes had been merged from approximately 28 pupils to around 55 pupils. I have observed PE classes many times, as

student teacher, as co-teacher, as teacher, as teacher educator, and each way of looking is different, as are my (human) intentions in each way of looking, regarding, watching. The desired outcomes from each role are different, as are the affects/effects of my presence on-with other actors in these assemblages. Whilst walking or waiting patiently in threshold areas, I remained open to things 'popping into my head', beckoning a dialogue. For

making field notes, notepad and pen and laptop walked with me. Notetaking on site captured elements of emotion, ethos, my feelings whilst in the class (Bridges-Rhoads, 2018).

Human participants

All participant names are pseudonyms. Sarah was a third-year undergraduate university student on her third teaching placement. She was working with a primary (P) 2 class (age 6). A P2-3 composite class also joined her PE lessons. The conjoined lessons included around 45-55 pupils at any one time, and 4 staff. Reasons for merging both early years classes include COVID-19 to cope with staff absence as well as being efficient with outdoor space usage. Sarah's school was situated in a city. I visited Sarah on two different days and observed two PE lessons. Sarah was interviewed and also shared some of her lesson plans.

Erin was also a year three undergraduate student on the third teaching placement. She tweeted/posted on X and was interviewed.

I interviewed Holly, a post-graduate student (PGDE) in August 2021 when

The digital devices also invited more things into the research assemblage (Wang, 2014) such as tweets/posts made by student-participants before-during-after their PL-PE lessons.

her programme was finished. Postgraduates have completed a first degree and may have career experience, families, and homes, unlike most undergraduate students. Holly shared some lesson plans and was interviewed.

Eileen has fifteen years' experience as a class primary teacher, and after retraining as part of Scotland's Developmental PE Postgraduate Course (Jess and Collins, 2003; Chapter 1) has been a peripatetic primary PE teacher for fifteen years, in one local authority. The school visited in May 2021 was in a semi-rural area, in a medium sized town. I observed two P1 (ages 5-6) and two P2 classes (ages 6-7) in succession for one full-day visit. There was usually at least one other staff member present (class teacher). That staff member did not teach or assist during the PE lessons. Eileen was also interviewed.

I have not started this research with the particular data collection point being described here – I was already entangled in PE, PL, and can be traced in-thought-around documents, actions, cones, discussions, conference presentations, websites, or diffracted through myriad other actors, times and assemblages. My methodology was working alongside empirical field work and analyses (Lather and St. Pierre, 2013). It contributes to Lather’s (2007, p. 35) ‘troubling’ of “habitual frames of representational space” by reducing researcher ‘authorship’ through experimentation with presentation. Although much research seeks to make the researcher’s presence known by admitting bias, placing researcher history firmly to the fore, there is also concern that researcher ‘voice’ continues as “dominant confessional ... humanism” (Lather, 2007, p. 44). Posthumanism goes some way to flattening the landscape of heterogeneous things, decentring human. Further, methodology was fluid and attuned to the actors that-who contributed to PL-PE, agreeing that the “methods employed need to be commensurate with the phenomena being studied” (Adams and van Manen, 2017, p. 781). Similarly, theorisings *and* practisings were part of the entanglements because, during PL-PE, students-becoming-teachers were “movement or growth” in “a proliferation of loose ends!” (Ingold, 2013, p. 132). Ongoing work with theory—practisings invited multiple methods as are being explored here.

Visiting Schools and Walking

I walked around the playground areas, altering height as well as directions of travel, to disrupt what might usually be observed by watching from a static position (Andersson and Risberg, 2019). The observer need not be on the feet, which for Ingold (2004) reinforces the dualism of mind (head) over body (heels/feet) as well as

culture (‘civilized’ cultures) above nature (grounded in multiple sensorial experiences). I squatted or sat with legs out front or could perch on a rock in a playground. Moving to a prone position or hands and knees crawling to share a landscape more in tune with those of the primary pupils was not feasible outside. Whilst seated on the ground this invited pupils to approach

me – asking “Are you going to teach us?” or telling me “I can do this [hula hoop is twirled around pupil’s wrist]”. There seemed to have been an approachability by first, being a visitor, but also by being perched at half my height on a rock with a laptop beside me.

Masschelein (2010) highlights the variety of perspectives provided by ‘walking’, by allowing the gaze to be called forth by things along the ‘unprepared path’. By combining movement of walking with the variety of researcher gazes, intention is also disrupted. Feeling the ground beneath me in different ways alerted me to uneven paving in school playgrounds, slowing down movements – a slow ontology (Vannini, 2015; Ulmer, 2017b), altering movement possibilities of human-nonhuman. Walking could be the physical activity of displacing one’s gaze – that is, leaving one’s position (*ex-position*) along an arbitrary line, a trajectory that at the same time exists (and is recaptured) and is paved anew, a way for new perspectives. Multiple experiences were observed, such as the pupil—wheelchair assemblage that moves differently, the autistic pupil uncomfortable with too many others nearby, me as researcher and COVID-19 both imposing on conjoined classes. Lines were not leading to somewhere given before, but somewhere without a destination or familiar kind of orientation (Masschelein, 2010). In multiple spacetimes, lines flowed into and away from the not-yet assembled, creating a centre “which comes to stand for and articulate” all the lines (Law, 2003, p. 8). These ‘centres’ or knots were where an event was freeze-framed, temporarily, long enough to hold my attention and retrospectively, loosen the assemblage to analyse what might have been happening.

It would be remiss to suggest that perception is limited to only the visual, as is challenged by Braidotti (2006) and Sousanis (2015). For example, the calm, slowly paced, or singing voice of Eileen (the PE teacher) was felt and heard during observations, by me and the pupils. I noted in words, on my notebook, hearing and seeing e/affects of this ‘voice’. The example illuminates some of the detail

arising from multiple ways in which visual, oral, audio, affective, physical, cognitive aspects of a PE lesson are contributing to non-representational research.

Words about data/information/empirical findings

Social Media Posts

In the initial workshop/meeting with potential participants, posting on the social media application Twitter (as it was known at that time. It is now rebranded as 'X'), was mentioned as a way of documenting their journeys as they prepared lessons in PL-PE. Using the hashtag #plpeproject, tweets (or posts) could then be searched, responded to and grouped together. Early in the research, posts were used by one or two students to show images of their preparation for PE classes. For instance, one student had made cards using the Key (Significant) Aspects of Learning (SAoL) in PE (Balance and Control; Education Scotland, 2014) to act as prompts for her lesson (Erin, Tweet/post, Image 1).

Posts also acted as communication prompts. For instance, Erin prompted me to send a direct message via Twitter/X confirming when her PE lesson was scheduled. The student also suggested she would ask the HT in

school the next day, perhaps helping to ensure my own email request to visit was not lost, overlooked, or ignored.

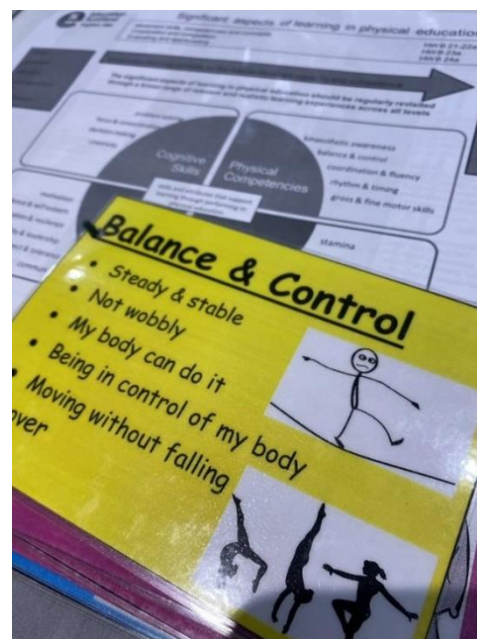


Image 1 Tweet/Post

Immersing herself in this way is not uncommon to participants who feel they can contribute (Pope, 2020). Erin's contribution seemed to be an expression of self-confidence - she was managing her time, coping with the demands of placement, all whilst experiencing effects of COVID-19 restrictions.

In quantitative and qualitative studies, informed by the positivist framing, 'data' are gathered and interpreted, with meaning(s) developed for communication in a thesis or as 'evidence' for policy change, for example (Koro-Ljungberg et al., 2018). In my study, neither quantitative or qualitative paradigm satisfies how data is conceived and presented. It has been a great task to shake off expectations of aspects of these paradigms to do data analysis and present data differently, since research remains caught in the positivist net (St. Pierre, 2013a). Data are not organised *a priori*, merely 'existing' waiting to be found, data are dynamic, unstable, or 'given', a 'gift' (Standish, 2001). Indeed, the appropriateness or helpfulness of the word 'data' has also been questioned (St. Pierre, 1997). I do not intend to remove this word, but it was important for what is to follow that there are caveats about what I mean by 'data', conventions associated with how data are gifted, viewed, interwoven with theory, interpretations, and (re)presented in research texts. For example, emotional, affective, and data which is present in other spacetimes, is included in discussions.

What 'counts' as data in (post)qualitative inquiries? Is it pre-planned, an interview set-up, is it the surprising conversation like a student sharing unprompted details about something a class teacher said? Could data be called something else - 'artefacts', objects, concepts, or documents (Bueger, 2014)? For example, the *Benchmarks PE* document (Education Scotland, 2017) circulates (inter)nationally, locally, informs the design of student lessons, travels digitally as a tweet/post, negotiates assessing pupils, thus the document connects multiple sites—people—things (Bueger, 2014). Documents can provoke political disruption or consolidate understanding. 'Artefacts' as a replacement term for data could have been a useful linguistic substitution. That said, my sentiment towards data was/is viewed more of an encounter. To 'en-counter' data is a less prescribed occurrence than asking what 'counts' as data. The etymology of encounter emerged from the Latin "*incontra* toward, from Latin *in-* + *contra* against" (Merriam-Webster, n.d.) and used to describe encounters with an adversary. Toward and against – as a verb, to meet unexpectedly or come upon something or someone; as a noun, a meeting, whether chance or of a particular kind, leaves open the potentials of data.

Encountering data is different from ideas of data 'collection', data 'gathering', terms usually associated with research practices. However, with the ethicoontoepistemological positioning as sociomaterial posthuman researcher, I have been drawn to some things, some events, or practisings, more than others. In keeping with Suits' (1979) opening preface to this Chapter, I retained a lusory attitude, entered into the spirit of the 'game' (read research). In that sense, what data comes along is an ethical gift (Standish, 2001) received with humility and in the spirit of the not-yet, as data continues to engage with other actors.

Text

Whilst visiting schools, notes were made in my hard back A4 notebook. Electronic notetaking was not easy due to being outdoors and me not being proficient at notetaking on something like a mobile phone. I needed to sketch, to write quickly, at times not looking at the page whilst writing, as seen on the scribbles in Image 2. In contrast to my desire to reduce or refuse methodology and associated restrictions (St. Pierre, 2019), I wrote headings into my notebook before visiting each school. The headings are not emerging from the data and are evidence of *a priori* framing. This was done in response to coping with PE being outdoors due to COVID-19. Thus before each visit I had written the three headings 'interesting, remarkable, important/

unusual' on my notebook. These headings are in reference to Deleuze (Olkowski, 2011). Headings helped fine-tune how I was 'seeing' the lessons and were an attempt to lessen dominance of my gaze, with its imbued meanings. Further down or over the page, I wrote headings which summarised key elements of PL – 'cognitive, affective, physical, holistic, lifelong'. The logic of choosing these headings is that they are drawn from Whitehead's (2010) and the IPLA (2017) components of PL. I tried to let data about PL-PE flow through my notes. However, interestingly, the broader, less restricting Deleuzian headings provoked more voluminous notes during Eileen's (practitioner) observations, and one of Sarah's (student) observations. In Sarah's second visit, there were less Deleuzian comments. The comments on that day

were less in number possibly because the lesson was static due to hot weather. Headings related to PL seemed to be more broadly accommodating across participants, perhaps because I understand these, and was looking for this to address my research questions, an inherent bias. Any further notetaking was written

around the diagrams and/or headings, and on spaces on the paper page.

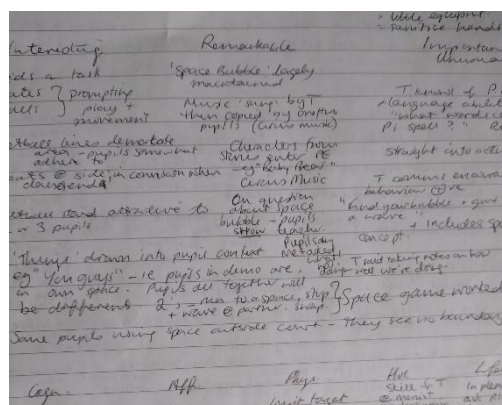


Image 2 Notebook Headings

Certain data/assemblages/things have ‘lured’ me, prompted further thinking or wondering (MacLure, 2013a). Some encounters were surprises - for example, water bottles were gathered at the sides of Sarah’s lesson on a particularly hot Scottish day! These were not touched during the lesson by any pupils. Evidently, I held this data in my sketches and reflections for a reason. Indeed, wellbeing influenced bottles being brought outside, but ongoing care was not demonstrated since I observed no encouragement of pupils to take in water. This created “a kind of rage for explanation and meaning” (MacLure, 2013a, p. 662). In Chapter 6 I use the term ‘lure’ to describe the kind of data encounters that stimulated attention for a variety of not-yet known reasons. Interestingly, unlike the ideas of data ‘collection’ or ‘gathering’, *encounters* with data/things/affect seemed less ‘possessive’ or colonising and appealed to the philosophies in my research. Much data is arguably, immanent, transient, intangible, temporary, flighty, mobile, distributing, emerging, dynamic, fluid, and so is not ‘mine’ to gather and keep. Ethically, data which lured or was encountered was borrowed for this research production, an idea which I think is not grasped by procedural form-filling. Thus it is with respect and thanks that data-things were walking me (not as ‘I’ (Somerville, 2016)) and we merge into this doctoral work as joint outcome.

Immersion in the fieldnotes occurred in stages. First, I followed the playground plan (Image 3) and considered how I had moved around during one particular visit (Figure 3). This was the third visit to a school playground, and rather than simply making the movements, I also noted my own movements during the observed lesson. I wrote, "I took walks around, through; paused @each 'side' of areas". Figure 3 depicts movements around and through the playground plan of Image 3. The circular are the various moments of pausing, sized according to time paused, during which I wrote notes and observed from a different position.

Observation started beside Sarah and movements were made with consideration of class activities, around the semi-circular tarmac playground. Pauses were largest when at the margins of the PE lesson space, where equipment and activity would not be interrupted by me. Things were assembling in such a way as to create boundaries, guiding PE and my movements and gaze. Images contribute to the methodological meshwork as they provide visible

presentation of the trajectory of researcher, where things were placed, and where pupils were active/playing in this lesson-research assemblage (Decuypere and Simon, 2016). Several walk-through 'cuts' in Figure 3. occurred. Imagine walking the line which goes from the bottom middle start point in a wiggling north-westerly direction. Foam javelin-throwing in the bottom left corner of this scape precluded a walk around that space. Thus, safety during physical activity enters the assemblage. The walk-through was something I intended to do during field visits to 'displace' or 'liberate' my gaze (Masschelein, 2010). In this example, the practices in the PE lesson-assemblage delineated or for Masschelein, 'commanded' my movements. Concurrently, the work that Figure 3 is doing is presenting my movement in relation with other things and logging a "relational gaze" (Decuypere and Simons, 2016, p. 382). Not all fieldnotes have been re-written into diagrammatic presentation as in the above example. However, all field visits did involve walk-throughs/arounds during each outdoor lesson.

Actors

Heterogeneous actors or assemblages were ‘speaking’ rather than me imposing theory and methodology onto the context. As a result, I had a mix of notes, sketches, photographs, with some reflective thoughts made immediately and some later. Humans were not made invisible, but rather all actors were emerging in practices, performances and doings-in-the-world (Adams and Thompson, 2016). Actors have agency and as Harman (2007; 2009) has noted, some actors are weaker or stronger than others, and actors are forming relations in a more ‘democratic’ way than humanist research may have previously attributed. For example, digital actors became prominent during the academic year leading to my data collection, encouraging communications which otherwise could have been problematic (Guest, 2018). The digital actor assumed a specialist role becoming more central to the ethnography than some others/things. Employing digital methods is not necessarily ‘better’ or ‘innovative’, but importantly, digital actors are foregrounded at times to provide insights – such as in how participants can share information when interviewed via Teams, albeit arguably sharing ‘thinner’ data than if interviewed face to face (Travers, 2009). For me, these are merely different method-assemblages.

Artefacts at Interviews

Human and nonhuman actors are at liberty to ‘speak’ (Ingold, 2021) and be interviewed (Adams and Thompson, 2016). For example, during the moves to online learning in schools, ‘invisible’ digital connectivity supported Microsoft Teams™ application software, and these (unseen) connections enabled audio and visual interview experiences. As already imbued with

meanings and intra-activity, things were ‘intra-viewed’ (Kuntz and Presnall, 2012), including some-thing (an artefact) brought by participants to their interviews. I had asked participants to bring something that showed what PL meant to them at that time, and these artefacts played multiple roles during participant interviews. A tennis ball, for instance, had to be held by Sarah because her dog would think it was playtime. The

ball also created a comfortable ethos which permeated the interview. The intra-activity of the ball, the dog, digital laptop, humans, emerged together, creating a stable assemblage as Sarah's story unfolded. Interviews were semi-structured in that topic areas were prompts for discussion (see Appendix B). Broad areas included seeking

[Walking—Interviewing in surround sound](#)

Walking through the outskirts of a semi-rural town in Scotland where we lived, Holly and I shared an interview experience. Our wandering was accompanied by notable sensorial affects (Vannini, 2015), such as physical changes in breathing when meeting small hills, pausing with passing tractors, the deafening effects of the wind in places, and negotiating single-track roads. We were walking-talking and had to be jerked into the return journey. The walking interview (Springgay and Truman, 2018) was an example of diffraction where Holly's fitness background, my prior knowledge of this and digital research methods were entangled. As a process during

experiences of placement, of planning and assessment, support for becoming a teacher and aspects of PL. Topics were developed from my reading and understanding of PE environments, as well as knowledge of participant journeys during university.

empirical data collection, creating different spaces and different time(s) whilst moving and speaking—listening—recording, included disrupting human dominance. Being alive to the processes of knowledge-making with Holly exemplifies ethnographic practisings which contributed to understanding posthuman activities and is an example of Ingold's (2021) 'wayfaring'. For example, there were no destinations, and horses, tractors, wind and road surfaces were storying quite different encounters to those involving Teams interviewing. This was "an embodied ontological approach in which more-than-human methodological possibilities animate through research" (Ulmer, 2017b, p. 207).

Selected as participant for its convenience, my mobile phone was key in recording the walking interview. It did this first, by temporarily hosting the university linked Teams application (app.), onto which the recording could be made. The app. was uploaded solely for its use as a mobile, dictation-recording capability. The recording brings human voices, sounds of tractors passing, footsteps over gravelly roads, pauses in the conversation, wind blowing, and breathlessness with the walking/wayfaring. The recording was saved in the University OneDrive and played as Mp3 file through the transcription software. The recording and recording app. were subsequently deleted from my mobile phone. I do not keep the Teams app on my mobile device, and the app. and contents present an example of the limited lines of flight of these actors. They met an abrupt end, like Thompson's (2012, p. 99) delete button which is used repeatedly to "click when we want to get on with things". In thinking about the sociality of the app., it was essential to fulfilling an aspect of research at a particular spacetime, and this was brought to the fore in the moment when I was about to confirm its deletion. My own feelings caused a second thought – a pause – before finally thinking that 'if the worst happens, the downloaded recording is securely saved on the University of Stirling OneDrive'. At that brief but poignant moment, technology and human affect were entangled but the heightened awareness was safely diffused by the click on a mouse operating a virtual touch on a screen. Although I will not say more about the role of digital at this point, it is worth noting that "without careful interview of the [digital] things enrolled in one's research, it is difficult to determine how they may not only be supporting but also potentially undermining key methodological understandings and practices" (Adams and Thompson, 2016, p. 96).

Documents

From when empirical field work began, and through the analysis stages, I noted when participants made explicit reference to

curriculum, PE or PL documents. For all student-participants, university practical session documents were used to inform lesson creation, such as ideas for warm-up activities.

Students accessed a second layer of documents, such as websites listed on the university materials. CfE documents informed several participant discussions. These were Key Aspects of Learning in PE, Health and Wellbeing (HWB) *Experiences and Outcomes* (Es & Os, Scottish Government, 2009a), and *CfE HWB Principles and Practice document*

(Scottish Government, 2009b). One student-participant and the practitioner-participant mentioned a LA document called *Progression Pathways in PE*, which helps primary staff plan and deliver across curriculum levels. This document was authored by PE specialists in the LA, including the practitioner-participant in my research.

Experiences for human and nonhuman actors are enacted during intra- (Barad, 2007) and interactions in the world (Ingold, 2015). Thus, in trying to follow the flow of relations as students were-are becoming teachers, the e/affects of PL-PE may have been rendered visible as part of these intra- inter-actions. Sociomaterialism seeks not to *re-present* (Somerville, 2016) but to document activities in multiple and refrain from imposing *a priori* epistemological and ontological dispositions into the research assemblage. Ethically and practically, this was-is difficult. Investigating multiple knowledges, of coming to know things, challenged some “conventional humanist qualitative inquiry” (St. Pierre, 2013b, p. 654). Here, I would argue that my methodological meshwork is diffractive apparatus that addressed material entanglements (Barad, 2007), thereby overcoming the social and material separation argued against from the outset of this doctoral research. Contributors to the meshwork have included: lesson plans, field-work observations with walk-through “cuts” to disrupt the gaze (Masschelein, 2010), student-participants, artefacts chosen by participants, tweets/posts, PE equipment, a hedge, documents, university materials, laptop, notebook, diagrams, rucksacks, a definition (IPLA, 2017), researcher, posthumanism, sociomaterialism.

Rather like the nonuniform, continual waves of the sea, the diffracted activities of actors (human and nonhuman) and what they ‘do’ (Latour, 2005; Fox and Alldred,

2015; Adams and Thompson, 2016) were explored as practisings were emerging. “To study practices is therefore, to undertake the analytical and empirical task of exploring possible patterns of relations and how it is that these get assembled in particular locations” (Law, 2009, p. 1). Thus, investigating practices where PL might be enacting in PE, the approaches being discussed were in part to disrupt the dominance of the optical metaphors often found in research (Barad, 2007). Having visited, observed, walked, and read, the question of what to do with data was also emerging. Multiple entry points into PL-PE assemblages helped curtail the research by making ‘cuts’ (Barad, 2007), which facilitated exploration of what-how things were relating to enact PL-PE.

Cutting the meshwork

For Barad (2007) ‘agential cuts’ are not a case of cutting in two, but a way of disrupting a research assemblage, like diving into the middle of a hockey game to fathom what might have gone before, what is, and what might be. A cut offers a sectional entry point into a meshwork, and the researcher ‘attends’/waiting (Masschelein, 2010), attuning to things human and nonhuman that might, *a posteriori*, (re)appear in the research critique. Actors make decisions, enacting their agencies in different situations (Latour, 2005). Herein actors are creating momentary boundaries, an idea which relies on how relations are enacting at given spacetimes – in PE Sarah stopped a lesson because a golf club was being swung too high and so was potentially dangerous to other pupils. The cutting of the meshwork, or halting of a line of practisings, that the particular assemblage of golf club—pupil—Sarah enacted, was a meaning-making act. The cut that emerged here, allowed me to notice the actions and provocations of the golf club. I had not ‘intended’ to notice the golf club; the intra-activity of each actor was *becoming* recognisable during this situation, and I attuned to it because of the minor breakdown (unsafe swing). The cuts made as the world is ongoing are perpetual (Barad, 2007), so equipment—pupils—Sarah continued relating, albeit more safely.

My intentions as researcher were different to those when I am teacher educator, since as a researcher I am attending to things – *attendre*, ‘waiting’ for data “to appear when the gaze cares for the present” (Masschelein, 2010 p. 51). As part of the research assemblage, I could already understand the PE lessons and could traverse to thinking about how to welcome human and nonhuman to speak for themselves. Posthumanism-informed practical guidance on how to inter-view objects has been offered by Adams and Thompson (2016, p. 6), who say that to attune to things nonhuman, a way of “speaking with things”, to interview a thing, is to glean insights from its activities, the interactions, the relations, associations with other things. The idea of surrendering to what is not known is also a kind of exposure, yet I bring my PE and researcher intra-activity where the ontoepistemological is not entirely un-known. Attending to – listening to – what things are doing-saying in the research assemblage requires a kind of gaze which encompasses suspension of judgement, a way of waiting (Adams and Thompson, 2016). Waiting patiently, “passively” (Standish, 2001, p. 504), allowing the feeling of deferring judgement, awaiting possibilities and potentialities – rather than feeling lost and uncomfortable – is like standing on the threshold of a doorway (Lewis, 2017). The data may not ‘appear’ in the conventional sense of that word, but affects/effects of the doings, practisings, enactings of PL and/or PL-PE were ‘given’ or were ‘becoming data’. My researcher intentions and some biases were downplayed – somewhere between passivity and being reduced – but attentions increased, thereby exposing things not yet known or better ‘exposing things into existing’ (Masny, 2013).

Attuning to data as it was unfolding, to make cuts in the meshwork, suggests reliance on researcher choice, and this has been a criticism of the notion of cutting because influences might be based on biases (Fox and Alldred, 2023), such as white, female, physical educator, and similar. However, as will be explored in the next chapter, analysis was ongoing throughout empirical data collection period and ways of challenging researcher bias were foregrounded. Cutting moves away from Cartesian cutting of subject-object, human-nonhuman, inside-outside, nature-culture and so on, yet includes researcher as entangled, and so there is

ongoing tension whilst researching. Living with such a tension (attention) is fine. Further, Barad (2007) has noted that the researcher cannot exert a separate will to make cuts because the researcher is already part of the enacting realities.

Subtle delineations occur in any study, such as whether human participants will give ethical consent, or pupils will adhere to physical boundaries such as lines on the school playgrounds. Boundaries such as time given by funders for the research, the time student-participants are on placements in schools, the word count limits suggested by academic policy, are all factors influencing that which could be included in data and analysis. Consideration of these *a priori* cuts became backgrounded, however, because it was the emerging relations that were important during this period (Decuyper and Simons, 2016). Further detail of empirical data sources, can be seen as a summary in Appendix A.

Chapter Conclusion

During theoretical exploration and empirical data collection periods there has been a fundamental approach to this research based on moving. Ontologically the case for multiple realities and ‘becomings’ has been emphasised from early in the reading-writing of this research (St. Pierre and Kuecker, 2024). As such, the empirical data has provided more than one way of seeing whether, how or why PL is enacted in spacetimes where PE is being taught. Analysis is not therefore, separate from the empirical data collecting episodes; just as becoming with and working with theory is not separate from the empirical. Decentring the human has meant that things, whether education document, golf club, student-participant interview phrases, or journal article, were entangled. “Things are their stories ... paths of movement in an unfolding field of relations” (Ingold, 2021, p. 196). Travelling through/with/around the data as outlined above has encouraged certain strategies for analysis of the unfolding relations. As a process of discovering – as a heuristic – reading, re-reading, moving data pieces, looking, thinking, following, tracing, removing information from empirical data, has led to the creation of stories (Adams and Thompson, 2016). Whilst moving data around,

that which has caught my attention has provoked further sustained thinking. One visit to data does not make the data stable, indeed, multiple (re)visits bring other, new understandings and interpretations (Lather and Smithies, 1997; Crowther et al., 2017). The paths being traced are a mix of those already made, but also forging new paths, lines of flight, as potential trajectories or of *becomings*.

The ways in which data is presented in doctoral theses are varied, from conventional text to comic sketches overlaid with short bursts of text (Sousanis, 2015), to danced and musically performed theses. I wanted to interweave text-image-theory and so split the pages above to capture the dynamic four-dimensional methodological meshwork. The linear format presented towards the end of this chapter provides detailed information to satisfy academic requirements of research design and empirical data collection. In the next chapter I detail strategies for analysis using a more conventional structure and form.

I invite the reader to the next chapter or if further detail about participants, places and organising data is sought, please read the Addendum to this chapter. In the next chapter, the strategies for analysing theory-with-data are explored. By retaining a sense of moving, the strategies included ongoing attention to analyses and embodied ways of thinking data-with-theory.

Chapter Addendum

I sought to question some of the assumptions fuelling the 'university', the Academy, in that the rational (mind) is not being held as only contributor to this doctoral assemblage. Indeed, measuring my research I hope, considers more than traditional higher education predilection for individualism (Lynch, 2010) and measurement against (often externally set) normative outcomes (Buissink et al., 2017). In trying to embrace the complexities of methodological meshwork(s) I refute *re-presenting* that which I, as researcher, deem worth reporting back. I have sought to lessen my own colonising of the research with emphasis on ethicoontoepistemological entanglements, inter- and intra-connectedness (Barad,

2007; Dennis and Huf, 2020) and diffractive thinking (Barad, 2007). In presenting researcher as another actor, reducing human privilege, and seeking interconnectedness, the ontological power often assumed by researcher and human has been altered. Further, the Cartesian binaries so influential in many methodologies and practices, are challenged, if not removed (Standish, 2016; Charteris et al., 2019; Kuntz, 2020). This last point is commensurate with my earlier discarding of Cartesian dualism in the context of PL and PE (Bailey, 2020; Durden-Myers et al., 2021), thus demonstrating that both context of my research and methodological approach for investigating context, have been in synch and were already entangled.

Inviting Participants

The participants were invited because they were all primary ITE students who had completed the Physical Literacy Foundation Course (IPLA, n.d.) led by me the year before. Twenty-seven ITE students at a university in Scotland had completed the course, during which they were introduced to key aspects of PL and encouraged to reflect on their own PL journeys. They also think about and write a realistic three-point action plan relevant to their PL context. Of those students who achieved the course, four were not to be invited as participants, as advised by the teaching practice convenor (personal email, August 2020). As stated earlier, the invited human participant group was twenty-three primary ITE students, in their third year of a four-year (MAEd) undergraduate degree.

Participants also act as gatekeepers and so I hosted a workshop online, which sixteen third year (MAEd) students attended. At the workshop, I asked that if students would like to tweet/post if they felt their PE was influenced or informed by PL. When a post is intended for research, preceding it with a hashtag makes for effective identification of any tweets by the researcher – or anyone with the hashtag (Guest, 2018). Participants were not prolific in their use of social media, perhaps this was the influence of COVID-19. What was interesting, however, is

that Erin continued to tweet using the hashtag, beyond her university graduation (a whole year after this empirical data collection period ended).

Due to the COVID-19 second lockdown in Scotland, and further restrictions influencing how far I could travel from home to LAs, further convenience sampling occurred. I decided, to include another year group in the research. The Postgraduate Diploma/Certificate in Education (PGDE primary) is a one-year programme, but the group experience three teaching placements in schools in that time. I embed content from the IPLA PL foundation course during four PE workshops over their PGDE year. These are completed by the February of the programme. In the academic year 2020-21, however, only three online PE workshops could be delivered, with the last in January 2021. Of the 120 in the year group, eight presented at the first workshop, and two returned consent forms. The pressures of living in the pandemic were common to all individuals but it might be suggested that compared to undergraduates, this PGDE group had added concerns due to taking a year 'out' of a secure job, and/or with family priorities. All of these factors contributed to low numbers of human participants.

An additional participant was recruited after an opportune conversation with a teacher in one LA, who suggested I ask the PE primary school specialists to participate. Four staff were contacted, and one, Eileen, agreed to participate. All participants in this research have been granted a pseudonym and remain anonymous to anyone but me, retaining anonymity of their data. The one caveat to this is that all participants identified as female – I discuss this in Chapters 8 and 9 and acknowledge that around 89% of primary education students and teachers are female (Scottish Government, 2022).

Places

Visiting students on school placements is a part of my role in teacher education and so familiarity with schools and with classes full of pupils already informs my expectations. I am also a former PE teacher, with experience across primary and

secondary education. However, this particular series of planned visits were very much *not* familiar. I am now another actor interweaving as I seek information and consent to enter a new assemblage that is the COVID-19 affected 'classroom'. PE guidance has altered the experiences ordinarily afforded by use of (at times) endless pieces of equipment. Before visits, I asked myself: what would the PE-PL lesson look like? Would I recognise it? It was exciting to consider the possibilities, and I found myself curious, unsure of how student-participants were responding to the restrictions in place. During online PE, students and I had discussed home learning and so they would have some ideas about what activities were accessible during the restrictions they were about to experience.

Organising Empirical Data with Theory

Three participant interviews were recorded via Microsoft Teams, changed from Mp4 audio-visual format to Mp3 audio only. Teams software provided a transcript, which I edited. The walking interview with Holly was already an Mp3 file. The process involved VLC Media Player and Cloud Paging App, available via Microsoft Office 365. I am thankful to the software capabilities, digital actors working in the background (Eftekhari, 2024), as well as to the University of Stirling learning technologist for help using this software.

The first reading of computer-generated transcripts was accompanied by editing out errors as I listened to the audio. A second reading included annotating the transcripts electronically. Annotations were made in different highlighter colours and comments made in the reviewer margin areas of each Word document. I could compile a key which became relevant to each transcript – this key was added to as patterns emerged (see Chapter 5, Figure 4). For example, in the first two interviews with student-participants, what PL meant for them was clearly articulated and so the same highlighter colour represented verbalising of understandings of PL. The same colour was applied to the other two transcripts, and the key was built up to eight coloured themes. This is an example of a moment when close reading led me to what a participant was saying, wherein something

was 'coming through' in "the affective encounter of reading" the transcript (MacLure, 2024, p. 1648). I then printed all interview transcripts to facilitate reading and re-reading, off-screen. The relief of not having to read screens was important at this point in the researcher journey, compounded by COVID-19 online teaching/learning. Eyes required an optician's attention, body posture was continually strained by sitting/standing at desks, and wellbeing was important as the research demanded intense time thinking-moving (not moving enough?) with theory-data. The spacetimes here, where I was encountering most of the empirical data, led to a more focused period of analysing that data alongside theory. Strategies for analysis are outlined in the next chapter.

Chapter 5: Entering the Meshwork, strategies for analysis

This chapter shows how I probed for analytic insights from data-theory to make the relations which were working in PL-PE practisings explicit. As already evident, I have sought to do research differently, by embracing multiple ways of *becoming with how* to investigate student-teachers learning to teach PL-PE.

What is important is that thinking differently offers a pre-cursor to doing everything in research differently: representation, writing, theory, ‘data’, collaboration, and so on... (Ulmer, 2017a, p. 842).

Although wary of the term ‘representation’ it is stated here with the purpose of showing that representation is being undone, and this includes analysing and *presenting* data-with-theory (see Chapter 6). In the current chapter I show how ethicoontoepistemological approaches outlined earlier were enacted during embodied, written, moving, ways of analysing and “thinking-with-through” empirical-theoretical data (Thompson, 2023, p. 236). In other words, how posthuman sociomaterial research was operationalised. It will become clear that the strategies for analysis relied on philosophies which have been presented in Chapters 1 and 3, that chime with PL, immanence, and retain a sense of movement.

Whilst presenting analytical choices, this is not to elevate the human and thus be contrary to the design of my research, which, as explored in the previous two chapters, flattened the ontological (Latour, 2005) and admitted ontological as multiple (Mol, 2002; Law, 2004). Rather, the discussion serves to demonstrate transparency of researcher actions which “co-merge” with research assemblages, events and research topic (Michael, 2017, p. 116). I lessen the opaqueness of what was done and how it was done, including my implicated presence as being “caught up in the aforementioned process as part of the ‘data’ of the research” (Mercieca, 2011, p. 2). Theories introduced in Chapter 3 and enacted during analyses are briefly revisited – that is, sociomaterialism and posthumanism, which challenge anthropocentrism and dominance of the human gaze. Further, as also introduced in Chapter 3, analyses of data-theory were informed by diffractive thinking, examples of which are presented here to show diffractive analysis during fieldwork. Key aspects of posthuman heuristics (Adams and Thompson, 2016) as

an approach to analysis are then introduced, as prelude to their enactment during subsequent analyses-discussion chapters. First, I explore the use of anecdotes because the analysis technique is used here and in all three analysis-discussion chapters.

Metaphors and Anecdotes

As was seen in Chapter 3, theory is laden with support from metaphors – Merleau-Ponty's flesh of the world (Dufourcq, 2022), Nietzsche's (1885/1971, pp. 61-62) "unknown sage" as the 'intelligent body' living in and being "your body", Whitehead's 'philosophical pillars' of PL, dropping stones into water replicating diffractive patterns (Whitehead, 1938; Barad, 2007; Hollin et al., 2017), and so on. Metaphor is also helpful in interpreting and understanding qualitative interview data, which is specific and located. Metaphors used by participants can express difficult, sensitive or complex ideas and reflections, and these might also be unconsciously produced (Steger, 2007). As researcher, too, I employ metaphor as a way to contribute to imagining, not as 'lens' or 'container' but as heuristic communication device. Indeed, metaphors, anecdotes and images (figures, pictures) are not static and are helpful as prompts along with text beside them (Decuyper and Simons, 2016). In the preface for Chapter 4 I likened the rules/attitude/means-ends of games and sports (Suits, 1972) to those of doing a doctoral thesis, which may be more of an allegorical device. Metaphors may be (and hopefully will be) read by the reader in multiple ways, since they might be culturally dependent (Lakoff and Johnson, 1980), interpreted on their own or in a wider sense with the text and other knowledges brought to-by the text. For my purposes, they are another already entangled device, such as the use of anecdotes.

In this posthuman research, humans and nonhumans contributed to anecdotes, fostering different ways of collating and investigating data. Moreover, anecdotes served to share experiences of events or happenings, with some factual and some fictional storying of events (Adams and Thompson, 2016), often setting up

tension(s). As I composed anecdotes, several iterations were necessary as blending data accounts around a happening/event required experimenting with which lines to follow, or which to disrupt (Masny, 2014). Anecdotes “weave together one or more aspects of the lifeworld that have been previously held asunder” (Adams and Thompson, 2016, p. 27), such as entangling human-nonhuman from across spacetimes - diffractions. In the context of PL-PE, anecdotes foregrounded empirical data to analyse how PL was being enacted (or not) in professional practices of student teachers. ‘Gathering anecdotes’ is a way for sociomaterialist researchers to present the minutiae or to focus on parts of practices at work in specific contexts (Oosterhoff et al., 2023). This is Heuristic 1 in Adams and Thompson’s (2016) guide to interviewing (digital) objects. As a tool for storying whether, how and why PL-PE may be enacted and indeed, what PL-PE meant to the participants in this research, anecdotes created a narrative to analysis-discussion chapters. The words of participants are interwoven in the narrative compilations from across empirical data. Anecdoting also provided a way of lifting and loosening the meshwork (Law, 1992), enough to dive into the entanglement, practising rhizoanalysis. This was particularly helpful since convergences of theory with philosophy with empirical data prompted a dynamic to-ing and fro-ing as I traced actors and their affects/effects.

Planned or surprising events, collections of things, and ways of storying these together are brought to the fore by me who, as being entangled in the research, is also part of the anecdote (Adams and Thompson, 2016). Production of an anecdote means that the anecdote becomes an artefact, it is an assemblage and is useful for further thinking and analysis. Anecdotes in my research were drawn from, for example, tweets/X posts, the absence of things, PE equipment, a lesson plan, a water bottle. Next, I provide an anecdote to exemplify one way in which analysis processes were embodied in movement – that is, to show *how* I moved-thought with-through data-theory.

Anecdote 5.1 - Somatic Analysis

Core Practice 3 (Spatz, 2019) asks for an object to be placed on the floor - a baseball cap is lain down. Many pins cover this cap, they are from multiple Olympics and countries and sit beside the *1996 Atlanta Olympics* logo on the cap (Image 4 Somatic Exercise). I am asked to breathe and to prepare to move. [Deep breath.] The audio asks questions as prompts to moving-thinking: ‘What motivated you to research this topic? What (in)formed your curiosity? Was there something that felt awakening?’



Image 4 Somatic Exercise

Moving away-towards the baseball cap and pins whilst thinking about three defining characteristics to do with my research, the following emerge: lifelong desire to remain physically active; physical educator; female. The three things are written on three pieces of paper, then these are positioned somewhere in relation to the central research topic (baseball cap – whether physical literacy is enacted by students). In moving to and fro papers and cap, different feelings emerge. (Later, further thinking and analysis would focus on how the responses will influence the research – perhaps interpretation or understanding is being made explicit here.) Spatz (2019) asks, ‘Is the feeling strong, comforting, belonging, alien, uncomfortable, and how might each paper relate to one another? Is there a

relationship between papers that means you move them apart or closer? What is the relative influence of each paper on the research?' A 'map' of the quality of relations between what is written on each piece of paper is being crafted.

During the exercise, tensions, comfort, personal assumptions, preconceptions, judgements, surface. These are made static as they are written in bullet points on the relevant pieces of paper. The audio then asks me to 'Feel still, a place of comfort. Sun is the topic; planets revolve around, and this includes researcher. Relations in motion constantly shift' (Spatz, 2019). Whilst focusing on breathing, surprising emotional responses about my personal and professional values surface – affective immersion whilst thinking about data and research direction. It is inherently a gendered response, but one that feels larger, global, distributed, flowing from outside me into depths of me and out again: "we too are dark chambers, impenetrable black boxes that reach deep into the local and extend broadly into the global" (Adams and Thompson, 2016, p. 111). The idea of being a strong female role model, with a sense of belonging to a project, brings tears to my eyes.

As depicted in the above anecdote, thinking and moving with theory was a rhizoanalytic entry into the middle of empirical (and I would add theoretical) data at various temporal-spatial points (Masny, 2014; Sellers, 2015). Hermeneutic phenomenology (Crowther et al., 2017, p. 833) also follows this line of thinking – that data moves, and the researcher dives into the "murky middle of existential experience". Hermeneutic phenomenology and rhizoanalysis are experimental because of the overlapping (Sellers, 2015) and dynamic nature of research assemblages. However, it could also be added that I and other actors, were already hives of intra-activity (Barad, 2007) who-which may or may not conjoin, co-respond *with* (Ingold, 2012; 2017) other actors. The flow shown in the above anecdote occurred during thinking↔theory and exemplified, for example, what was not observed during field visits or provided in participants' verbatim transcripts.

Recapitulation

The double-headed arrow ($\leftrightarrow$) was introduced in the introductory chapter and is a way of visually expressing the fusion of social and material binaries (among others), of conjoining thinking $\leftrightarrow$ theory, demonstrating the back and forth, movement, relations among each, and the in-between. Other strategies like 'new' terms, neologisms and symbols available on the keyboard (hyphens and the Em Dash (alt 0151 —)), further support these fusions. The engagement of symbols to help support nuances otherwise not available by plain text is returned to in later analyses chapters (6-8), where the effectiveness or otherwise of symbols becomes relevant.

The anecdote is a demonstration of how to surface that which linguistic data could not tell me about the research. As a device, the anecdote is not the only way of interpreting any kind of data-theory, indeed, no such device can claim to be a “‘silver bullet’ to the interpretation of narratives” (Steger, 2007, p. 19). As an heuristic device, the anecdote has shown how to move away from reliance on only the discursive (Barad, 2003; Markula, 2023), and as such makes an important contribution to how researchers might implement sociomaterial and posthuman methodological analyses.

The anecdote also embodies the fluidity and extended ideas that I have drawn from Spinoza's (2002) work. To help imagine and experience the dynamic and ongoing ways in which events are happening, the inner drive of *conatus* provides an understanding that humans and nonhumans are all one and immanent to themselves (Braidotti, 2019). For example, I already value moving and physical activity and come to this research investigation with a belief that this is important for everyone. The emotional responses during the somatic exercises were in part because I believe in the contribution to holistic wellbeing that a PL approach to PE *could* be. In admission, this is an inherent bias, and the somatic exercise foregrounded this affectively, adding to previous sharing of researcher positionality in Chapter 3. Involving the baseball cap, with its already immanent associations with-for me, also demonstrates the agency of things. Having been

worn on my head as a sunscreen in 1996, this actor's past-present-futures are unfolding as it becomes involved in working with data-theory. Alongside the somatic methodology, to aid organising and analysing many lines flowing in-from data-with-theory-with-researcher, several strategies were employed, and these are explored below. First, I present a word about anthropocentrism before detailing the role of diffractive thinking in the analyses.

Anthropocentrism

The Somatic Toolkit (Kieft et al., 2019) provided ways in which I could become embedded as part of the research process – such as to engage with some theoretical ideas in a performative way. Enacting conceptual play like this brought affective, physical and cognitive into the research at the same time, assembling, demonstrating an example of a 'knot' in the meshwork (Ingold, 2012). As ethicoontoepistemologically entangled in analytic processes (Barad, 2007), my experiences as PE teacher were diffracting with theory as explored in Anecdote 5.1. Further, processes like this challenge anthropocentric gaze (Hultman and Lenz Taguchi, 2010) by including multiple analytic practices.

In her critique, Barad (2003) foregrounds the anthropocentric epistemological dominance of research processes of both researcher and human participants. To challenge the anthropocentric gaze, I provided space for the nonhuman actors to 'speak'. By attuning to things (not only human) in the research assemblage the researcher 'sees' the world saturated in meaning, seeing things and humans concurrently (Adams and Thompson, 2016). As introduced in Chapter 4, another way in which I did this was to explicitly invite the material into interviews – each participant brought an artefact that embodied what PL meant to them at that time. Then, offering accounts of artefacts, already imbued with meanings, memories or sensory-based responses might also have been triggered (Hultin, 2019), adding to how each participant understood PL. Indeed, even during the three interviews, which were by necessity mediated by computer hardware and Teams software, humour and lightness of feeling were evident. For example,

Eileen recounted why she had chosen children's liquid bubbles as artefact to show how she understood PL, and she also enacted blowing the bubbles, all whilst smiling playfully. Arguably, these sociomaterial posthuman interviews offered something different because of the agency and situatedness of the nonhumans (Barad, 2007; Fox and Alldred, 2018). Interviewing with attunement and attendance to human and nonhuman helped later thinking about how relations were holding assemblages together. Thus, interviews were a demonstration of practising where no one actor was separate or conducting events. Rather, actors co-constructed, enacted interviews, which also highlighted how things were mattering in each particular assemblage.

Diffractive analysis

To retain the dynamic and performative approaches, the research analysis was informed by Barad's (2007) notion of diffraction. As outlined in Chapter 3 (Theory) and 4 (Methodology), diffractive thinking in relation to methodology *and* analysis has informed aspects of my research. As was demonstrated above, in Anecdote 5.1, "(D)iffractive analysis suggests theoretical, embodied and affective entanglements with data" (Taylor and Gannon, 2018, p. 470). This meant attuning to phenomena being studied (PL, PE) as these were entangling with other things (Fox and Alldred, 2023), which made it difficult to know where to begin analyses. Diving in or 'plugging in' (Jackson and Mazzei, 2012; Taylor and Gannon, 2018) could have been an approach taken, whereas 'interfering' with the assemblage is a tactic of diffractive analysis that seeks out the affects/effects of where differences might be occurring (Barad, 2007). Thus rather than plugging in as *conceptual* tool (Jackson and Mazzei, 2012), I refer to rhizomatic *processes* more akin to Barad's idea of diffractive analysis, as ways of analysing *with* multiple theoretical, empirical and personal data. I refer to the metaphor of ripples when stones are dropped into the water. Essentially, there was no one *re*-presentation of 'the data' – "diffraction functions as an analytical kaleidoscope" (Ulmer, 2016, p. 1382). Multiple ethicoontoepistemological (ripples) possibilities or lines, are retained - the messiness of research assemblages was invited during analyses.

Importantly, diffractive analysis challenges a more conventional research drive of 'making sense' or 'meaning making' with data, which is informed by a 'data logic' (Taylor and Gannon, 2018). To tidy, clean up, seek themes or to categorise multiple 'findings' from the research assemblage(s), not only severs connections among heterogeneous phenomena, but the epistemological is stabilised. Whilst wanting to embrace data as entangled with other things, and to reduce reproducing fixed re-presentative 'meaning' (Latour, 1996), criticism could be levelled that an interview on its own, for example, might not contribute to wider research questions. However, in this doctoral research document multiple data contribute to understanding the relational effects or affects emerging during student-teacher practisings. Sociomaterialist intentions offer ways of bringing to light how practisings *are coming to be* understood (Bueger, 2014). It has not been my intention to tidy up data, or to remove other already entangled actors.

It is unavoidable to enter research without the ethical being continually diffracted, and this was important for Barad's (2007) conceptualisation of Bohr's belief in the relevance of the research apparatus and researcher influence during his experiments (see Chapter 3). Researchers in the positivist vein may attempt to gain what is perceived as objectivity (Fox and Alldred, 2017), yet researcher selection of what is most relevant for inclusion and analysis in a document/experiment cannot be objective – processes in researching are inherently value laden and therefore, not objective (Todd, 2003; Standish, 2016). Indeed, as exemplified in the opening anecdote above, focus on flows of ideas, emotions, and tracing of these, including what things are doing, further decreases any claims to objectivity. The search for objectivity in this research has never been the goal but it is diffracting as the ripples of post-positivism are not quite dissolved.

Diffractive thinking has complemented the strategies for (diffractive) analysis as the theoretical, embodied, and affective have been entangled throughout. Diffractive analysis has been occurring as I have been (part of) reading empirical-theoretical through other data-theory, thereby gaining understanding of the

specific spacetimes - that is, in this particular worlding of PL-PE. The strategy of 'interfering' with data-theory must include researcher as one among many actors, already intra-acting with others in the meshwork, creating effects/affects of differences. For example, during the (white, female, middle-class, European, PE teacher) somatic exercise, affective responses were being diffracted with how I understand the ontological and epistemological aspects of PE. In the immediate aftermath when (re)tu(r)ning with theory, Spinoza's affect was found to be diffracted as response to the sense of movement from past-present-ongoing towards the not-yet. As was discussed in Chapter 4, where I 'cut' the meshwork was related also to how diffractive patterns were producing data that 'glowed' or was meaningful for this research and for me, during engagement in the exercise (Lenz Taguchi and Palmer, 2013). Thus, critiques of diffractive thinking, such as referred to in Chapter 4 – that is, researcher being so entangled that biases can be potentially 'fatal' for the project (Fox and Alldred, 2023) – can be addressed through the ontological flattening which encourages *effects* of affect to surface. Next, as further example of analysis throughout the research, I discuss how data and theory were brought together, organised and analysed.

Organising Data-Theory

As detailed in the Addendum in Chapter 4, there were many ways in which digital actors supported preparation of empirical data as it began to diffract with theory, and how PL was being understood by participants and me. Sociomaterial and posthuman sensibilities provided ways to disrupt and destabilise data (Hultin, 2019), whilst avoiding, for instance, producing codes, because in doing the latter, "difference is often shed in the interest of similarity" (Kuntz, 2020, p. 44). Coding tends to tidy up data thereby silencing, removing or reducing the visibility of some actors (Jackson and Mazzei, 2012; 2013). Further, coding tends to being static, fixing humanist concerns. I did not follow well-known forms of thematic analysis either (Braun and Clarke, 2006; 2019), but recognising diverse kinds of information, from theory-data and how these and myself were entangled, meant unravelling complex sociomaterial assemblages and finding patterns.

Figure 4 is an example of how I organised data from across sources and shows the research analyses processes enacting. How data travelled and where-how translations were occurring and effecting changes in data-theory can be inferred, as I had used headings associated with PL to organise information. I used blue highlighter, for instance, to show where 'Knowledge and Understanding' in/of PL might be evident across data sources – Figure 4 shows this in a transcript key at the top, and lesson plan comments in the middle. The image presents how I moved back and forth temporally and spatially with data which 'glowed' (MacLure, 2013b) or caused me to 'wonder' (Lenz Taguchi and Palmer, 2013). The date/time stamps where I made comments on lesson plans, for example, show that I was interpreting where aspects of PL were evident, during June 2021, and a few months after fieldwork (November 2021).

The figure presents interview transcripts which were generated by several digital actors from a Teams recording. The highlighted transcript then shows how commonalities, or patterns from the participants' information, was diffracting with theory-field notes (such as my notes from school visits shown in Chapter 4, Image 2). Transcripts, for example, included a key which was similar to headings on my observation notepad, showing practisings (as they were unfolding) diffracting with Whitehead's (2010) key aspects of PL. Attributing coloured highlighter to each aspect helped generate patterns across multiple empirical data sources (field notes/observations, transcripts, tweets/posts, lesson plans). Further, each participant was designated a pseudonym and a highlighter colour to better follow their words as they moved into the doctoral thesis text – Sarah was purple highlighter for example. Highlighted words/phrases were added-removed accordingly during (re)writings. Further evidence of data coming together is seen in Figure 4 after the straight arrow, where I amalgamated all data from one participant, hyperlinking to original sources. Hyperlinks allowed easy moving from combined text to original items that had been digitally stored.

2016). These demonstrate knots and seem to be static presentations of things brought together after unravelling a knot and showing traces of lines, such as in Chapter 7, Figure 6. The image on the page is static but captures a snapshot of the entanglements from multiple spacetimes, lines from which continue elsewhere (Adams and Thompson, 2016). I have tried to depict dynamic matters of what-who was researched and the doings of posthuman research in an empirical way (Fenwick and Edwards, 2010). This acknowledges fundamentally, that theory-with-data are becoming or halting elsewhere, already.

To make sense of practisings, or 'states of affairs' (Latour, 1999), it was necessary to unload statements, such as those from images or interviews. Presenting trails/traces for other researchers to follow is not to be confused with the positivists' desire to provide reliability (Cohen et al., 2018). In following a broadly postqualitative research philosophy (St. Pierre, 2013b), providing structured fixed guidance on 'how' to trace this or any other trail in the future, was not the goal. Rather, tracing was one possible way for me to follow internal workings of practices and lines that veered back and forth, not in linear fashion but more like slug and snail slime trails (Ingold, 2013), where even broken pathways do not prevent routes through/around/out/in (Adams and Thompson, 2016).

Lines across PE↔research meshworks

There is a physical activity which asks 'pupil 1' to travel along/across lines on the hall floor, with 'pupil 2' chasing/following. Pupils can travel by finding routes that follow lines, by stepping, hopping, or jumping from one line to another.

There is synchronicity with where-how I have been thinking with 'lines' and the work lines do in many PE spacetimes.

As one the many entangled lines, I attended to my own assumptions by being reflexive when choosing to highlight, or when making sense of-in data-with-

theory, whether patterns or themes or something else (Braun and Clarke, 2019). For example, I kept returning to field notes which had been quickly written, often made whilst standing or squatting at the side of an outdoor school playground. These, I think, were such quick note-taking activities that little conscious effort was placed on what-why I was writing. Traces remain of my preferred gaze, my unconscious biases, and historical-cultural PE experiences. Being mindful of how past traces enter spacetimes and were followed, was as much about recognising bias as well as being open to different practisings during these observations, as part of a posthuman attitude to remain open and flexible in research (Thompson and Adams, 2020). Indeed, following traces is following divergent lines as they were converging in assemblages and as they travelled onwards, if they did.

As a challenge to many binaries, sociomaterial and posthuman accounts refute linear hierarchies and analysis which 'normalises' certain practices, reducing possibilities in attempts to show cause and effect 'outputs' (Ulmer, 2016). This is an attempt to overcome what Deleuze and Guattari (1987) term 'interpretosis' – the tendency of some western researchers' to represent. Inherent within interpretation is the *deleting* of the materiality that was lived by the researcher and other actors (Decuypere et al., 2011). In doing the philosophical-with-multiple-empirical, this was my way of trying to keep the data alive whilst stabilising it onto electronic paper. Data was and is not static as it continues as lines of flight morphing assemblages. I have not followed each line; that is quite impossible. However, the ethico-onto-epistemological informing sociomaterialism are premised on data-theory always enacting (Hultin, 2019) and so there will be futures in which some intra-activity includes the actors that are being discussed here. There is another way in which data are kept alive, and this relates more to when I was analysing data-with-theory.

When the material-social, nonhuman-human, is kept alive during the processes of writing or co-producing analyses, this is what Law (2004) terms *inscription* in ANT. In other words, some "aspects of reality are transformed into material

entities/accounts – e.g. figures, diagrams and texts” (Decuypere et al., 2011, p. 124). The IPLA (2017) definition of PL is an example of a feature of my research which has undergone processes of inscription. After many iterations by Whitehead since 2001, the definition has been inscribed with ‘key aspects’ such as motivation, confidence, and so on. In research (Whitehead, 2010) and public consensus policy (Sport England, 2023), these are widely understood as being core to what is meant by PL, in part because they have further inscription devices informing them – such as philosophical works by Merleau-Ponty (2012, in Whitehead, 1987) and Sartre (1956, in Whitehead, 1987). As well as being displayed as text, the IPLA definition can also be summarised in visual form, as introduced in Chapter 2 (re-presented below as Figure 5), where key aspects can be foregrounded, whilst only a hint of the philosophy informing PL is visible.

Being presented succinctly, Figure 5 might be a starting point for understanding PL. As inscription device, the diagrammatic presentation can foreground materiality which is not always available. Such as here, all aspects are in relation for PL to be enacting and there appears to be equal weighting to each aspect. In research practisings however, student-participants occasionally thought they were too focused on ‘physical competence’ - an idea which becomes clear during Chapter 7. Each time PL is inscribed differently, processes of translation have also been occurring - I discuss translation below. By making visuals, figures, diagrams, I am/have been creating artefacts, which were not in the original research assemblages. Analysis through diagrammatic, and I would suggest, moving, has been (re)constructed for the purposes of writing-sharing-conveying the research in posthuman and sociomaterial ways.

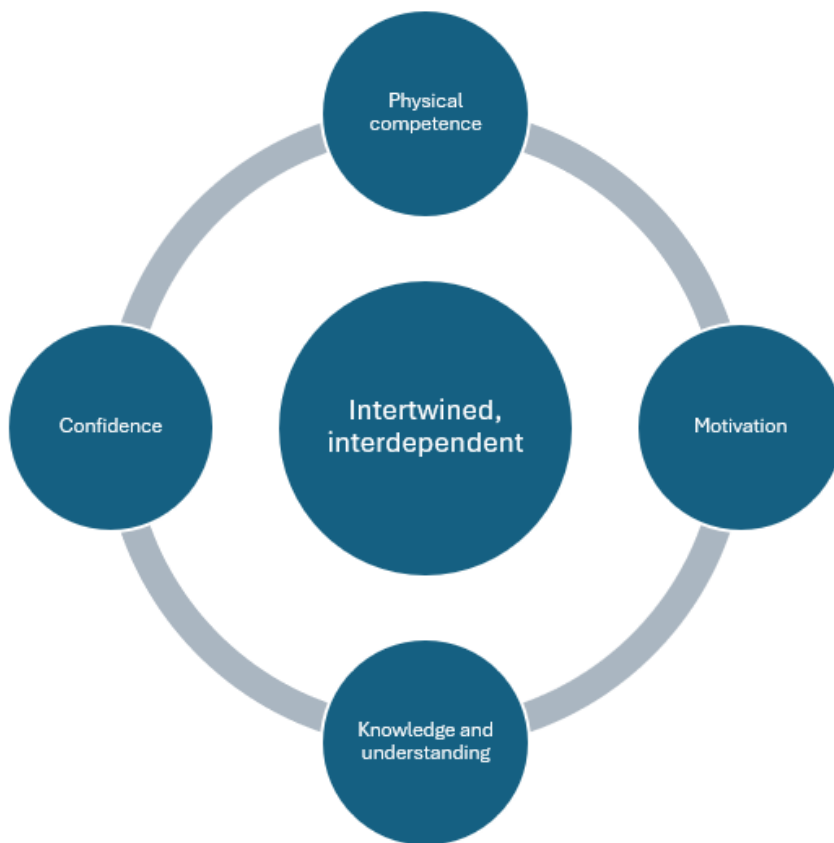


Figure 5 Key Aspects of Physical Literacy (Whitehead, 2010)

Entry and Egress Points/Rhizoanalysis

A subtheme of ‘cutting’ emerged when I was in the field, taking notes and making sketches as well as when thinking about how and what to analyse, further showing how these aspects of research overlap or are entangled. In addition, my presence in the research field was already interfering-contributing-interpreting events or happenings. In many ways, I was interrupting practices *physically*, such as whilst making walk-through cuts during PE lessons but interruptions also occur where affects or theories are/were being read through one another – diffractions during observations. Once away from the field, diving into the middle of the data was a way of cutting the meshwork. Rhizomatic analysis became a way of thinking about data without the functional boundaries which arguably delineate much research. In educational contexts, rhizomatic analysis has been explored in ethnography (Masny, 2014), early years education (Sellers, 2015) and the outdoors (Mannion,

2019), for example, and maintains a decentring of the human which aligns with the ethicoontoepistemological approach taken here. That is, analysis invites multiple ontologies and is not representational, since representation “limits experience to the world as we know it, not as a world that could be, a world of production, invention and experimentation” (Masny, 2014, p. 351). Being already in the middle of things concurs with *conatus* but also rhizoanalysis, since each idea operates in a philosophy of immanence (Deleuze and Guattari, 1987; Spinoza, 2002; Masny, 2013). As a response to the opening concerns of the present chapter, of doing research differently, of not elevating the human, rhizoanalytic practices meant entering the theory-data anywhere, whilst also being a process which is always becoming (Masny, 2013). Features of rhizoanalysis resonated with the fluidity flowing through the writing.

As entry point into the often-concealed relations working to hold/not hold assemblages (Koro-Ljungberg et al., 2018), I return to Barad’s (2007, p. 33) term “intra-action” or what Whitehead (1938) called the ‘betweens’. Language has meant that humans can articulate the organisation of things in words, and it has been interesting to work out how to present what might be the between, the relations, the ‘unseen’ in this research. As actors ‘emerge through’ intra-activities and each thing requires another for its existence, none is a separate entity. Further, intra-action is matter having the capacity to alter assemblages, matter is lively (Bennett, 2010), and so agency is attributed to matter (Barad, 2007). This means matter is agentic, and to attribute agency to data which is not human may seem controversial, perhaps even science-fiction. However, as a different way of coming to understand whether PL-PE is enacting in student practisings, the affordances provided by this way of thinking offer multiple insights. As mentioned earlier, where to make an “agential cut” (Barad, 2007, p. 178) means that the researcher is attuning to interesting or novel events or activities. The researcher is responsible for a part of how assemblages are happening, as part of the “material becoming of the universe” (ibid.), as an agent among many, employing experiences and insights to make cuts for analysis. Again, ethical responsibilities are infused through making choices about which data-theory is then organised,

analysed and presented (Lenz Taguchi and Palmer, 2013). Theory, research and ethics are working *with* researcher to guide making these cuts. I return to intra-activity in Chapter 6 where theory-data is presented as interwoven.

Heuristics as Approaches to Enquiry

As a further entry into analysis, I introduced a set of heuristics that at different stages of analysis prompted other ways of questioning data-theory. As a mix of sociomaterial and posthuman sensibilities, several heuristics were “offered as *possible approaches to enquiry*” (Adams and Thompson, 2016, p. 20, italics original), “a possible compass, not a complete roadmap” (ibid., p. 109). Although introduced here, they are explored in the subsequent analysis-discussion chapters as they became entangled in the research. The heuristics have helped direct ways of looking, interviewing, and following data-theory. This is very much in line with Law’s (2009) call for ‘doing empirical philosophy’. At the same time as doing empirical then, I am putting abstract concepts to work, since concepts are not fixed, and philosophy too, is practical (Lenz Taguchi and St. Pierre, 2017). The analyses emerged from the following Heuristics: 1 *Gathering anecdotes*; 2 *Following the actors*; 4 *Studying breakdowns, accidents and anomalies*; 7 *Unravelling translations*; 8 *Tracing responses and passages* (Adams and Thompson, 2016, p. 21). I outline key ideas of how to ‘speak’ with things, ‘translation’ and tracing relations, each of which underpins or informs reasons for why each heuristic shaped subsequent analyses.

Following the discussion from the Introduction chapter, it is worth referring briefly to COVID-19. It was stated that this is not a ‘COVID thesis’ but the global circumstances were influential in affecting activities in education and this research. Heuristic 4, *Studying breakdowns, accidents and anomalies* offers a way of investigating the different effects of PL-PE assemblages, due to the overarching breakdown caused by COVID-19. Direction for this was prompted by a question from Adams and Thompson (2016, p. 49) - “(I)n the wake of a breakdown, accident, or anomaly, what practices and things become more visible?”.

Breakdowns can offer “analytically generative moments for understanding” (Ebeltoft and Beck, 2023, p. 1401) and the following analysis chapters capture many relevant moments. COVID-19 prompted very different practisings in schools and research due to massive disruption as a result of restrictions on people-things in PE. Although limiting the number of school visits I made, the “*interconnectedness* of actors, knowledge and materiality” (Ebeltoft and Beck, 2023, p. 1401) was shaken up from the slumber of ‘normal operating procedures’ thereby adding different understandings. Unexpected events and relations became visible, hence the relevance of this heuristic. Analysis strategies were an entangling of theoretical (and possibly theatrical) treatment of moments of breakdown in education. The example of COVID-19 as breakdown of a global event is unusual since breakdowns are often based in more localised, specific practice episodes – such as the technology not working to share screens with students. The overarching contribution of COVID-19 as breakdown was, ultimately, productive in unpredictable ways.

Heuristic 2, *Following the Actors*, (Adams and Thompson, 2016, p. 33) will be explored in the first analysis-discussion chapter (Chapter 6). To ‘follow the actors’ (Latour, 1996; 2005) offered a way in which nonhumans might ‘speak’, and these included PE equipment and lesson plan template. Chapter 6 offers the reader three columns to be followed individually, vertically, or alongside and/or entangled. Reasons for the presentation format are argued in that chapter, but the aim is to show entanglements of the theoretical-empirical-reflexivity/analysis (adapted from Fox and Alldred, 2021). I focus on key examples from empirical data – calling these ‘lures’ after MacLure (2013b, p. 228) and the desire to sit in the middle of wondering↔coming-to-know, stimulated by data which fascinates, “glows”, or induces a sense of “wonder”. In Chapter 6 I diffract aspects from the philosophical-empirical meshwork for analysis-discussion in Chapters 7 and 8 and ‘elsewhere’. ‘Elsewhere’ is in spacetimes where students continue becoming teachers, or for further thinking beyond the final chapter of this doctoral thesis. I suggest that the columns also make visible entanglements of assemblages in which I am one actant (Latour, 2005). I am another thing entangled, thereby

showing how the researcher-things do not pre-exist one another (Barad, 2007; MacLure, 2013b) and researcher is also “*becoming with* the things of their research” (Thompson and Adams, 2020, p. 340). I addressed some of my presence through the third column where reflexivity for further analysis is written.

Heuristics 7 (*Unravelling Translations*) and 8 (*Tracing Responses and Passages*) (Adams and Thompson, 2016, pp. 74 and 81 respectively) extended knowledge and understandings generated from following the actors whilst associations were traced along lines into-from assemblages. In particular, Heuristic 7 asked questions about how actors were associating, how they might have been holding an assemblage or event together or not. Political activities, multiple (Mol, 2002) and unintentional realities (Law, 2011) were surfaced during these analyses-discussions. In Chapter 8 how flows of connectivity were generated are examined as actors became ‘strings of mediators’ (Callon and Law, 1997), ordering and re-orderings things. For example, pupil learning was notable even with no equipment on the lesson plan but during the lesson an imaginary television remote provoked *how* pupils were to move (fast forward, slow motion). The ANT notion of ‘translation’ was relevant for investigating this kind of minutiae, of *how* two actors were coming together to effect change, and this is discussed herewith. Heuristic 8 afforded ways of tracing how different actors were in relation with one another (data encounters), to provide a relational account of these associations (analyses) (Decuyper and Simons, 2016). Where actors were conjoining and/or creating points of tension, multiple lines were converging, creating knots (Ingold, 2012) and this became relevant for understanding how students were becoming teachers during PE and/or PL-PE. The ‘meshwork’ was introduced in Chapter 4 but returns in relation to Heuristic 8. Adams and Thompson (2016, p. 84) note:

It is important for the inquirer to attune to an assortment of moving lines and how these may intertwine: a form of meshworking. Things are relational. ... things are continually becoming. They are lines of movement.

Both heuristics 7 and 8 contributed to the activities of things in PE and PL-PE across multiple spacetimes. Diagrammatic techniques are presented in Chapter 7 to support analysis-discussion. Next, the key idea of translation is introduced.

Translation

It might not be possible to make all relations or things which shape and inform PL-PE explicit. The logical move might be to follow ‘the’ definition of PL into practice. However, in moving from definition of PL – that is, knowledge presented as textual and fixed – to whether PL is enacting in practisings, means unravelling the ‘translations’ that have been contributing to that ongoing story (Callon, 1986; Latour, 1996). What if I came from the other direction and tried to follow the stories (plural) of whether, how and why PL-PE practisings help understandings of PE and PL? Or, what if theoretical PL—previous empirical research—this empirical data—my own PL experiences are travelling at the same time? Like Callon’s (1986) fishermen, scallops, researchers, and scientists, actors/things that are implicated in relations in PL-PE might become visible. For Callon (1986, p. 224),

translation is the mechanism by which the social and [material] worlds progressively take form. The result is a situation in which certain entities control others.

As outlined in Chapter 2, PL may not be translating (in the everyday use of that term) from theoretical/philosophical understandings into teaching PE in schools. Chapter 7 attends to details from multiple empirical data to make translations (in the ANT sense) visible. The intent is to undo *processes* which are often hidden, such as exposed in relation to international children’s rights and Scottish policy (l’Anson et al., 2017). In discussing the United Nations Convention on the Rights of the Child (UNCRC, n.d.), l’Anson et al. (2017) present a recent and ongoing example where translation is restricting how a rights-based education might be informed. The legal and ethical charge communicated via national policy, such as GIRFEC (Scottish Government, 2008b) in Scotland, results in a reduced, mostly technical version of what is an utterly ethical issue. The move from policy to classroom practice omits multiple versions of the ethics involved in children’s rights because these are not contested, and processes are not made visible (l’Anson et al., 2017). *Processes* are ultimately ethical in nature since they involve human-human/thing actions (Law, 2011).

It seems to be that during multiple points of change, of transformation, translations occur but can be quashed and become hidden. However, deliberations of PL are often visible in open discussion during which its meaning is wrestled with (Carl et al., 2023a). Thus, the expression and enactment of PL is critically debated *prior to and simultaneously with* practisings of PL. This activity could be holding off a definitive understanding of the concept, refusing to 'black box' it (Latour, 1999b). Can PL become a 'policy', actor in policies, or not? Indeed, to be meaningful, any translations where PL becomes part of PE may include the idea that it is not fixed, it is malleable and dynamic, therefore always '*becoming*' (Biesta, 2016; l'Anson, 2018).

To trace relations, or associations among actors, is to make visible how translations have generated transformations between actors (Latour, 2005). Describing this process, Latour (2005, p. 108) refrains from calling translation an actor itself but refers to it as a process of "transporting transformations". That 'process' is translation (Callon, 1986) – wherein two mediators affect/effect some kind of change or series of changes, in a specific situation. Importantly, Latour (1999a) and proponents of sociomaterialism (Mol, 2002; Law, 2004), provide examples of tracing internal workings of assemblages, with trails being followed back and forth, like a web or mesh. Along trails, some things are redistributing and some transforming - such as in this case, signs on the pages of philosophy, policy, and in practices (or not) of PL-PE. What is not entirely clear is how two things are 'linked' during translation, if those two things that were different, relate and enact a change (Law, 2009). These 'in-betweens' are continually (re)addressed in my work, as I suggest that these 'fleshy' (Merleau-Ponty, 2012) in-betweens mean there is no gap, but rather energies where relations are enacting transformations.

Relations have been called 'reference points', or as Latour (1999b, p. 71) says, "phenomena are what *circulates* all along the reversible chain of transformations, at each step losing some properties to gain others". The 'circulatory reference'

might be that working in the ‘no gaps’, ‘in-betweens’ - for example where interpretations of PL texts enact changes, interrupting or casting doubt on meanings. During ITE, students learn to complete a lesson plan template, and this skill is brought to placement experiences. The plan is brought to the classroom to inform how to teach a certain PE lesson. On reflection, mediators that have converged onto/into the plan stretch back to university lecturers round a table deciding the layout of the page, creating space for Education Scotland terminology current at the time. Relevant policy texts are working in the background but have all but disappeared by the time the template is shared with students. Students bring content from their experiences (home-school-community-lectures-websites-) and present this as written discourse on the plan. Arguably, the lesson plan *template* has already been ‘black-boxed’, in that the plan remains the plan after the event. Further, in Latour’s words (2005, p. 38), the plans were “intermediaries” – and occasionally the plans did not induce changes (such as learning not occurring). Arguably, COVID-19 disruptions meant lesson plans were largely deviated from. This will be exemplified in later analysis chapters. The point here is that when COVID-19 interrupted the lesson plan templates, they became actors, mediators transforming at some points along tracings in this example.

At points of translation inter- or intra-relational activity of actors has brought about an effect/affect. For example, I am typing on a plastic keyboard, and the effects are seen on the screen in front of me. Translations occurring include the tangible noisy keys as well as the intangible thinking and bringing forth relevant knowledges through my fingers (hitting keys with varying degrees of accuracy). Multiple translations are working as the goal of producing a doctoral research assemblage is enacting. In taking away the material things – such as keyboard, books, screen, chair – I, the human thing, am left with little agency (Law, 1992) in this assemblage. Similarly, removing equipment in PE altered movement experiences, pedagogical options and becoming teachers due to policy changes associated with the COVID-19 pandemic (Education Scotland, 2020). Points of translation were continually assembling, or contexts were being “appropriated and reconstructed” (Ward and Quennerstedt, 2015, p. 590). Aside from this

reinforcing the argument for the fluidity of concepts, this hints at the deeper issues of translations occurring across spacetimes, where past-present-future PL-PE are enfolding-unfolding. In Chapter 7, the effects of translations will be made explicit through analysis-discussion with data.

Chapter Conclusion

In this chapter I outlined the strategies for analysis which chime with the overarching sense of movement, dynamism, *conatus* which permeates my work. Moving along multiple lines into/away from documents, definitions, lecture content, PE lessons, interviews, PL-PE, leaves traces. Rhizoanalysis allowed for dives into various middles (Sellers, 2015; Hordvik et al., 2021), hence 'lifting' and loosening several meshworks to enable 'seeing' and tracing lines of flight that were interwoven. To investigate whether PL-PE was enacting as students were becoming teachers, this meant engaging with posthumanism during analyses, to make 'fuzzy' the subject-object binary (Adams and Thompson, 2016). To reiterate, social-material configurings are not fixed, concepts are dynamic (Barad, 2007; Lenz Taguchi and St. Pierre, 2017; Hardman, 2019) and it is upon these principles that the analysis strategies have been based. Efforts have been made to maintain the messiness of theory-philosophy entangling with empirical, since "(C)oncepts are indeterminate outside of the appropriate material conditions needed to make them intelligible" (Barad, 2010, p. 253). Reading and understanding conceptually is also a practising, a dynamic doing which I live, and they live through me (Lenz Taguchi and St. Pierre, 2017; St. Pierre, 2024b). Philosophy, theory, observations, things, me, are all passing through/emerging with my senses or apparatus, and the thesis is an unfolding of these (Neimanis, 2017). Thus the strategies for analysing theory-data (the apparatus) are also entangled and this chapter has sought to show how sociomaterialism and posthumanism expressly enable understanding the entanglements.

The enlisting of a somatic toolkit, and several heuristic devices, has been outlined and shown to support how I investigated the multiple lines of flight into/away

from research assemblages. Following actors, unravelling translations, and tracing responses and passages were engaged alongside discussion with empirical data and theory. Each of the three following analysis-discussion chapters are enactings of these heuristic approaches. The key idea of translations was seen above, to inform how effects of changes, of differences, were enabled by following actors and traces. Judging whether PL documentation has ‘translated’ into practice might be better questioned by “gauging the uses and merits of specific translations – which involve losses and gains and misunderstandings, but also the possibility of new affinities and attunements” (Felski, 2016, p. 752). Rather like Barad’s dropped stones, the effects/affects rippling from and overlapping with one another, create things anew (Hollin et al., 2017). Where policy-practice ripples are effecting/affecting PL-PE practisings, the areas of overlap are the diffractive patterns showing, for example, different physical activity experiences for pupils.

When I discuss theory-with-data in the next three analysis-discussion chapters, it will become apparent that ‘collateral realities’ (Law, 2011) emerged with the pandemic. This is in contrast to some critics of ANT-based research who suggest that by focusing on ‘networks’, ANT cannot adapt to include unexpected happenings (Pennycook, 2016). However, I would contend that both sociomaterial and posthuman sensibilities do embrace possibilities – indeed certainties – of change. For example, spacetimes were troubled because of COVID-19 restrictions during data collection period (the period of which did not alter because of COVID-19, ironically). By seeing spacetimes as non-linear, multiple PLs emerged, some of which were collateral realities of pandemic restrictions in relation with PE equipment (or lack of), for example. Whilst (re)drafting and creating the analyses, I found the process of doing analysis and discussion *all at once* brought trouble as well as excitement. Thus, in analysis chapters which follow, presentation will challenge how to read what the (post)positivist research traditions call data/findings/results. I

worked to disrupt the ways of thinking that a conventionally linear construction demands enabling a more playfully generative processing through the middle (Sellers, 2015, p. 10).

The three-column format of the next chapter presents theoretical alongside empirical data lures arrived at by following the actors, and shows how things enacted snapshots of happenings. The sense of wonder informing the theoretical basis of this research and into analyses, offers openings rather than closures (MacLure, 2013b), and such openings fill column three for ongoing discussion in subsequent chapters.

Chapter 6: Follow the Actors, analysis-discussion

1

The following three chapters show analyses of empirical data *with* theory - introduced earlier and augmented below. As mentioned in Chapter 5, each of the three analysis chapters includes anecdotes as a way of lifting meshworks to help loosen them, to 'tease the social and material apart' (Law, 1992). Teasing them apart was not deferring to dualistic methods but enabled a clearer view of the connections in heterogeneous *agencements/assemblages* (Deleuze and Guattari, 1987; Gherardi, 2021). Throughout the next three chapters, guiding questions from the heuristics introduced in Chapter 5 were employed to help me follow lines of flight and see the effects/affects of actors in PE assemblages. The heuristics guiding analyses were: 1 *Gathering anecdotes*; 2 *Following the actors*; 4 *Studying breakdowns, accidents and anomalies*; 7 *Unravelling translations*; 8 *Tracing responses and passages* (Adams and Thompson, 2016, p. 21). I would reiterate that Heuristic 4 – *Studying breakdowns, accidents or anomalies* – was a useful way of framing the data collection period of my research, which was unavoidably influenced by the COVID-19 pandemic (a breakdown).

Heuristic 4 helped unravel multiple lines, the idea onto which I build lines of flight, and these permeate the next three chapters. For example, Sarah's lessons plans and practisings, emerged alongside imposed COVID-19 government restrictions. Throughout these three chapters, I will reflect briefly on possibilities, indeed "collateral realities" (Law, 2009, p. 1) which seemed to be enacted during a 'breakdown', the effects of which included disrupting practices in education and in researching. My perspective during the data collection and subsequent analysis chapters was that I was not working on a COVID-19 thesis but the pandemic and effects/affects during this time were part of the meshwork - from March 2020 when restrictions were introduced in the UK (Institute for Government, 2022), to August 2021 when I completed transcribing participant interviews. After this time, COVID-19 remains as one actor among many in the research processes and this final textual account.

Several questions from Adams' and Thompson's (2016) heuristics are offered as guides for the researcher. Alongside Heuristic 4 (the breakdown), *Following the Actors* (Heuristic 2) was guided by:

Who-what is acting? What are they doing? Are some actors more or less powerful than others?

How have particular assemblages of actors come to be configured? What sort of work does this assemblage do or try to do? (Adams and Thompson, 2016, p. 33).

The focus of this first analysis chapter was to practice rhizoanalysis by entering the middle of data-theory (Masny, 2013). Data which glowed (MacLure, 2013a, 2013b) are presented and interwoven with theoretical sensibilities of sociomaterialism and posthumanism. The technique of following an actor meant attuning to flows around/through/in/by an actor (Adams and Thompson, 2016) in a meshwork/across meshworks and on reflection, there was jostling for position among actors whilst I drafted the text below. This jostling occurred many times as actors – whether PE equipment, human, concept – also 'kicked back' (Barad, 1998) as I was thinking about and getting-to-know the research assemblages. Latour (2005, p. 47) makes it clear that following an actor should not be guided by what has "currency in the rear-world of the social" because fundamentally, the social is always emerging with material. To seek to understand PL-PE was to remain open to possibilities that the unusual, hidden, lively, or puzzling, might bring. Next, I open analysis with an anecdote, to enter the middle of empirical data and situate student-participant activities.

Anecdote 6.1 - Social Media as Ontoepistemological Assemblage

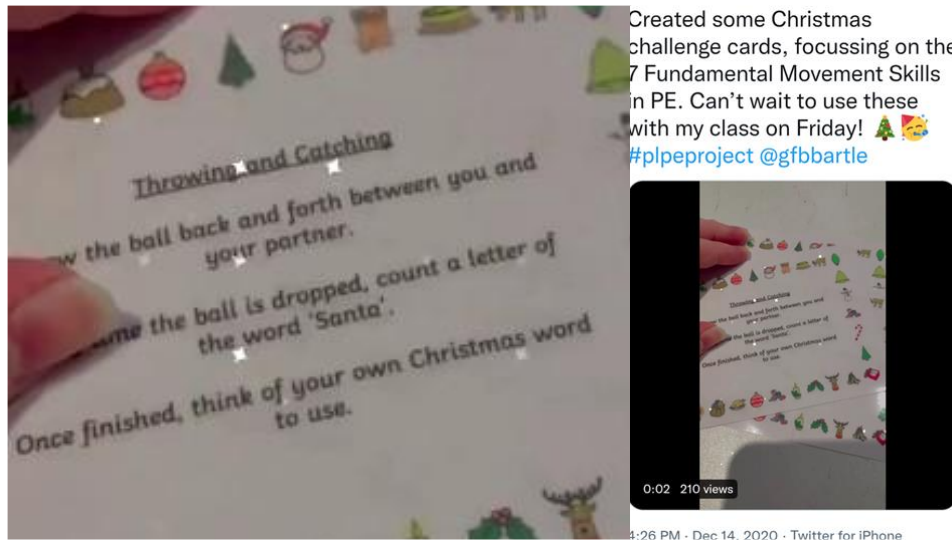


Image 5 Tweets/Posts, Erin, Dec. 2020

Erin cannot wait to use these with her class on Friday! This is Christmas time and the colourful images on the homemade cards reflect Erin's enthusiasm for creating fun – but educational – lessons! A class of pupils ages 7-8 can understand the instructions because the text is brief. Working in pairs, a ball is being sent and received, and at the same time pupils are making wordplay. This is quite complicated - children have to move the ball and make a word. Drop the ball and you are penalised! The pressure is making demands on concentration as well as physical competence, and the ball is actively seeking to be thrown and caught without being dropped on the wooden floor. Erin's focus for lessons is on '7 fundamental movement skills' which will inform future physical activities. The ball encourages development of at least two of these skills, but this is not all that is developing. With pupils cooperating well, they feel success, and this means that they are communicating, showing core stability by standing ready to receive or throw a ball, using eye contact and hands up – assuming the 'ready position' for their partner. These are all aspects of PL. More than physical skills are being challenged.

This anecdote has been written to show how actors were converging to enact PL-PE and that Erin's tweet (her post on 'X') becomes an artefact of

ethicoontoepistemological knowledges. Cards created by Erin include knowledges from PE policy, from digital design features of the social media platform, informed by the time of year and movement skills foundational to PE. The knowledges are performative, tacit knowledges, to be enacted by pupils in the gym hall. Lines are coming and going as part of a four-dimensional meshwork working to hold and communicate with pupils and then with anyone reading the post (tweet). The post becomes an artefact that has collated past and future PE lessons. Image and text become Erin's practisings (Michael and Munday, 2014), and the post hides the diffracted readings of different knowledges that are enfolded within it.

Erin posted more than any other participant. Communicated in this post are the effects on physical activities of pupils via the card instructions. Movements are being bound, guided, encouraged by the written text. Static appearance of text belies the intended, provoked, desired movements asked of pupils by the cards. Diffraction ripples are with/to/from policy and PL-PE lesson. Whilst physical competence seems the main aim here, the affective domain is foregrounded as pupils show motivation and confidence to try the skills, thereby also demonstrating knowledge and understanding about (at least) how to send a ball without losing one's balance. PL and Significant Aspects of Learning (SAoL/Key Learning, Education Scotland, 2014) are permeating the post's assemblage; card—ball—Erin distribute the messages to the pupils, and pupils—balls enact the instructions. The assemblage of ball—pupils—cards—SAoL—PL-PE is depicted in this one post, which has invited multiple directions of further thought, activity, and diffracts across spacetimes.

The post has flowed into this thesis, becoming an artefact and/or another actor. The relevance of an actor and what that actor does or does not do, will serve to detail further analysis now. As explained in the previous chapter, the format of the following text is my way of presenting theory-practice as interweaving, emerging, dynamic, inseparable, to refuse strictly chronological data presentation. I am seeking to find out if connections or relations become visible during diffractive readings of data (Ulmer, 2016) of a non-linear lifeworld. This is what Jackson and

Mazzei (2012) call for in doctoral work – that is, *not* (I paraphrase) ‘presenting a theoretical framework, coding data to represent what I have found’. Thus, theories explored in response to addressing what was missing in PL (see Chapters 2 and 3), have contributed alongside empirical data, avoiding ‘frameworks’ and attending to what was emerging.

As introduced in Chapter 4, inspiration for different layout came from *Troubling the Angels* (Lather and Smithies, 1997) and *The Body Multiple* (Mol, 2002) and how each presents empirical, alongside researcher journey with theory, on the same page. ‘On the same page’ literally and metaphorically, suggested to me that I experiment with presenting data-with-theory in two columns on each page. However, discussions with the supervisory team led me to include a third column (on the right in this chapter), taking some lead from the Ancient Hebrew scrolls, which could have up to eight columns, depending partly on the size of animal hide on which they were written ([Memorial Scrolls Trust](#), 2022). Another consideration was whether to write each column first as a ‘portrait’ layout just like this page. However, the whole point was to challenge that single page presentation wherein interview quotes or images might be inserted and read in linear fashion. As mentioned in Chapter 5, I follow Ulmer (2017a) whose sentiment was that when thinking differently, it is important to maintain that throughout the research phases. The purpose was and is, to “reorient thought” (Lenz Taguchi and St. Pierre, 2017, p. 643) by placing philosophical thinking in column one, and in column two, data which glowed or ‘lured’ me. The third column shows where I follow actors and collections of actors into the next two discussion-analysis chapters (7 and 8).

Philosophising/Theorising

I have been using the term ‘posthuman’ to move beyond centralising the human, and bring organic or inorganic, human or nonhuman things into this investigation. To build on earlier discussion on posthuman from Chapter 3, I note other possible terms. For example, Thompson and Adams (2020) use ‘more-than-human’ and interchange posthuman and more-than-human in their work. Strom and Lupinacci (2019, p. 112) present “human-and” as another way of moving towards other or away from human only, which Haraway (1992, p. 313) also does with her term “unhuman”. Kuby (2017, p. 877) posits that the more-than-human ontologies also fall under what she calls

Indicative Empirical Lure

The empirical lures presented here are from observations and interviews. Interviews were with human and nonhuman participants. During three different field visits I observed a student teacher (two visits, Sarah) and a primary PE teacher (one visit, Eileen). Details of data encounters and human participants were outlined in Chapter 4, and summarised in Appendix A.

The data from lesson observations included many actors to follow, but as outlined in the neighbouring column, some things glow, are ‘powerful’, ‘excluded’, or are more clearly associating

Lines of Flight

Avoiding the human centric is not easy as I tried to research with posthuman-sociomaterialist. For the posthumanist aspect of this research, Thompson and Adams (2020) provided a frame of reference for how to hold posthuman research to account, asking ‘what is its worth in everyday practices?’ In brief response to this question first, the practisings of primary ITE students teaching PL-PE are complex assemblages, and these are illuminated through posthuman strategies during the three analysis-discussion chapters. Second, thinking with data-theory from multiple sources is enacting a diffractive approach, as outlined in earlier chapters.

“an umbrella term” of posthuman, on which I settle in this doctoral work. Further, I have considered using a different term to refer to things, such as ‘Body(ies)’, as Spinoza (2002) did, to better serve my writing. Bodies could refer to anything, and theorists such as Bennett (2004) have taken as their point of departure, terms like ‘body materialism’. Two factors influence why I am not adopting the word ‘bodies’. One is that body materialism seems to remain rooted in human body (Bennett, 2004) and second, there remain strong associations of ‘bodies’ with physical-biological bodies. I suggest posthuman, without a hyphen, to provide a sense that there is not a split, not an in-between

in events or activities, or are shutting things down. The data lures discussed here are actors or collections of actors (assemblages). After visits to PE lessons, assemblages, which included PE equipment, education policy, theory and previous research, provided opportunities for analyses which are presented here from various points in the middle. Relations among these data lures, and others not immediately visible, are traced from entering the middle of practisings of PL-PE. Had the methodology been limited to phenomenological interview with Sarah and Eileen, opportunities afforded by the posthuman and sociomaterial might not have been surfaced.

Overlapping ripples create insights from my own experiences, sociomaterialism, posthumanism and Spinoza, empirical data, PL theories, and diffracting these through one another also challenges researcher dominance and human centrism (Lenz Taguchi and Palmer, 2013). On reflection, it felt like the dynamic nature of things pulled me into the middle of assemblages and during these moments Bennett’s (2010) descriptions of lively data lessened my, and other human, presence. The ‘I’ of human centrality became less relevant because of the activities of things - like the importance of water bottles in hot weather. This is one way of fulfilling how the posthuman aspect may be held to

human and other things. There may also be multiple posthumanisms, such as the research methodology, theory, or ethics (Ulmer, 2017). Overall, posthumanism is an invitation to “think critically and creatively about who and what we are actually in the process of becoming” (Braidotti, 2013a, p. 12). In relation to my research methodology, ethics, and desire to encompass all kinds of things, posthumanism seems to fit well with the questions I am asking about PL-PE and students becoming teachers. Drawing from Barad and Gandorfer (2021, p. 18), posthumanism is a way of seeking “what differently constitutes the human – and for whom” in specific senses. The ethicoontoepistemological ways of

During PE lessons, the dominant gaze appears to be anthropocentric because there were many pupils being observed by teachers, teachers were observed by pupils, as staff encouraged and managed smaller groups within each of Sarah’s lessons. I watched pupils, teachers and Sarah and Eileen. Pupils watch one another, copy, contest, play with. Sarah and Eileen gaze over the whole lesson as well as interjecting when they see something upon which to comment. However, a sociomaterialist sensibility evokes a shift in subjective gaze from one of anthropocentric dominance to multiple ontological perspectives. As already described in Chapter 4, I

account (Thompson and Adams, 2020). The next two analysis chapters provide more detail to indicate ‘doings’ of posthumanist research. The remainder of this chapter-column shows the entanglements of researcher-researched-research, providing analysis from the data lures—theory from columns two and one.

When walking through or around PE lessons, I felt ‘exposed’, and more attentive to things. Masschelein (2010, pp. 46-47) suggests that the researcher is more present, trying to be without judgement whilst re-orienting, and in this experience, I did feel less at home than other lessons because there were more pupils than expected, for example.

theorising are not from a humanist starting point, but, as discussed in Chapters 3 and 4, from the middle of the already materially constituting world (Barad and Gandorfer, 2021).

Importantly, for posthuman research, the researcher ‘lingers’ with things which beckon (Bennett, 2010), including humans; thus, humans are *among* things-in-the-world – “one *type* of object among many” (Bryant, 2011, p. 249). The terms ‘object’ and ‘thing’ might be conceived differently – for instance, objects may already be fixed whereas things are constantly altering and being altered, in flux (Harman, 2009). Objects may be associated with ‘instrumental’ “abstract”

disrupted my own gaze as I walked ‘through’ PE lessons. In addition, these walk-through cuts seemed to disrupt the gaze of other things as well.

During different visits to different school playgrounds, empirical data which ‘lured’ or spoke to me, included:

- a pile of ‘stuff’ (Image 6) at the side of a demarcated mix of courts
- imaginary TV remote
- plastic golf clubs
- lines/court markings on a playground area
- student lesson plans and evaluations (Images 7 and 8)
- plastic hula hoops.

In a warm-up activity of ‘tig’/‘tag’, a pupil moved in amongst hedge—PE equipment, to hide. No-one saw that the

Potential judgements, or biases remain entangled however, whether being diffracted through my PE teacher or teacher educator experiences and so on, as I was looking for PL to be evident. Habits of seeing are difficult to break (Hultman and Lenz Taguchi, 2010). However, maintaining an open attitude, and being mindful of my part of the school placement assemblage(s), went some way to disturbing the “epistemological myth of an outside observer providing an explanation” (Latour, 1996, p. 377). As noted in Chapter 3, the researcher cannot play a ‘god trick’, there is always a view from somewhere (Haraway, 1988). Further, after observations I was not seeking to

“technical” etymologies whilst ‘thing’ relates with everyday interactivity (Standish, 2016, p. 627). Things are inherent, perhaps essential, they are the ‘everyday’ in PE and are usually moved or moving as part of PE assemblages. The animate, and continual flux in the broader sense of the world (Ingold, 2006a), cements the logic to continue with the term ‘things’ and not objects in this research. Taken from the work of Latour (1999a), the term ‘actors’ is also used. Actors can be germs, cars, thistles, laws, and hoops and all are on the same ethicoontoepistemological plane, as explored earlier (Chapter 3). Further, actors or things in PE are not ‘just tools’, benign objects, they are already

pupil had moved beyond the boundaries of the game set by Eileen. When ‘tig’ ended, the pupil had managed to remain hidden but had to come out when the next task was being described by Eileen. Perhaps the pupil was happy to have avoided the game or even have ‘won’ the game. The pile of things is a common feature in PE lessons, in or outdoors and things move/are moved/move as ‘pile of stuff’ and ‘invitation to play’. Oftentimes, the teacher/student-teacher moves the things, other times the pupils are given guidance about where to put things, at other times still, things prompt movement. Things create the parameters of an activity, prompting movements which student or teacher values as

provide explanations for things. Immersed as part of the assemblage of outdoor PE space, I recorded many things working to make pockets of activity, which I would be able to describe and think about later. For example, Sarah stayed at one physical activity station where dynamic assemblages of heterogeneous actors were working towards creating physical activity successes. However, Sarah was simultaneously present across multiple assemblages, such as lesson plan evaluation—lecture experiences—electronic resource—interview—golf club.

entangled and embedded in lesson assemblages. Non-human things are already acting on/with human actors (Rich and Lupton, 2022), hence this chapter ‘following the actors’ to make visible how the relations are working or not, to enact or not, PL-PE. As mentioned in Chapter 5, when analysing the data, the researcher attunes to relations and their effects/affects, where associations between actors attract attention. The experience for me was like waiting for “pockets” of the world to open up (Stewart, 2011, p. 447), ‘dwelling’ with the data assemblages (ibid., p. 449) for what might affect me. In this way, choreographies are not structured as in a ‘scripted’ dance performance but are

worthwhile in PE. For example, pupils practising rolling a tennis ball to a partner through the yellow mini hurdles (featured on the right in Image 6).



Image 6 Hedge-container-tennis balls-cones-cone holder-bag-hurdles-coat-notepad-tarmac assemblage

Image 6 shows a bundle of equipment which is ready to play in PE, the bundle,

The golf club ‘glowed’ for me and it seemed also to call Sarah. There are more examples like the golf club, wherein things-humans are interwoven in such an entangled way that there seems to be no ‘gap’. Golf club-pupil are ‘co(a)gents’ (Michael, 2004), actors are connected, associating, creating practisings – such as PL-PE. There are multiple perspectives interwoven in this episode and others like it - for instance, the assemblage of student teacher—pupil—writing ability—PE practisings—professional learning—researcher questioning—. Further, things in an assemblage include the ‘unseen’ “interstices” (Ingold, 2016, p. 10), ‘Möbius strip’ (MacLure, 2013a), where actors are connecting, associating, and

emerging as actors are in relations with one another, and teachers and pupils are often improvising.

How I followed actors is presented in the third column, and the hula hoop appears in more than one place in analyses-discussions because it delivered multiple performances across spacetimes (Koro-Ljungberg et al., 2018). Specifically, it appeared in PE lessons and was the artefact interviewed with Holly. Whether ‘following an actor’ is a linear experience becomes a moot point since the hoop, for instance, was part of multiple posthuman networks of “complex connections between actors: the actor-*network* or assemblage” (Adams and Thompson,

and/or each item is potential that invites, provokes, invokes feelings of excitement, fear, indifference, as it becomes part of the lesson-assemblage. The things in the pile delineate movement ideas for the lesson-assemblage as things are moved away from the protection/out of bounds area beside the hedge (boundary) and set out on the tarmac surfaces of the playground. Often, lines on the playground which indicate netball and basketball courts, delineate other activity areas. These lines are fixed, other lines are sometimes indicated by other equipment, like cones.

At times, a thing might be removed from activities, such as when it is damaged, or

may or may not be transforming things in meshwork(s). This is where translations occur, in the ANT sense (Callon, 1986). That Sarah makes a link from how a pupil is writing in the classroom to the PE lesson is a pool/pull of relations that is seamless, there is not a gap at work among overlapping, diffracting, ripples of intertwined/enfolded/unfolding heterogeneous assemblages (Latour, 1996). What Merleau-Ponty (2012) calls the fleshy in-between, or where Bennett’s (2010) ‘liveliness’ of things vibrates through the world, seem to be made visible during realisations such as Sarah—golf club—classroom writing. In other words, things ‘afford’ relations and activities. Things already matter, (Barad,

2016, p. 38. Italics original). Connections holding a network assemblage involved the hoops' sociality *and* materiality. In the university context, hoops were present and used as 'holders' of PE equipment (such as to stop balls moving around a hall), or for 'driving' around the space in a 'space bubble' – an exercise to help pupils regulate spatial relations with others, or hoops were targets into which to send things like beanbags. Following an actor-*network* acknowledges the already-connectedness (to varying degrees) of an actor. In *doing the following*, of materiality and sociality *at the same time*, any divide between social and material is at least reduced if not removed, ignored, challenged (Adams and Thompson,

a ball is deflated, for example. Even so, things make/are entangled in/across PE and PL-PE lessons, with localised experiences such as the one I observed, showing momentarily stabilised PL-PE. The data presented here is another way of making visible the relations affecting and effecting PL-PE (or PE), such as home life, or previous experiences of pupils, or what might enfold in futures.

A virtual television (TV) remote control made an appearance in another warm-up activity (Eileen, Observation, 27.05.21). Early years pupils (ages 6-7) responded with actions that suited the music – this was noted during observations under the heading 'Remarkable'. It was a skilled

2003) and already have a history (Ingold, 2012). Moreover, that history is lively. Enacting knowledges is hard work (Law, 1992) for the student becoming teacher and for things in these assemblages.

How students or practitioner-participant planned PL-PE was an ongoing performing of knowledges-through-practisings. Usually, pedagogically, each PE lesson builds on the previous knowledges experienced – an example of assemblages where pupils, lessons and student-participant were constantly becoming (Bennett, 2010; Ingold, 2012). Each actor in PE or PL-PE assemblages brings affordances (Rich and Lupton, 2022) which might be positive/negative

2016). Indeed, “an actor is also, always, a network” (Law, 1992, p. 384). An exemplary working of the actor-network by Mol (2002) shows that when a human body becomes unwell, breaks down, attends hospital clinics, multiple parts of the actor-network are foregrounded. The hoop in the above example moves, follows, locates, binds and bounds things human and nonhuman across spacetimes.

As a sociomaterialist sensibility, features of ANT (Callon, 1999; Latour, 1999a; 2005) meant I could dwell among things, to draw out and present aspects of the entanglement of humans-nonhumans. ANT also helped illuminate weaknesses

pedagogical technique that was circulating with this experienced teacher, connecting pupils, things, and movement activities. The imaginary remote was brought from pupils’ homes into the PL-PE assemblage by Eileen-with-pupils. Many acts of translation have enabled the movement responses – do pupils understand ‘play, fast forward, rewind, pause’? There was shared understanding, perhaps an assumption, that all pupils would know what a TV remote control was because they had one at home. Some accompanying ‘circus music’ was sung by Eileen (“*ra, ta dada dada ra ta da da...*”), pupil bodies moved and sung with the music. Smiles and joy were enmeshed in these experiences showing affective

experiences for pupils or might exclude human or nonhuman actors, regardless of student-participant intention or according to the lesson plan. Indeed, the lesson plan-as-assemblage may show potential affordances brought by golf clubs, PE policy, balls, spaces and pupil groups. These are *potential* affordances which may or may not be realised as bodies come together in relations (Spinoza, 2002; Rich and Lupton, 2022). It is becoming clear that nonhuman things are providing direction, they are agentic, as are humans in these assemblages, and so phenomenologically, concerns with intentionality are demonstrably not the sole domain of humans (Barad, 2003).

with the philosophy of PL (Kanger, 2017). For instance, recently Young et al. (2021) have followed Latour (2005) in mapping PL as a ‘controversy’, to find out who-what is working in the current PL literature/research-network. By incorporating nonhuman and human into a mapping exercise, Young et al. (2021) call for multiple PLs to co-exist in harmony rather than under tensions. This demonstrates ANT as methodological device to include nonhuman. Young et al. (2021) address the landscapes of PL from sources of scholarly literature and wider political web searching using Google (Young et al., 2022). My approach follows relations or connections among a broader range of actors (Kanger, 2017). Indeed,

learning domain, motivated pupils, perhaps motivating future physical activity, PL-PE. The idea of memory-making seems relevant here too, memory in a performative embodied sense which included neurological flows, muscle memory and the affective.

An item from Sarah’s observation notes, and then her interview, provided wonder - the plastic golf club(s). It seems the golf club had made an impression because Sarah had positioned herself at that activity area during several PE lessons. It had drawn her because of events in the classroom. Sarah stated: “they struggled with fine motor skills, like they couldn’t write very easily, so anything that was

How things will ‘act’ is not predictable and highlights a sense of thing-becoming.

Liveliness of things may disrupt, interrupt, bodies at work and play. One observation showed balls being thrown ‘off’ target, a foam javelin being pushed into a fence hole, or a catch missed by a pupil, and these (dis)junctures were viewed as interruptions to the lesson because the pupils involved were last to re-join PE class—teacher discussion. On the other hand, the missing thing-human had to return for the lesson to continue. Things can ‘surprise’ the gaze of the human (Bennett, 2010, p. 5), and like the pile of stuff in Image 6, things (including lesson plans) are always immanent – part

some things involved in practisings in PL-PE have what Latour (1993b, p. 391) called “delegated competencies” and I am interested in the nuanced, detailed ‘doings’ of things (Fenwick et al., 2011). In doing something, things are changing or changed, and *how* things are investing into becoming PL-PE meshworks is of interest.

A potential problem here is that by focusing on certain actors, certain things, some actors are inadvertently or purposefully favoured over others (Mutch, 2002). This is a criticism of ANT in that making some things present implies not presenting other things. However, as MacLure (2013b, p. 229) suggests, “We

em... really tight grip things, they weren’t very good at and that’s why some of them struggled with wrapping their hands around golf clubs and things like that” (Sarah, Interview). Some pupils found holding the golf club to be difficult, and this translated from and to class-based writing or drawing activities. To have the knowledge and understanding that balancing on a chair, holding the core muscles stable whilst also trying to hold a mark-making implement such as a pencil, and then make letter marks from left to right, shows the layers of traces flowing across these two meshworks. University lectures may also have connected with this assemblage, including knowledge about eye tracking and the relation

of what Bennett (2010, p. 4) calls a “speculative onto-story”. The properties of things have their own histories and potentials as to what they can do (Stengers, 2010; Ingold, 2012). Latour (1996), however, notes that the thing is not always altered in these relations. Transferring a ball from hand to hand, for example, is what Latour (1996, p. 379) calls a “poor example of a quasi-object, since, although it does trace the collective and although the playing team would not exist without the moving token, the latter is not modified by the passings”. Perhaps the thing *is* modified – the ball changes, deflates ever so slightly, is becoming worn, unnoticed, but this happens. If left interacting with weather the

may feel the wonder of data in the gut, or the quickening heartbeat” but “(W)onder is not necessarily a safe, comforting, or uncomplicatedly positive affect”. If something is absent it may manifest during the process of being drawn to something, such as progression in PE, sensed by me during observations and reported by students during interviews. There is some relationship here with ANT’s challenge to nearness/farness, wherein geographical proximity is replaced with the idea of ‘associations’ (Latour, 1996). Certain things, such as CfE *Health and Wellbeing* (HWB) *Principles and Practice* document (Scottish Government, 2009b) are being brought to the foreground, where they may not

between writing and watching/catching a ball.

As mentioned, playgrounds have lines of courts, or there are boundaries provided by tree lines or fencing. Participants spoke about ‘space bubbles’ during the lessons and pupils already knew what these were, their own personal boundaries (extend arms out to the sides, up above the head, and rotate to show your personal space). Eileen built on this idea of space by using language to describe ‘sending’ an object up and out of the space bubble. Many aspects of PL were evident across empirical data associated with Eileen. There is scope to explore the ways in which student-

thing/’quasi-object’ changes - colours fade, stitching loosens, someone else strikes, catches, rolls it, it loses some integrity, such as deflating further. Who will play with this ball – thing now?

In PE assemblages, as hoops-tennis balls-pupils are coming-to-know together, these practisings *are* PE/PL-PE. It might be suggested in pedagogical terms, that this is knowledge construction, but for post-ANT scholars, it might be described as ‘associations among heterogeneous things’ (Michael, 2017). Knowledges will be multiple. How I paid attention to these multiples and to show analyses that made sense of the practisings, required thinking differently. Drawing on diffraction,

necessarily be physically present, or visible. Near/far dissipate into associations, connections, and relations.

Further criticism of ANT is directed at the notion of symmetry, which brings into one plane the social, discursive and material (Mulcahy, 2012). Suggestions include that this is at some expense of the human, that ANT removes meaning (Latour, 1996), removes the ethical (Latour, 1999a) and does not obviously involve the organic, or 'ecology' (Ingold, 2012). Sociomaterialism as an "umbrella term" (Orlikowski and Scott, 2008, p. 434) may help here, since meaning and matter are not separate, materiality/matter is the fluid, dynamic, flow of things. Indeed,

participants are becoming teachers in relation to the practitioner-participant, but this line will not be pursued here as it would be unfair to compare and is not the aim of the research.

Example lesson plans were shared with me during and immediately after school visits. Below, one of these exemplifies how the plan was presented, and how other lines of development flew in and out of plans. COVID-19 disrupted and provided opportunities.

The format for the lesson plans to be used on placements are provided by the ITE programme of the university.

introduced in Chapter 3, I present key actors through theory-empirical data as is being read in this three-column experiment.

Barad's (2007) 'diffractive methodology' serves as a way of reading information from multiple research sources, as they pass through one another, and a researcher is "paying attention to patterns of difference (including the material effects of constitutive exclusions)" (Barad, 2011, p. 445). The analysis of entanglements is thus multiple. As is being shown in columns here, data, more than one theory (monism, sociomaterialism, ethology, posthumanism), and student-participant

for Merleau-Ponty (1968) this is the ‘fleshiness’ of the world – that is, all things in flow, ever present, all stitched into the fabric of the world.

Posthumanism and sociomaterialism seem to offer the opportunity to research differently by refusing many binaries - of mind-body (even ‘body I am’ and ‘body I have’, Sheets-Johnston, 2015), nature-culture, theory-practice. By addressing ‘gaps’ among things, I am seeking to move beyond changes of terminology (Mulcahy, 2012), to actualising an empirical-philosophical account of PL which is also occurring as you read this.

Individual Lesson Plan Format (Primary)

Class/Group: P.2 Lesson: P.E. Date: 25.05.21

Previous Experience Children previous p.e lessons participating in cosmic yoga (indoors) or carousel-based practice outdoors (working on footwork, passing, catching etc)		
Working towards outcomes of a Curriculum for Excellence within and beyond my place of learning I am enjoying daily opportunities to participate in physical activities and sport, making use of available indoor and outdoor space. HWB 1-25a		
Responsibility of all - Literacy/Numeracy/ICT/HWB (where appropriate): Hwb – opportunity for physical activity/exercise		
Learning Intentions We are learning to use our body in different ways to improve coordination and fitness.		Success Criteria In P.E. I can: 1. Participate in a variety of activities. 2. Attempt to move my body to increase skill. 3. Practice my activities to improve coordination and balance.
Resources	Indoor – IWB Outdoor – balls, tennis racquets, hoops, bean bags	
Timing		Assessment methods
10 mins	Outdoor Setting the context/Beginning the lesson (Introduction) Children will be brought outside and warmed up using different types of tig (disco, toilet, child choice) approx 5 games	
5 mins	Teaching the learning intentions (Development) Children will be brought back to the centre to go over the variety of carousel activities which are on offer and the types of activities which they could participate in at each, expectations will be made clear that children are active, getting involved and sharing resources with their peers – they are also keeping each piece of equipment in its designated space. 1. Hoops 2. Large balls 3. Small balls and racquets 4. Hurdles 5. Bean bags etc	
30 mins	Children will be placed into designated groups by myself giving each child a station to go to. Timing depending on going out, children will either have	

Image 7 Part of Lesson Plan, Sarah

reflections, are being read through one another. Whether PL-PE is enacting in student-participant teaching is being addressed by following multiple traces and relations. Within each performance intra-actions (intra-relations) will be becoming differently. There are no solid boundaries around PL-PE practisings. Indeed, boundaries are unclear, not distinct or definite.

Boundaries are ‘enacted’ for Barad (2003; 2008), and for Latour (1996, p. 6) “(a) network is all boundary without inside and outside”. Movement in-around-through-by things is helping me create a 4-D meshwork, without inner and outer, near/far properties, only connections,

In seeking to refuse binaries, in doing research, cuts are being made throughout. Adams and Thompson (2016, p. 113) say that “(C)uts are acts of division and separation, of analysis and of valuing this and not that. Research practices are themselves never neutral”. Indeed, the empirical lures in the middle column here, are cuts. The cuts were made to create a starting point for analysis, where human-nonhuman were coming together (Lupton, 2020) in everyday PE practices. In appearing to fix or capture lessons and present these as images, the cuts helped me ponder and illuminate whether aspects of PL-PE were being enacted from across the data-theory. Taking account of things whilst thinking with posthumanism

Image 7 shows the layout of such a plan with sections for previous experience (of pupils), learning intentions, success criteria (intended outcomes) and space to link to Scottish curriculum policy. There are also sections for evaluation of the lesson, next steps for the next lesson and next steps for the student-teacher. I return to interview a lesson plan in Chapter 8. Below, Image 8, is an example of where Sarah has recorded reflections

associations, or relations. Some features of PL-PE may traverse sociomaterial meshworks and these are ‘boundary objects’ (Star and Griesemer, 1989) - for instance, a PL definition might be viewed as a boundary object or as an ‘obligatory point of passage’ (OPP, Callon, 1986), towards enacting multiple versions of PL-PE. Young et al. (2021) similarly found that Whitehead’s 2007 paper serves as such, thereby cementing the IPLA definition and underpinning theories as OPP. Restrictions on how PL is enacted are not predetermined because of OPP, and this was exemplified during my own empirical data collection period. The next chapter provides examples of such ‘unrestricted’ PLs.

and sociomaterialism meant being mindful of Adams' and Thompson's (2016) call to see both *at the same time*. Thinking with PL-PE activities, including nonhuman actors, demonstrated a shift "from questions of correspondences between descriptions and reality (e.g. do they mirror nature or culture?) to matters of practices, doing and actions" (Barad, 2007, p. 135). This shift seemed quite natural in the context of primary student entanglements in PL-PE assemblages of observations, lesson plans, interviews.

Things seem to 'beckon' the pupils to swing a hoop, avoid the cones, roll the ball through/under the hurdle or to a partner. As has been noted in Chapters 2

with pupils, as an example of formative assessments.

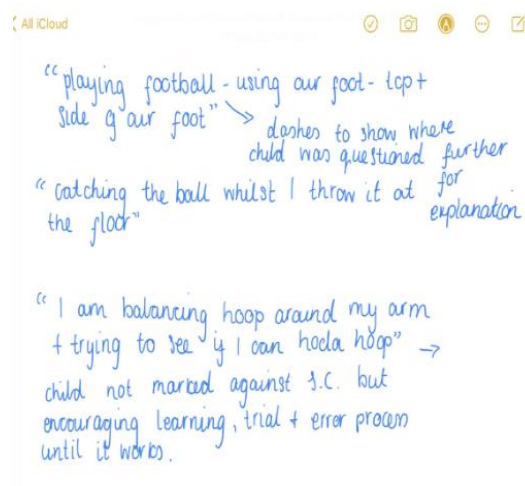


Image 8 Lesson Outline, Assessment Notes, Sarah

Sarah has written, "child not marked against S.C. but encouraging learning, trial and error process until it works" (Lesson Outline, 18.5.21). This kind of lesson outline is a broader plan which oversees several individual lessons, for

Enactments of PL-PE were unavoidably influenced by the Roadmap Out of COVID-19 (UK Government, 2021; Scottish Government, 2021) and as mentioned in Chapter 5, I conceived this overarching phenomenon as a 'breakdown' (Heuristic 4, Adams and Thompson, 2016). Throughout PL-PE lessons, nonhuman-human were materially (re)configuring, creating knowledges anew, and across spacetimes, not bound by the usual school placement expectations. Knowledges and practisings were not as familiar as they might have been, with differences and effects/affects being influenced by prominent (COVID-19

and 3, Merleau-Ponty (2012) informs Whitehead's (2010) conceptualisation of PL, especially in describing human-world experiences as 'dialogues with the world'. The extent to which current PL research literature explores the relational aspect of thing-human-nonhuman is limited, hence the relevance of showing relations being enabled, such as, ball—tarmac—eye direction—hurdle—success—pupil. Physical, affective/social and cognitive domains (see Chapter 2, Table 1) are intra-activity creating human-nonhuman PL-PE assemblages. Sarah had created a spacetime for pupils to experiment with hoops, for instance, and the engagement in practice was observed by me.

example six lessons in sequence. Here, the Lesson Outline Notes are brief jottings of evidence from teaching episodes which encompass future practisings also. Quotation marks are based on Sarah's assessment of how pupils and things are intra-acting to create success or demand further practice in PE. That the hoop was balancing around the pupil's arm as a "trial and error process" was meaningful activity for the hoop-pupil assemblage. The actors include perseverance, core stability and coordination, and cognitive skills embodied in doing the 'hula-hooping', as well as Sarah's attitude of reflective encouragement, and COVID-19 influence on the PE assemblage. Holly

related) sociomaterial actors. Indeed, Barad (2007, p. 342) says "(K)nowing is a distributed practice that includes the larger material arrangement. To the extent that humans participate in scientific or other practices of knowing, they do so as part of the larger material configuration of the world and its ongoing open-ended articulation". Whilst becoming a teacher student-participants are always emerging from intra-actions in what are dynamic posthuman assemblages (Lupton, 2020). The capabilities associated with becoming teachers are never pre-existing but are creating whilst relations are being done, undone and redone. Arguably, things like *Benchmarks in PE* (Education Scotland,

As outlined in Chapters 3 and 5, Barad's (1998; 2003) term *intra-action* connotes ongoing ontological relations where object-subject are brought together in what she calls *phenomena*. This is developed here to show the challenge to dualist *re-presentationism*. Inter-action presumes an external/outer pre-existing entity whilst Barad's intra-action removes the need for a signifier and signified. For example, the knower-known-knowledge triad becomes one phenomenon – knowing. Knowing is thus performative rather than a linguistic, representative concept. To develop knowledge and understanding of a range of movements, Whitehead (2007, p. 285) would argue that the coalition between knower and

(Interview, p. 1) also noted that with hula hoops there were “so many different things they [pupils] were able to do that you could see that they were confident to take these chances to try these things, and it was more the trying than ... the ability that I saw”. There are multiple translations through tracing the hoop, which evidence PL-PE practisings.

Hoops were not placed at an activity station with the intention for pupils to swing them around their wrists – Sarah had placed the hoops as targets for a different task – but hoops invited other actions for some pupils who picked them up and twirled them around body parts

(2017) or CfE guidance documents could appear black boxed for students if a social realist, structuralist perspective is adopted (Mutch, 2002). However, here, a posthuman, sociomaterialist approach is detailing how, where, with, what-whom different relations might be dynamically enacting PL-PE.

The assemblage brought to life by following the plastic golf club shows temporal aspects of knowledge as things are diffracting - for example, through me, my reading, experience/intentionality, student learning, or Sarah's reflection on pencil-grip capability. In the physical activity context, successful interactions with things are built up through practising

known is so intimate that it is inseparable. It could be said that concepts such as PL are becoming determined as phenomena are performed or practiced by constant “material-discursive intra-actions” (Barad, 1998. P. 104). As introduced in Chapter 3, Spinoza (2002) suggests that all bodies are materialised. Similarly, all bodies ‘matter’ in Barad’s (2003) understanding of practices. For researcher, this also signifies “*the inseparability of “objects” and “agencies of observation”*” (Barad, 1998, p. 96, italics original), overcoming at least the knowledge-knower Cartesian binary, and important for recognising the researcher as part of the research apparatus.

(Sarah, Interview). For example, Sarah (Interview, p. 5) said:

“this is such a random thing, but the children in getting like, I don’t know if you’ve seen the children ... they put the hoops around their arms...So somebody would start it and then they all learned how they had to move their arm and how quickly they had to move their arm, and then in more ... in what direction.”

Hoops seem to be intentionally driving activity with pupils. Going ‘off lesson plan’ with hoop activity was not concerning for Sarah because there were around fifty pupils outside at any one time, and so other staff were with other pupil activity areas. Sarah remained with a small group of pupils at a certain station. However, to

(Breivik, 2017). For example, the ability to grip the golf club in PE, or the mark-making implement in a classroom context, is not a skill pupils necessarily have prior to coming to school. Whilst practising in school, a pupil may be showing active ‘coping’ in the world wherein an attitude of ‘body-in-action’ is neither mind-intention nor body-intention (Breivik, 2017). Instead, thing-pupil works in the regions among body—thing—practisings. Merleau-Ponty (2012, p. 104) says “(I)n movement, the relations between my decision and my body are magical ones.” This could be the flesh or interstices referred to earlier in this column, thus furthering my thinking that there is no ‘gap’. Although ‘magical’,

There are implications for thinking about agency of things, which Barad (2003, p. 818) calls ‘agential realism’, “ongoing reconfigurings of the world”. This is with reference to human and nonhuman agency, which Barad (2007; 2014) follows up in other texts. Practices of PL are not external, and pre-determined, waiting to be placed into a correct space and time; intra-actions are “within-phenomena” (Barad, 2003, p. 815). Thus ‘following an actor’ is not following a “singular entity”, but rather tracing the connections, relations (Adams and Thompson, 2016, p. 38). Whether following a tennis ball or a student-participant, the thing is multiple, and is relating, interacting, desiring, in dynamic

interact with other pupils in the lesson, she shouted encouraging comments across the area, and offered pupils ideas for improvement, “try your arm a little faster” (Sarah, Interview).

The hoop was also the artefact brought to interview by Holly who expanded on its usefulness and the ways in which this actor transformed and influenced PE lessons. The hoop is PL for Holly (Interview, p. 1) because “seeing the children out in the playground I thought a hula hoop because it was allowing them so many different ways to move”. During the same observation period, a primary 2 pupil (aged 6/7) stated to me, “I’m practising my hula hooping but getting it

practising is still required for these capabilities to develop (Durden-Myers and Bartle, 2023). Children need “lots of practice” (Eileen, Interview) and similarly, student-teachers are learning how to include multiple practice opportunities in their PE planning, and in their becoming teachers. The idea of magic reappears in chapter 7.

The lesson plans such as in Image 7, do not stand alone, and are diffracting with past—future PE lectures at university, online resources used in those lectures, and the ‘next steps’ identified by students (Image 9). Tracing past-present-futures evidences the “spacetimematterings” (Barad, 2014) involved in how students

flows, and is not self-contained (Braidotti, 2013b). Perceived ‘boundaries’ are created by the intra-actions performing or practising a boundary or limit of some sort, into being. For Barad (2003, p. 817) “(t)he world *is* intra-activity”. The relevance of her idea of intra-action for my own research into PL is that it helps show how PL is enacted by iterative encounters among things, hence the importance of the posthuman perspective. Intra-activity which “*constitutes*” (Barad, 1998, p. 106) the restrictions on teaching PE during the COVID-19 pandemic, were temporary and imposed powerful forces working to create (inclusion/exclusion) zones on the phenomenon of PL-PE. In trying to work from one hand to the other.” This pupil also played with the hoop whilst Sarah gave instructions to the joint PE classes. When pupils came to the ‘hoop’ area/station, I observed moderate levels of physical activity. They were engaged in talking and occasionally rolling the hoop, freely or with more control, swinging the hoop or hoops around wrists, and sending-receiving a hoop between pairs. There was very little scope for teaching points to be made at the hoop station because, as mentioned above, there were two classes outside at once and one lead-teacher (Sarah). Sarah later said that because of the large number of pupils, she did not pay specific attention to other are becoming teachers. Experiences during university PE lectures are informing a PL-PE understanding involving COVID-19, theory-based sessions online and (for some students) practical PE workshops. Aspects of PL were becoming visible *as contexts were being created* (Baiocchi et al., 2013), such as: physical competence (Sarah is looking for golf/hockey skill resources, Image 9); motivation and confidence, “giving children a variety of equipment ... something they enjoy and practice” (Sarah, Image 9). The traces from Image 9 bring to light the many different effects diffracting and affecting assemblages (Mulcahy, 2012). By including things as ‘mattering’ (Barad, 2014),

out where or if PL was being enacted, with/despite what were perceived as restricted practisings and arguably, knowledges, aspects of PL were present. Excluding normative practices associated with PE and PL meant bodies (human and nonhuman) were propelled into very different assemblages. Participants remained compelled to act as closely to those norms as possible, but it could be suggested that, for example, Sarah's reflection on the pupil with the hoop around the arm 'not being PE', was in fact an assemblage of enjoyment—play—hoop—motivation—physical competence—experiential learning, in other words, PL-PE. This is also an example where hoop-pupil activity leapt

activities, as she was with a small group of pupils at the golf station.

EVALUATING MY PRACTICE	
Going well (what worked and why?) > giving children a variety of equipment able to find something they enjoy + practice	Areas for development (what didn't work and why?) > Not checking in children know how to use all equipment safely when adding new resource
Next Steps for Me > physical literacy G.B. website for golf/hockey skills.	

Image 9 Lesson Evaluation, Sarah

Image 9 shows the boundaries within which student teachers are summarising their lesson evaluations. Here, Sarah had written “physical literacy G. B. website” in the ‘Next Steps’ section of a lesson plan.

sociomaterialism is making visible the multitude of things that are emerging in relations to enact PL.

Further, the posthuman approach means that the intra-activity of lesson plan texts (students' reflections and evaluations), makes visible aspects of PL that were not observed during visits to Sarah's placement school. Inviting more than one theory *with* data and diffracting with these helps follow many lines in entanglements (Barad, 2011; Ulmer, 2016). Sarah's 'Next Steps for Me' in Image 9 are moving her into the future, bringing her past, and following lines as she is becoming a teacher. This is evidence of existentialist philosophy

out at me as rebuff to potential socio-political—medical—public health restrictions. So normative practices were restricted, but some things managed to rebel or counter restrictions by reconfiguring their intra-actions.

As one aspect of PL and PE, the affective learning domain was perhaps not as easily traceable in assemblages as, for example, effects of things which are performing the physical domain (Mulcahy, 2012). Affect, located in the in-between, or fleshiness of the world, moves among things, and Mulcahy (2012, p. 11) suggests this is more than mere ‘intersubjective’ linkage between things. Sarah’s choice of language indicated that

In her interview she recalled a resource that I had suggested all students download. Researcher is evidently entwined with students’ development in PL-PE. Other invisible things in the lesson evaluation assemblage include the IPLA definition— university lecture content— Scottish curriculum policy. Unpacking the messiness of the sociomateriality shows Sarah becoming teacher and that aspects of PL are being surfaced.

Students occasionally shouted encouragement to the whole class, trying to motivate with specific comments, such as, “How are we doing today?”. The prompt by students during lessons also opened up conversations about how the

inherent in Whiteheadian PL (2001; 2010), another ‘hidden’ actor in Sarah’s PL-PE assemblages.

During interviews, participants explained that they could not ‘see’ progression in pupils during their teaching in weeks between lockdowns (for example, Sarah, Interview, p. 5). In the assemblage of student-becoming-teacher, curriculum documents are one line of flight being made visible here – Sarah and Holly talked about progression, one of the key principles for curriculum design (Scottish Government, 2008a). There appeared to be tensions where students understood policy documents promoting challenge but found few opportunities to enact

the enjoyment of pupils is important, and joy during a PE lesson is associated with the affective domain. This concurs with Spinozist (2002) thinking about bodies as always immanent and desiring health (see Chapter 3). In PL-PE, enjoying and participating in movement activities is an effect/affect of motivation, confidence and physical competence. On the matter of language, the discourses used by some PE practitioners trying to understand PL is often hindered by “the phenomenological vocabulary” (Larsson and Nyberg, 2017, p. 140), so this is worth further investigation elsewhere.

In a sense, what my research has been doing is reversing Latour’s (1999) ‘topofil’

pupils were ‘feeling’ – recalling how-what they played in PE last time. If the PE or PL-PE experiences were positive, the affects will be happy, perhaps joyful, and lead to more successful physical activities. CfE documentation (*Building the Curriculum, Principles and Practice*) may be influencing Sarah’s efforts to provide continuity, which was achieved at some level with these two classes because they had been outside before, using the same equipment. Sarah did refer to this in the interview, and that adjustments to the ‘golf’ station and use of Unihoc sticks were made to provide more chances for pupil success and lessen the chances of injury!

progression for/of pupils. On the contrary, memories can be recalled differently, such as different responses on different days to the same interview questions (Gardner, 2001). Sarah demonstrated this in her interview (p. 9), referring to classroom plenary discussions with pupils. Pupils reflected on which activities were fun, safely practiced, and at which the pupils felt they needed more practice. Sarah demonstrated ways in which becoming a teacher involves making sense of pupil learning, experiences and possible contradictions or tensions, all of which could be the “driving force behind transformations and innovations” (Nguyen, 2017, p. 402). Sarah did seek to

experience, wherein site visits removed soil, which was then analysed and translated more than once as it journeyed to a laboratory and written text. Here, having been initiated predominantly by Whiteheadian (2010) and IPLA (2017) versions of PL texts, the PL-PE assemblage is being traced and any knots loosened (Adams and Thompson, 2016) to see how (Law, 2008), and where any circulating relations of PL-PE were being enacted.

Participants-COVID-19 seemed to be enacting opportunities for PL-PE with things-pupils. PE lessons also demonstrated that the intrinsic worth of moving was valued by pupils. The activities of the hoop, once static but calling to be moving, demonstrates that hoops-things are agentic and working across spacetimes. There are lines of development in PE which are retraced by student and practitioner, with the intention of creating stability for pupil experiences, yet along these lines, chinks or unstable moments are also necessary parts of the practisings.

progress pupils, and included this in her reflecting, but did not articulate this in the interview. Student-participants were grappling with teaching practice across many subject areas, as well as COVID-19 at this time in their lives. Becoming teacher involves the power of things, “thing-power materialism” (Bennett, 2004, p. 354), a relational continuum for Latour (1996), who suggests that things make differences to degrees. Once a thing makes a difference, it is an actant, a term which I do not continue to adopt. However, as an example of translation, ‘hoop spinning round pupil wrist’ is that point at which wrist↔hoop relations hold a stable assemblage, in other words, fun!

Conclusion

At the beginning of this chapter, I introduced the reader to three analysis-discussion chapters which explore how a Spinozist approach extends different ways of understanding PL, as students are becoming teachers. This chapter was the first of the three, and here I presented theory-data in a way that chimes with philosophical informants of Whiteheadian (2010) PL and my posthuman, sociomaterialist and Spinozist contribution to that. The three-column presentation was intended to provide interferences (Mol, 2002) and exemplify the entanglements of things human and nonhuman. Heuristic devices were drawn from Adams and Thompson (2016), and these informed where to practice rhizoanalysis. COVID-19 was referred to as a breakdown, an actor which conjoined with many actors during at least, the data encountering period. Informing this chapter, I was guided by the idea to,

follow the actors themselves ... to learn from them what the collective existence has become in their hands ... which accounts could best define the new associations that they have been forced to establish (Latour, 2005, p. 12).

Adams and Thompson (2016, p. 33) provided guiding questions to support this activity (Heuristic 2):

Who-what is acting? What are they doing? Are some actors more or less powerful than others?

How have particular assemblages of actors come to be configured? What sort of work does this assemblage do or try to do?

Data which glowed, such as the plastic golf club, were presented and interwoven with sociomaterialism and posthumanism. Such data seemed to be livelier than others (Bennett, 2010) or perhaps more powerful at specific spacetimes during the research period. It became clear that things were important in how and whether PL-PE was enacting. For example, the hula hoop was prominent across spacetimes and conjoining with aspects of the affective domain – such as

happiness when successfully relating hoop-arm. Things in and of PE and of life, are full of their own histories (Ingold, 2007), and act with humans, merging at interfaces where, for example, world-thing-pupil meet. “Thus, the properties of materials, regarded as constituents of an environment, cannot be identified as fixed, essential attributes of things, but are rather processual and relational” (Ingold, 2007, p. 14).

As became clear from the data-theory, the agency of things and how they are in relations *with* humans was demonstrated. There were several examples of this - the hoop, learning intentions on lesson plans, motivation as an affective aspect of PL, and dialogue-as-pedagogy, as student-participants sought to provide challenge for pupil learning. This is not to disregard the histories and activities of human actor(s). A Spinozist informed monist ontology of immanence (Spinoza, 2002; Braidotti, 2013a, 2019; St. Pierre, 2019), means rather, that human subjectivity is emergent during practisings and these practisings involve nonhumans. Braidotti (2013a, p. 188) would also advocate that the ethical and political is foregrounded through a “politics of relations ... firmly located somewhere”. Always materially entangled, the posthuman is striving towards *conatus* (Spinoza, 2002), existence. In the next analysis-discussion chapter, I present empirical data as leading narrative from lines of flight introduced in column three, including how the agency of things such as hand sanitiser, or the affective, are enacting PL- PE.

Chapter 7: Unravelling and Tracing Data-Theory Responses, analysis-discussion 2

This chapter builds from Chapter 6 where data lured me and provoked ‘lines’ to follow. The approach here foregrounded ‘things’ leading the way, so empirical data from across spacetimes has been written or presented as figure(s) to do much of the work in sharing the lines followed (Decuyper and Simon, 2016). Language is enlisted to help to show *how* I worked with theory-data. As mentioned in Chapter 1 (Introduction), to bring together binaries that are commonplace in language (theory and practice, mind and body) required strategies to disrupt those binaries, such as using the Em Dash, hyphenating words or creating neologisms. Specifically in this chapter, the use of various metaphors brings non-linearity, an openness and multi-logical ‘bricolage’ of expressions (Berry, 2015). The point of including different language – tools, metaphors, imaginings, or other techniques such as double-headed arrows ($\leftrightarrow$) – was to interfere, create fissures in expected discourses of some PL-PE literature and research. Rather than strict metaphor, language is imaginary (Sellers, 2015), where terms like knots, meshworks, rhizomes, are not to be conceived as things that relate to something, but rather as ‘imaginaries’ in helping to think otherwise. As mentioned in Chapters 2 and 5, concepts are fluid, are enacted, and language is helping to avoid re-presentation. An important contribution of this chapter is to open up educational (teacher education and PL-PE) intra-activities to what is yet to come, to the virtual, rather than accept what is presented as foreclosed or complete.

As mentioned in the Strategy for Analysis (Chapter 5), data has converged based on where patterns were emerging across spacetimes. Theories explored earlier (in Chapter 3) continued to become entangled with empirical data as aspects of these theories became helpful for analysing data-theory together. Lines of analysis were from school visits, (re)reading transcribed interviews or lesson plans, and during organising and seeing patterns across these data. Thus convergences were where effects of ‘knot-making’ (Ingold, 2016) acted as catalysts for analysis in this and the following chapter. In knotted areas I slackened or loosened the meshworks (Adams and Thompson, 2016) to ‘see’ whether relations were enacting PE and/or PL-PE. Where actors co-responded in relations I returned to the notion of ‘translation’, first introduced in Chapter 2 and explored in Chapters 3 and 5. To show some translations that illuminated PL-PE relations, empirical lures (some

from Chapter 6), have been enfolded in anecdotes. In this current chapter, figures convey converging lines and diverging lines of knotted events that come from empirical lures. Further, after the first two anecdotes, I present an experiment where two lines of text show how a researcher could share “strings of mediators” (Latour, 2005, p. 109). Strings of mediators are found along lines as translations have occurred in a particular part of a specific event. I also reflect on my entanglement in ‘becoming-with’ (Hultman and Lenz Taguchi, 2010) data-theory.

The first Anecdote (7.1) surfaced aspects of PL-PE through interrogation of hand sanitiser assemblages. Anecdote 7.2 then follows the liveliness of things coming from data lures expressed in Chapter 6. The anecdote tells of the effects of the agency of equipment, where relations among safety—enjoyment—frustration, for example, have been made visible. Anecdote 7.3 focuses on how PL-PE is enacting in planning and practisings in PE. The final anecdote (7.4) draws attention to extended affect traced by following water bottles. By the end of this chapter there are two key (temporary?) convergences spotlighted through analysing data-with-theory, as it is not possible to follow all actors or all lines. The first is that relations bind things. Second, sociomaterial posthuman analyses can surface the minutiae of PL-PE practisings. The two heuristics which informed analysis in this chapter were *Unravelling Translations* and *Tracing Responses and Passages*. Each heuristic includes guiding questions (Adams and Thompson, 2016, Heuristics 7 & 8, pp. 74-86) which I have adapted here:

Set 1: How has a collection of actors come to be assembled, and how are assemblages kept stable or kept in flux?

What unintended realities come into being as everyday (PE) practices unfold? How do some actors seem to become more powerful or persuasive than others?

Set 2: How do humans-things join in co-response to what is happening around them?

What kind of knot-making (a temporary bringing together of human-thing) is going on? How are lines of movement (or becomings) being (re)directed?

The first set of questions focused on fluidity of/in assemblages, entanglements, and how (un)intended realities might become apparent (Law, 2011). The second set of questions focused on lines moving into and away from meshworks and how humans-things may conjoin or co-respond (Ingold, 2012), making knots. In turn, knots may or may not have redirected or created further lines of flight. Now, I present the opening anecdote, after which I revisit translation and share how the heuristic of ‘unravelling translations’ (Adams and Thompson, 2016) has enabled analyses by loosening meshworks.

Anecdote 7.1 - Unravelling Translations Through Sanitiser

Processes of sanitisation have always been present in laboratories, nurse education, hospitals and so on. Then, during the pandemic, sanitisers were rapidly introduced and made prominent in schools to reduce chances of spreading the virus. PE equipment is seen as potential contaminator and is removed. Hand sanitiser machines are then fixed to school exit and entrance doors; levers pulled each time they are passed. Their unspoken presence is a reminder of the school’s COVID-19 role, a subtle message to comply in an area where pupils, visitors and teachers slow, enact, conform, and communicate. Working like silent mechanical security guards, hand sanitisers dispense and disperse flows of safety through PE lessons. Students and teachers become creative, imaginations are entangled with fitness activities and ideas from the computer game Minecraft™. PE equipment is nowhere to be seen. Eileen (Interview, p. 2) says that “although probably the most *efficient* way to have good lessons with the younger years is to use a lot of different equipment and stations, having no equipment has been quite good because it’s made you more creative with things that you’re doing.” She brings virtual equipment and well-crafted teaching strategies into the PE lessons and so sanitisers are perhaps less ‘related to’ equipment and more ‘in relation with’ hands and what is absent from hands in some lessons.

When restrictions change, a gradual (re)introduction of things in PE occurs. These changes accompany new instructions, signage, communications and

interpretations. There are shorter lessons because PE equipment is wiped down, so extra time is required “around cleaning equipment ... being able to share equipment ...” (Eileen, Interview, p. 2). Hand sanitisers continue to feature at lesson junctions, doorways or entrances - a gateway, a moment of action, conformity, and a reminder of COVID-19. The change in equipment just causes more frustration for student Erin since “before Christmas, when each class had their own box of things they could use ... like two hula hoops, one of this ...” and after Christmas when equipment is being shared among two classes or ‘bubbles’ of pupils “trying to find things that I could do ... like throwing and catching ... how are you supposed to do that without actually throwing and catching anything ... like, huh?” After the change in guidance, some equipment (re)turns, but to restrict interactions and potential for the virus to spread. When things are not available, absent equipment, they push their way forward. They want to be *heard*.

One of these silent actors was digital. For example, Holly had an “excellent idea to use minecraft for ‘challenges’ as this motivated them [pupils] very well”. Sarah, however, cannot remember which website she accessed for information, so that line of thought comes to a halt.

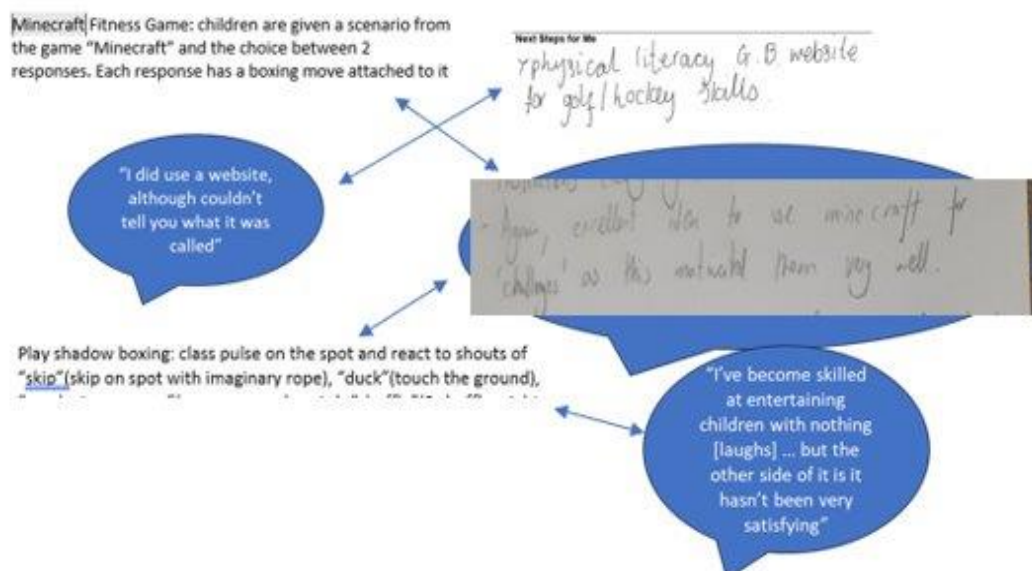


Figure 6 Participants-Teacher-Digital Assemblages (Holly, Interview, p. 13 and CT Observation, p. 2; Sarah, Lesson Evaluation, 2.6.21; Eileen Interview, p. 20; Erin, Interview, p. 12)

The entanglements of digital actors with other things belies what Eileen (Interview, p. 20) recounts with a laugh - that she became “skilled at entertaining children with nothing”. However, ‘nothing’ is observed here as play between the silent circulation of digital resources and the imaginations of students and teachers. The virtual television remote control which was foregrounded in Chapter 6 accompanies things like YouTube™ videos—university virtual learning environment—Max Whitlock ‘gymnastics Wednesdays’—Word documents—hyperlinks. These remain untouched by sanitiser yet ‘held the hands’ of students.

Effects from anecdote 7.1: translations as relations

To write about the effects/affects of things creating events, as depicted through the above, I had to put key ideas to work. Translation, relations, intra-action, and diffractive patterns are briefly explored below alongside aspects from the anecdote to present analysis. To show “*relations* ... relations of such a sort that they make others do unexpected things” (Latour, 2005, p. 106), after Anecdote 7.2 I experimented with written text to show ‘strings of mediators’ (Latour, 2005). Inspiration for this came from Callon’s (1986) work with scallops, scientists, researchers, and fisherfolk, all of whom—which became a sociomaterial event due to their associations, their relations. There is not on the one hand, a social actor, and on the other, a thing, but two things which are co(a)gents (Michael, 2017, as noted in Chapter 6) and in the act of translation coagents produce effects/affects, differences. Translation is the transformation which induces two mediators to conjoin and contribute to an event/assemblage/activity. Where relations create “a series of allies” (Harman, 2009, p. 20), this is like bringing together key actors to enact a lesson. Translation is a process, is ongoing between actors, and can produce negotiated effects. Translation processes could, I suggest, be synonymous with relations. An actor is already an assemblage, and intra-relations are already occurring, or ‘reconfiguring’ that actor (Barad, 2003). For example, Holly already had knowledge of how to create physical activity *coaching* sessions and whilst becoming teacher, coach intra-actions were ongoing during her postgraduate year. Differences between coaching and teaching were merging and adapting during what I would call *intra-translations*. Callon’s (1986) translations

relied on fisherfolk and scallops behaving a certain way, and indeed the breakdown that occurred in that example was based on fisherfolk enacting impatient intra-activity. The relations occurring were effects of intra-translations before the fisherfolk-as-actor farmed all the scallops. Holly as 'coach—becoming teacher' assemblage was entangling with teacher education mediators (pedagogical knowledge and practice, mentor advice, lesson plan design). Her own intra-activities were altered because of such varied strings of mediators, or lines of flight. In a way, Holly was lines of movement with inherent knots and lines coming and going during multiple spacetimes of intra- and interactivities.

Through a diffractive reading of Holly, her walking interview, and nonhuman things enacting Minecraft™ lessons, the different effects/affects of intra-activity of things become visible. Where Barad (2007) drops two stones into water and the ripples from each overlap in some places, these are diffractive patterns (Hollin et al., 2017). The lesson-assemblage being described here included diffractions of CfE *Principals and Practice* (Scottish Government, 2009b) document, Holly multiple (as coach, patient referral therapist, student-teacher) and Minecraft™ games, all overlapping, enfolding, and entangling with one another. Not only is this an example of diffraction(s) but it is also highlighting Holly's intra-activity - Holly is not alone when (confidently) teaching PL-PE fitness lessons. In the diffraction where two things overlap, this creates 'effects of interferences' (Hultman and Lenz Taguchi, 2010) and so where Holly is becoming teacher the overlaps from her coaching experiences are changes, translations, yet parts of her coaching practices will be retained.

When-where more than one actor come together the effects/affects are resultant changes, for instance, in student practisings. Interrogating the in-betweens or fleshy parts of the world where actors are coming together or (to employ Barad's term) 'cutting together-apart', 'co-responding' or 'conjoining' (Ingold, 2012), can provide insights into detail of how students are becoming teachers of PL-PE. Co-correspondence (in Ingold's sense) is not to be confused with Barad's (2003, p. 802-803) critique of "correspondence between descriptions and realities", which is

dismissed as representationalism - like “two facing mirrors, the epistemological gets bounced back and forth, but nothing more is seen”. At Ingold’s (2016, p. 10) “interstices”, conjoining of actors, or at the ‘betweens’ (Whitehead, 1938), translations are occurring (Callon, 1986; Dahlberg and Moss, 2010). Holly becoming teacher is one example of intra-activity being altered during *betweens* of teaching↔coaching. I would argue, as seen in Chapter 6, that there is no inert ‘gap’ at these junctures, at the points of translation, but genuine fusions, overlaps, fleshiness filled with vibrations (Bennett, 2010), ripples (Whitehead, 1938) or affective forces (LeGrange, 2018). To make explicit where translations were enacting PL-PE during student and practitioner practisings, I detail examples of ‘strings of mediators’ after Anecdote 7.2 below.

As noted in Chapter 5 and as I said above, the strategies for analysis include lifting or loosening the meshwork, airing collections of actors to gain a better view of the workings in an assemblage. As also introduced in Chapter 5, since I was diving into “the murky middle of existential experience” (Crowther et al., 2017, p. 833) the heuristic, ‘unravelling translations’ (Adams and Thompson, 2016, p. 74) seemed pertinent. Simultaneously, once loosened, the lines flowing into and away from the meshwork surfaced, and so the heuristic ‘tracing responses and passages’ (ibid., p. 81) provided access to where actors were conjoining or where lines of flight were knotting, then making other lines, or being left dangling at loose end(s). As explicated in the above example of becoming teacher, some collections of actors created knots (Ingold, 2012) where temporary aspects of PL-PE were ‘seen’. In knots, actors from across spacetimes were enmeshed, and diffracted through other practisings, observations and/or interviews with participants.

The next anecdote (7.2) about equipment in PE illuminates how acts of translation may “create convergences” (Callon, 1981, p. 211), and also multiple lines leading to different further translations, other practisings or assemblages. Callon (1986) calls the activities of actors negotiating processes of transformation “displacement” – such as here, an event/assemblage becoming recognisable as a PE lesson. Then, things continue to conjoin, translate, halt or flow elsewhere, hence this anecdote demonstrates one way of ‘tracing responses and passages’.

Anecdote 7.2 - PE Equipment 'driving what's happening'

PE equipment stands ready to become part of the lesson. Yellow mini-hurdles, tennis balls, playground markings/lines and teacher instructions are waiting to become part of today's PE.

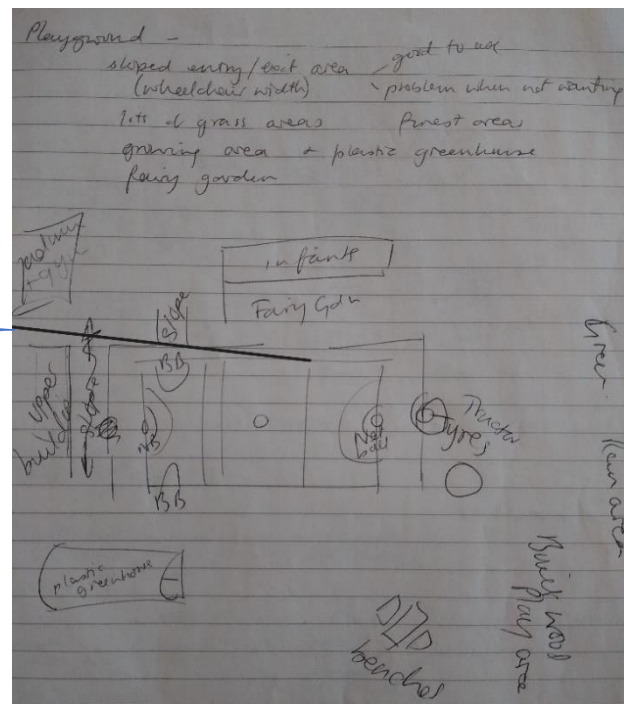
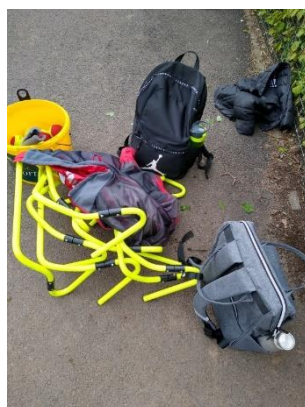


Figure 7 "Equipment ... driving what's happening", Eileen (Interview and Observation)

The gradual (re)turn of equipment has seen an increase in the variety of activities in lessons, showing that "equipment is kind of driving what's happening" (Eileen, Interview, p. 11). Pupils are excited, touching equipment and causing disturbances during PE lessons! Sarah (Interview, p. 4) says that giving the pupils discs, the big circle hoop ones ... never lasted! We ended up not keeping them out because there are some big trees, and they all got stuck in the trees. But, she says, pupils had to learn what to do with the discus, and you could see their knowledge developing when they said things like 'oh, if I did it like this then it's going to do that, but if I do it this way, it doesn't go as far', so they were kind of building that thing of how best to hold the structure of their body to then throw the discus. Throwing discus,

swinging hockey sticks or golf clubs are all practiced in PE but this also has to be done safely.

The physical-affective-cognitive are coming to the fore even though students are not making this explicit. For instance, cognitively ‘working out what to do’ in discus—tree—playground relations *whilst* performing physical movements, demonstrates how knowledge and understanding are becoming through/with practisings. Aspects of PL are implicated during some of these practice opportunities. The affective is similarly, relating/conjoining/co-responding as seen in Figure 8, below, as pupils learn to perform safe PE.

2. Bringing out new equipment for the children to try – kept their motivations up and excited them to engage in new physical activities.	Success Criteria Results > most children able to stay safe - some children not thinking about physical location of themselves + throwing equipment too high which may hit others *
* children enjoyed using hockey/ golf equipment but not using safely.	Areas for development (what didn't work and why?) > Not checking in children know how to use all equipment safely when adding new resource
keeping each piece of equipment in its designated space.	
Next steps for the children 1. Encourage children to stay at their designated station until told to move.	

Figure 8 Safety-Excitement, Lesson Plan Assemblage

Doing boxing moves means skipping about the playground, kicking high and punching the air. Not kicking someone else is a skill, but staying in their own space bubbles helps pupils to be safe. The game of ‘tig’ means pupils can go into someone else’s space bubble and someone can come into theirs. This is dangerous with the wheelchair user and so attention to ‘brakes’ is needed! Who is pushing the chair, are they travelling too fast, will the footrests of wheelchairs bruise another pupil’s shins? Accounting for all this means some pupils reinvented the rules of tig - ‘...right, we need to change the game ‘cause he can’t go as fast in his wheelchair as we can run, so it’s too easy to tig him ... so we’ll make the rule that

he's allowed to be tiggered twice ... before he's out' (in Eileen, Interview, p. 13). In another lesson, pupils sometimes come out of the wheelchair, "crawling or kneeling ... pull themselves up on things" in ways that suit capabilities (ibid., p. 14). Choice is important during PE and things can be adapted, accommodating (Pushkarenko et al., 2021) or enabling so everyone can take part based on what they 'can do'. Often, pupils can create the enabling environments, adapting activities to make them fairer.

Introducing a 'new resource' (Figure 8) stimulates reflecting on safety for children. Other times many children are able to 'stay safe' (Figure 8) during practisings – whether that means not hitting one another with golf clubs or self-regulating vigour of movement and level of boxing challenges. The tension between doing the physical activities and being safe is negotiated by all participants and reflected across data. Safe PE—equipment/thing is in relations with digital learning environment, coaching experience, other staff, the weather, whilst simultaneously, equipment, water bottles, or pupils, are given 'designated space' or a 'designated station' (Figure 8). Safety—equipment relations are influencing pedagogical strategies and pupil movement during PL-PE.

Summarising strings of mediators enacting realities

The above anecdote shows quite complex nuances of how PL-PE is enacting in practisings even without the prominence of PE equipment. To show lines of mediators and where some diffractive patterns were being enacted, I present two examples where I experimented with showing how to trace acts of translation - strings of mediators (Callon and Law, 1997). Along these lines, aspects of PL are becoming evident. In the first move the following mediators might be identified:

- COVID-19—no equipment on lesson plan—minimal equipment for teaching throwing and catching—hand sanitiser—imagination (affective)—virtual TV remote—travel—variation in speed (physical)—time (stillness/pause or move, physical)—space (space bubbles, cognitive, physical)—following instructions (knowledge and understanding)—engaging, having fun (affective, motivation and confidence).

In another move:

- Imagination (affective)—Minecraft™—boxing moves (physical, cognitive)—pupil learning (cognitive)—pupil feeding back (affective, cognitive)—peer assessment (cognitive).

Even in tracing lines in some detail, the above sequencing of actions hides the ‘nitty gritty’ in-between features that were also here. Callon and Law (1997, p. 179) note that “action cannot be explained, in a reductionist manner, as a firm consequence of any particular previous action”. Presenting strings of mediators as experimented with above, is also dangerously linear, possibly ‘slipping’ into a manageable, familiar way of sharing ‘data’ (Berry, 2015). The succession of actors ‘listed’ here were creating PL-PE assemblages which relied on many nuanced translations that it might be impossible to articulate. But this is not necessarily an issue. For purposes of understanding PL-PE, the move to thinking about relations and intra-activity is enlightening. It was mentioned earlier in this chapter that translation is two things being changed when they act together, yet for Callon (1986) translation is a process before a product, hence my suggestion earlier that translations might be more akin to relations. Callon (1980, p. 211) defines translation as “creating convergence and homologies by relating things that were previously different” – so relations among more than two heterogeneous things sometimes converge and are becoming similar in the e/affects, during their practisings. As discussed earlier in relation to Holly, each thing in the strings of mediators above is already imbued with intra-activity (Barad, 2008). In reading ‘virtual TV remote’ for example, there are both discursive and material intra-actions being blurred as pupils run, freeze and move backwards – travelling whilst being aware of their own space bubbles. Pupils understand the language, and what the virtual ‘sign’ of a TV remote control does, and can demonstrate this performatively, enacting PL-PE. Practisings like this show knowledges are being produced as pupil-virtual remote/discuses/boxing moves are blurred together (Jackson and Mazzei, 2012) in processes of translation, or in collective relations.

In a sociomaterial sense, PL-PE assemblages were created alongside the COVID-19 ‘breakdown’ (Adams and Thompson, 2016), circumstances which were inherently socio-political. During this time participants were actors in several realities, some

of which they could prepare for more readily than others (Law, 2009). As schools reopened, there were unforeseen realities for student-participants, including classes being taught together, no equipment for a period, and imagination being foregrounded in lesson narrative or storying. A very particular series of circumstances/events has afforded examples which have shown the importance of how empirical work is valuable in highlighting *how* sociomaterial practisings are unfolding. There was no *a priori*, 'single' reality to which most humans could relate during this time, which sits well with Law's (2009, p. 12) idea to,

attend to practices. Look to see what is being done. In particular, attend empirically to how it is being done: how the relations are being assembled and ordered to produce objects, subjects and appropriate locations. Second, wash away the assumption that there is a reality out there beyond practice that is independent, definite, singular, coherent, and prior to that practice.

There can be no returns to pre-pandemic 'realities' because COVID-19 is enfolded in past-present-futures. Fundamentally, PL-PE practisings were being stabilised with actors common to PE lessons and also not so familiar, showing how 'appropriate locations', objects and subjects were relating to enact PL-PE. By unravelling translations, 'unintended realities' (Law, 2011) were made visible by things like the imagined remote – objects not usually included in PE, or digital games (Minecraft™), for creating challenging PE lessons (see Figure 6). Not only did the digital become prominent in these realities, but aspects from Scottish curriculum policy featured also.

The principle of 'challenge' (Kretchmar, 2006; Scottish Government, 2009b) was circulating in PE lessons during ongoing negotiations, for example among class teacher—equipment—no equipment—motivation—outdoor spaces. When following the actors here and from Chapter 6, connections among certain things in PE were continually being made and unmade, creating multiple sociomaterial meshworks. Things like the plastic hula hoop and plastic golf club are commonplace in PE lessons, holding realities as co-existing (Mol, 2010). Examples included physical activities which challenge pupils—CfE Experiences &

Outcomes—pupil writing capabilities—safety— and so on. However, hoops and golf clubs also disrupted meshworks (Adams and Thompson, 2016). The next anecdote draws from a range of relations which demonstrate where aspects of PL were enacting during the re-introduction of PE equipment.

Anecdote 7.3 - Practisings of PL-PE

Pupils like spinning hula hoops around their wrists whilst Sarah is sharing instructions. She asks the two classes to work at their stations and be careful about how they are moving the equipment about. ‘Listen to your adult’ is shouted across the outside space. It is very warm and water bottles are lined up along the side of the grass area. As I walk around pupils tell me all kinds of things - “I’m practising my hula hooping but getting it from one hand to the other,” curious, they ask me “what’s your name? Are you a boy? Will you teach us?” “Look what I can do. Is this gym? Good. I like gym.” Teaching the “nitty gritty” (Eileen, p. 7) is important, so when a foam javelin is thrown but goes awry, Sarah comments “if the javelin went the wrong way – why?” Sarah is focused on the golf activity station since this is where safety is paramount but also where she thinks teaching how to hold the golf club relates to how they are gripping a pencil to write. She asks, “Is that how I told you to hold it?” She guides a visually impaired pupil. Eileen corrects particular movements, reflecting that “oh, his foot’s not in opposition”. She notes that “someone’s not just good at PE by magic ... there’s no mystery to it”.

Pupils are cartwheeling in random spaces, working well at different stations. There is constant chatter during the lesson - “Awe, I just missed. I’m going to try that again”. Sarah’s voice occasionally soars above the groups: “how are we going?” and at various points she signs to a hearing-impaired pupil. She expresses surprise when pupils demonstrate knowledge and understanding, and physical competence from previous throwing and catching activities. The pupils work well, showing great “teamwork, communication,” balls are being shared, pupils taking turns, including pupils who attend Sarah’s ‘social skills group.’ Pupils are

demonstrating affective qualities which is a pleasant surprise because Erin had not expected them “to come up with things like that” (Interview, p. 7).

Things permeate Figure 9 which shows student-participant lesson plans and evaluations. The practisings planned for in the tweets/posts and lesson plans are accompanied by unplanned things. This is in part because PE teaching during COVID-19 had “less boundaries ... allowing things to be freer” with “potential ... for getting the pedagogy right” (Eileen, Interview, p. 5). Students persevered in enacting guidance from documents, such as ‘Balance and Control’ found in *Benchmarks PE* (Education Scotland, 2017).

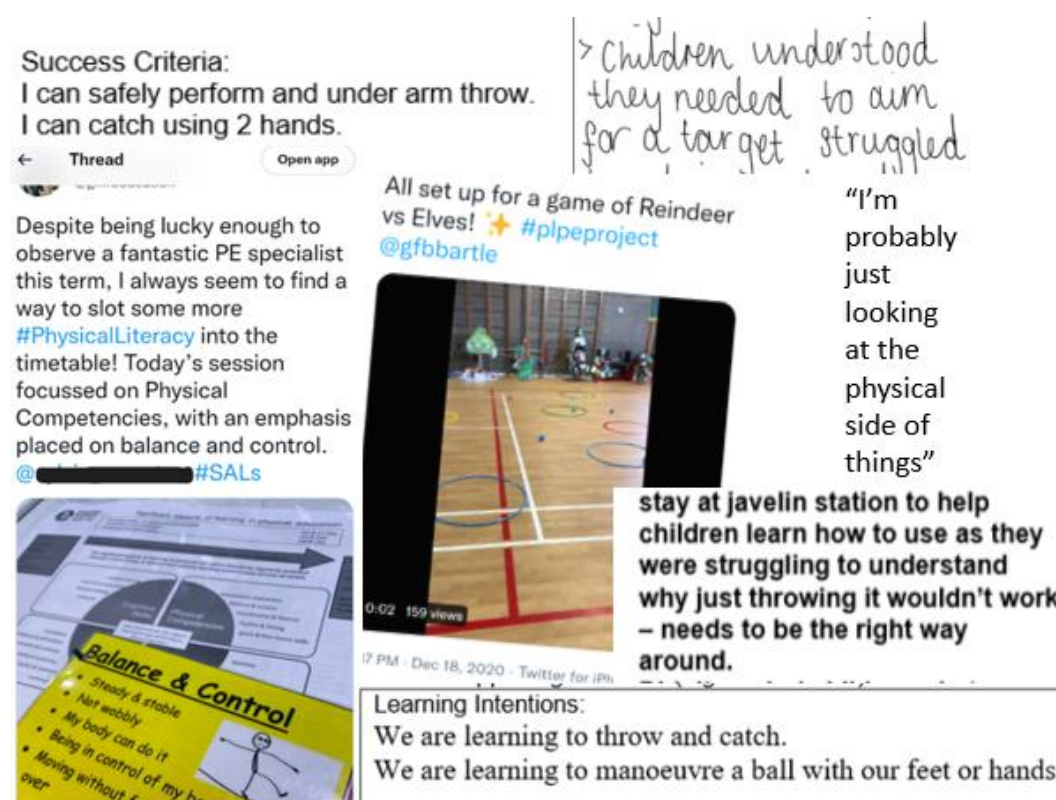


Figure 9 Things-Physical Competence. (Erin, Tweets: 18 Dec. 2020 & 8 June 2021 - Balance & Control-Key Learning (SAoL) in PE, Gym set up-hoops and balls; Erin Interview; Sarah Lesson Evaluation reflections)

Data showing in Figure 9 present activities for lessons which are located in the key aspect of learning in PE, ‘physical competence’. Participants reflected on “physical mostly” and fundamental movement skills (FMS) drawn from the *Benchmarks* policy document (Erin, Interview, p. 3) and a further local authority guide called *Progression Pathways* (ibid., p. 11). However, joy, fun, what pupils ‘like’, choice,

“avoiding disappointment” (Sarah, Lesson Plan, 25.5), providing challenge to thwart ‘boredom’, promoting enjoyment (Holly, Interview, p. 5) and encouraging more physical activity (Sarah, Interview, p. 3) circulate the movements provoked by these data. Relations among policy guides, enjoyment, safety and challenge become apparent in the practisings in PL-PE. I call this line of flight ‘enjoyment’ because enjoyment permeates much of the empirical-philosophical (data-theory) here and in empirical research on what-why-how of meaningful PE (Beni et al., 2019; Ní Chróinín et al., 2023). In PE, “meaningful accomplishments are those that have criteria, rules, standards for success and criteria for excellence” (Kretchmar, 2006, p. 352). In examples from Anecdote 7.3 above, both participants and pupils rely on enjoyment or fun being part of how they are *intra*-acting during PE, to be motivated to participate, despite physical competence appearing to dominate at planning stages (Figure 9). Accompanying fun, however, are movement challenges, and participants were aware of providing teaching points – the nitty gritty referred to in Anecdote 7.3 – thus contributing to hopefully, meaningful experiences for pupils.

Motivation through enjoyable physical activity experiences permeates PE and PL literature (Whitehead, 2001, 2010; Kretchmar, 2008; Durden-Myers, 2020) and is consistently present across empirical data (Ní Chróinín et al., 2023). In some findings, motivation—PL, as perceived by pupils, are found to be relating with low significance (Cairney et al., 2019a; Sum et al., 2022). However, opportunities to exercise choice within lessons also intra-relates with motivation through aspects of self-determination theory (Lee et al., 2017). Thus PL-PE during COVID-19 may have provided un-planned ‘freedoms’, for example where Sarah (Lesson plan 25.5, Figure 8) introduced ‘new’ equipment, which “kept their motivations up and excited them to engage in new physical activities”. There remained, however, juxtaposition between participants wanting to challenge pupils, for example teaching ‘how’ to throw foam javelin, with multiple classes and limited time for practice/play. Participants seemed to be working at the ‘in-betweens’ referred to in Chapter 2 (Kretchmar, 2007), where motivation may or may not flourish and is viewed holistically, not as either-or (external-internal, subjective-objective). The

‘in-betweens’, which I suggest are where energies, forces, affects are at work, are perhaps more pronounced for students becoming teachers than, for example, the practisings where Eileen (the experienced practitioner) readily embedded fun, skill development, progress of learning, such as when she asked a pupil to adjust foot position to improve throwing capability (Anecdote 7.3). However, all participants expressed frustration about the relations of enjoyment—challenge, and of not being able to develop learning in PE during this COVID-19 period.

Concerns from participants bely the practisings and physical activities that were experienced by pupils, as observed during my visits to schools. As entangled with choice, enjoyment, motivation, *confidence* at intra-acting with things was evident - confidence is another affective aspect of PL. Sarah sought to provide practice opportunities for pupils to build confidence and physical competence (Interview, p. 3; Lesson Plan 25.5). Her understanding of how pupils learn to write (including how to hold a paintbrush, pencil, chalk) seemed to ‘leap’ to a PE lesson plan (pupils need practice holding a plastic golf club). The golf club has been followed from Chapter 6, and the intra-activities explained now are diffractions whereby data from past-present-futures is alive in pockets across multiple spacetimes. Diffractive analysis shows how leaps are made across/between/among spacetimes and point to how past-present-futures are entangled and dynamic (Barad, 2007, 2011; Hollin et al., 2017). The intra-activities of pupil—golf club or pupil—pencil are examples where positive differences are identifiable (Colebrook, 2002), positive because actors conjoin to enact striking a ball with an implement or making patterns on paper. Herein each actor is complicit in co-constructing realities, hence Barad’s (2007) agential realism which leaves traces on bodies, that are effecting/affecting ongoing relations with the world, and specifically PL-PE. To exemplify diffractions further, the next anecdote unravels and traces lines around pedagogical techniques and strategies.

Anecdote 7.4 - To Drink or Not to Drink, who-what is conjoining?

Water bottles cause all sorts of unrest in primary school classrooms, being kept on the pupil's desk or at the communal class sink. Sometimes teachers give permission to go and take a drink, other times, they do not. There are silent expectations that water is a positive force, for concentration, for life, and so to withhold access to it would be unkind. On this scorching summer day pupils are outside with the class teacher, class assistant, student, and the head teacher. The head teacher is enjoying participating in a PE lesson, "just having fun with them [pupils]," said Erin. The atmosphere is relaxed, perhaps because of the heat! Today, the activity today is quite static, with a ball being passed around a large circle (Image 10). Out here, the water bottles are strewn along one side of the playing area and sweatshirts are taken off and dumped at the other side. Everyone is trying to keep cool in the heat whilst playing together. When an adult drops the ball, they pick it back up, persevere and carry on the game. It is not clear whether the head teacher or other staff would join ordinarily or if the presence of COVID-19 has prompted them. The enjoyment is palpable, and this unassuming physical activity of adults and children playing pass is bringing forth that motivational aspect of PL.

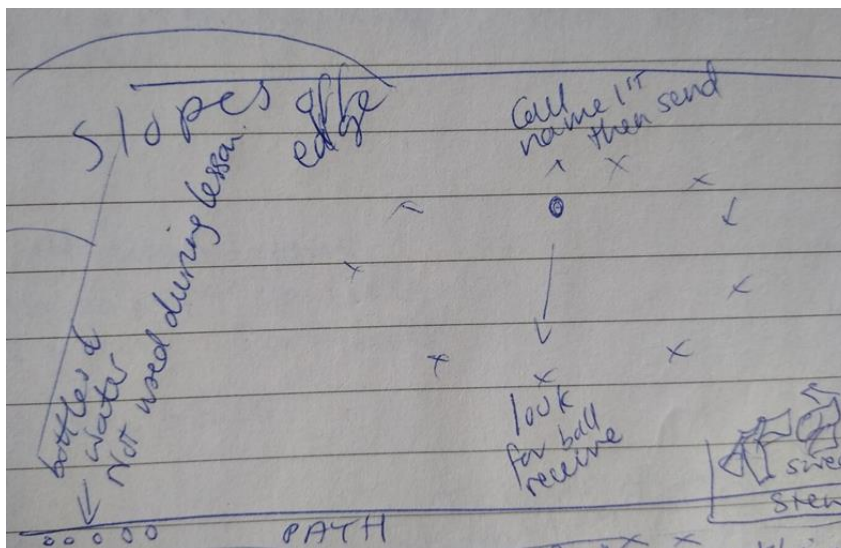


Image 10 Static Passing Game, Sarah Observations

There is little movement, to guard against young pupils overheating. However, other preparations for safe physical activity, such as placing water bottles at the

side, ready to be sipped from, were ignored. Maybe the fun of playing the game is more relevant for pupils than taking a drink. The adults did not encourage drinking either!

E/affects of water bottles

Taking on water is a line of flight left untethered, loose at the ends (Ingold, 2016). Heuristic 7 unravelling translations (Adams and Thompson, 2016) is helpful in seeing the ways in which social and material things in Image 10 might have been expected to conjoin (heat—water—pupil—play). The translations that were building a sociomaterial world progressed differently than was hoped for by the student-participants and teachers. There is an inherent contradiction between water bottles remaining static at the side of the play area whilst the class teacher recommended playing a static game of pass because it was so hot. Indeed, to use Callon's (1986) term, water bottles were displaced. Dynamics of play—adults—water—heat demonstrate the control certain actors have over others. In seeing what are failed (intended) translations between desired realities (drinking during activity) and practisings (of not using the water bottles), collateral realities are being enacted (Law, 2011). Water bottles demonstrate the importance of water as the flows of life, uniting and dividing, provoking changes as it flows (think of feeling dehydrated, or of sweating). Here, although water bottles are also a reminder of distributed embodiment (Neimanis, 2017), the water was not being used as prevention of dehydration, as intended.

Water bottles were enacting across multiple spacetimes, carrying important *solutions* to different human needs. Hot weather and being outdoors during PE provoked responses like moving less, reducing opportunities for bodies to overheat, and increasing opportunities for people to take in fluids (Holly, Teacher Observation and Interview; Sarah, Observation). In Anecdote 7.4, pupil—water relations were delayed until pupils were returning to their indoor classrooms after physical activity. Bottles prompted sipping of water and therefore, continued hydrating and recovery, with potential restoring of embodied wellbeing. Thus another reality is enacting as water—pupil return to further educational tasks.

Holly had made a point during her lessons to explore why drinking water is important during exercise, bringing prior experiences, and employing CfE Health and Wellbeing *Experiences and Outcomes* (Scottish Government, 2009a) into this meshwork. Here, water as an important actor for past-present-futures, shows how relations and connections are working fluidly across spacetimes, because water—pupils—moving—Holly are surfaced explicitly in this education context. The connections of water—pupils—moving—Sarah were not as evident, for varying reasons, but the point here is to show that at times connections/relations travel among sociomaterial worlds, and sometimes not so easily.

Research in PE has long promoted the contribution that the subject makes to affective learning (Krathwohl et al., 1973; Arnold, 1979; Hellison, 1987; Teraoka and Kirk, 2022). Although often assumed to be associated with relations among humans, affective experiences are reliant upon relations with things both human and nonhuman, *in moving*, which Whitehead (2001; 2010) would place at the heart of her phenomenological underpinning of PL. Similarly, Spinoza (2002) has argued that the relations of affective forces in ongoing *conatus* are what create different positive e/affects as things/bodies are moving towards *hilaritas*. Forces of affect swirl around PE-PL assemblages such as the example above, of teachers showing vulnerability when dropping the ball during the passing game in Image 10. Indigenous practices in PE embed the idea of being humble (Culp, 2021; Nездоль et al., 2021) which opens spacetimes for developing relations and challenging anthropocentric and text-based approaches. Shared experiences such as throwing-catching are already conjoining with affect, where the latter is a key element for positive experiences in physical activities and movement (Li et al., 2022).

Evident throughout Sarah's data meshwork was her attention to the affective experiences of pupils. This is important for PL-PE as it embraces an holistic approach of which Sarah seemed cognisant. Sarah's understandings of teaching PL-PE appear contentedly entangled across spacetimes. She had planned and carried reflections from her evaluations into next lesson(s). Importantly, PL-PE

predicts calls for teachers to “create powerfully sensory movement moments for students to share so that they may each feel i.e. respond in/with their bodies to express themselves emotionally” (Lambert et al., 2022, p. 15). As was discussed in Chapters 2 and 3, by recognising other(s)—world in PL-PE, embodiment is extended from and entangled with others/things. Here, the intra-actions of things human and nonhuman are potentialities for movements in all kinds of directions. Embodiment is already its own meshwork of humans and nonhumans, with their own intra-activities, and not a static thing awaiting inter-action.

Chapter Conclusion

The series of anecdotes, drawn from empirical data and then entangled with theory—other data have spotlighted two key (temporary) convergencies of lines. The first was that relations bind things in-with-through PL-PE experiences and relations are ‘being done by movement’ (Riley and Proctor, 2022). The example of teachers dropping the ball and being humble further shows how a relational materialist approach is a turn away from individualised conceptions of practisings. Second, sociomaterial posthuman approaches to analyses have helped surface the minutiae of PL-PE practisings. Rhizoanalysis pulled me into the middle of data, and anecdotes allowed ways of presenting converging lines in as much messiness as possible. It was apparent in data-theory that translations, intra-activity and diffractions were useful tools for unravelling knots to trace various passages during which PL has – or aspects of PL have – been enacting.

This chapter has shown that for participants there were restrictions, opportunities, unplanning, adaptations, and ongoing relations. These experiences highlighted what was present in education during this research period, and importantly, what has been/is being routinised during ITE. The strategies for analysis have allowed me to radically attend to what was/is present and provide examples of different ways of doing PL-PE. Things from empirical data were foregrounded and shown to be leading practisings, such as where *Benchmarks PE* (Education Scotland, 2017) conjoined with physical competence. What also

became apparent through multiple analysis strategies, was that the affective, such as motivating strategies, enjoyment, confidence, and challenge, were circulating in PL-PE meshworks. Points of translation, or what I termed intra-translations, the in-betweens that students/practitioners considered as tensions, were ripe for differences or unintended realities to be enacted. This discloses 'in-between' as not inert gaps but hives of activity/energies/affect. Detailed investigation of different practisings of PL-PE were afforded in part because of COVID-19 as breakdown, which created interferences. This foregrounded encounters of aspects of PL across many spacetimes, such as hand sanitiser, water bottle, affective domain interfering with student-participants - like diffractive patterns (Barad, 2007), ripples or waves of water overlapping (Whitehead, 1938). Restrictions on equipment, school structures, playgrounds, different-changing teaching staff and pupils, normative practices associated with primary PE, were enacting differently with the breakdown effected/affected by COVID-19. Enabling different knowledges was an affordance of restrictions - this was an (enforced) opportunity to challenge the norms such as the structure suggested by university-provided lesson plan, or how the space and people were involved in PE lessons. Whether such changed education activities have provided potential for re-envisioning how ITE is 'done' remains open to further research.

Next, empirical data-theory continues along multiple lines, some of which are interrupted, some of which traverse spacetimes, and so are existing in multiple sociomaterial, posthuman realities. The following chapter travels some of these lines exposing multiple PLs and how students were/are becoming teachers.

Chapter 8: Becoming Teachers ↔ Multiple Physical Literacy, analysis-discussion 3

In this chapter, aspects of how student-participants were becoming teachers will be presented alongside their practisings of PL-PE. The chapter structure is presented in Figure 10 to show the three parts. As noted earlier, separating the analysis-discussions is an heuristic strategy, not intended to deny entanglement. This chapter continues to weave empirical data-theory-researcher in its analyses and discussions. Part I presents how student-participants were/are ‘future-bound’ (Braidotti, 2005) becoming teachers during teaching of PL-PE. In Part II, I show how political effects/affects surfaced as more prominent actors were enacting singular but multiple PLs (Gatens and Lloyd, 1999). Picking up the ongoing second thread of this doctoral work, in Part III, I show how PL-PE was investigated whilst being mindful of philosophical approaches informed by understandings or enactings of movement. This is in part a response to Koro-Ljungberg et al. (2013, p. 141) who concluded that it would be “interesting to explore more how to blend methodological and content knowledge without creating binaries such as theory-practice ... of research”.

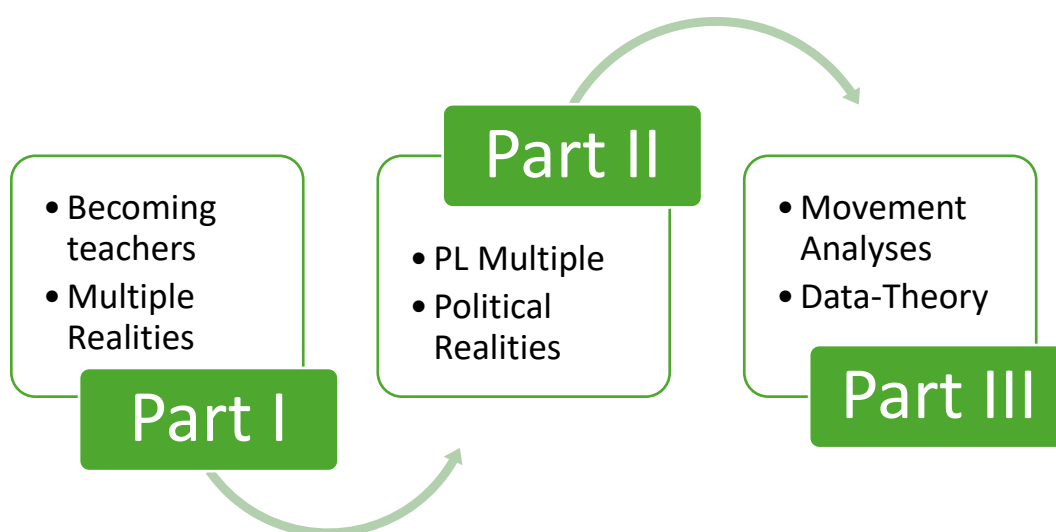


Figure 10 Chapter Overview

Following Chapters 6 and 7, in this present chapter several devices were used to bring data-theory together from across specific times and places, from across spacetimes. These devices are seen in the middle circle of Figure 11:

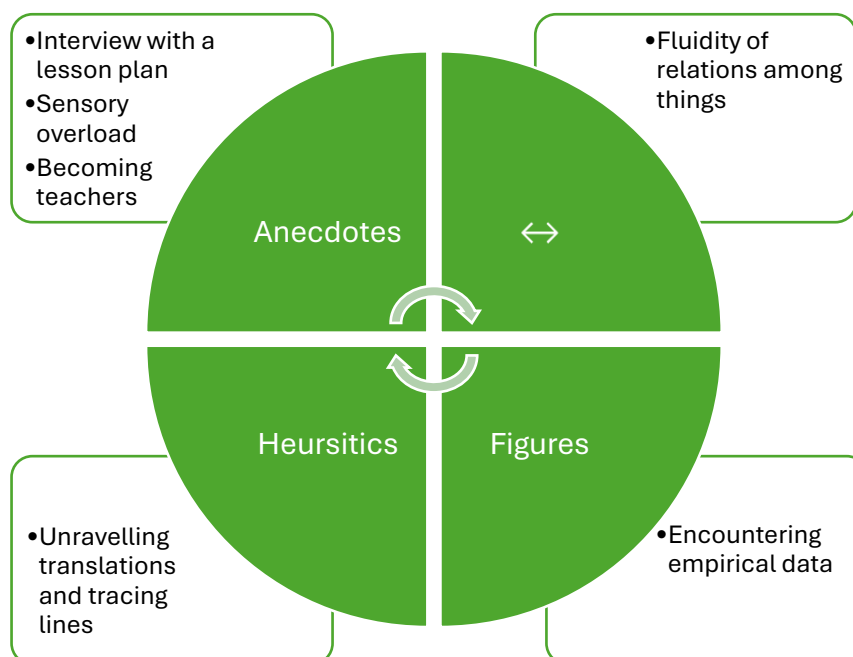


Figure 11 Overview of Analytic Devices

At the end of Chapter 7, it was suggested that PL was emerging across multiple spacetimes, and this idea of multiple realities is developed here. Building upon the previous two analysis-discussion chapters, I show that multiple realities e/affected different opportunities for students becoming teachers, informed by data collection during a particular period. Chapter 7 began the conversation about some actors being political and this is further developed here. The research entanglements continue to be unravelled - for example, *conatus* and Spinoza's (2002) monist perspective are relevant for discussion about relations in play as students are becoming teachers. Spinoza's (2002) notion of force, or affect, always requires another thing for that force to exist. For example, during the pandemic, PL-PE practisings continued to provide affective relations even though some students found themselves in spacetimes different to the placements they had previously experienced. Thus, collateral or unintended realities (Law, 2011) were enacted, some of which were depicted in the previous two chapters.

This chapter continues to be informed by Heuristics 7 (Unravelling Translations) and 8 (Tracing Responses and Passages) (Adams and Thompson, 2016). Key questions from these heuristics are a way of "interfering" with empirical-theoretical knowledges (Mol, 2002, p. 155) to seek entry points to try and

understand the research assemblages. As before, the heuristics are presented here in an ordered way, but the questions are entangled with data-theory throughout the chapter.

Set 1: What can be discerned about the gaps between practices and the realities they enact?

Who-what is entrenched? Who-what is excluded? What is made present? What is made absent? Are there any intruders?

Set 2: What kinds of passages are being improvised as entities thread their way through the ways of others (human and nonhuman)?

What lines of movement can be seen? How are lines of movement (or becomings) being re-directed?

The first set of questions is a continuation from lines exposed in the previous chapter, thus demonstrating how research analysis was unfolding during analyses, and not predetermined by other conventional strategy, as discussed in Chapter 5. Since observations and other empirical data occurred during a particular socio-political spacetime, there are multiple realities and practisings on which to reflect further. Some actors might be deemed political since they influence others (Law, 2009), such as the institutionally constructed lesson plan template which guides students as they are becoming teachers. Educational artefacts like the template, it may be argued, are based on long-standing or entrenched ideas. Indeed, it will be suggested that such routinising is commonplace in ITE and that by paying attention to what was present during this particular research period, different configurations of education might be opening out.

The second set of questions builds on lines which can be traced from analyses through the previous two chapters. Indeed, I purposefully repeat the question ‘*How are lines of movement (or becomings) being re-directed?*’ because this is an ongoing question as analysis progresses. The sentiment of the question and of this research is ‘movement’ which, it has been argued consistently, chimes with the philosophies of PL and Spinoza’s (2002) *conatus*. The second set of questions guided investigations about students becoming teachers and PL as emerging in

relations human-nonhuman. Before the opening anecdote, I would like to draw attention to the use of the double-headed arrow.

The notation of double-headed arrow ($\leftrightarrow$), as discussed in Chapter 5, shows that relations flow in multiple directions, creating “a webby sphere of intimate relational connections to our lifeworld” (Adams and Thompson, 2016, p. 59). It is depicting an interplay, the intra-activity among actors, and not linearity, despite the straight line showing back/forth or side/side directions. I defer to limits of text and discussions throughout this research wherein I have been seeking to indicate dynamics. Here, arrows show fluidity of the relations among becoming teacher *with* PL-PE practisings. As students were becoming teachers, the arrows also present how negotiations and how the effects of different assemblages are perpetually in motion – such as students returning to university and re-returning to placements in schools, developing confidence as teachers. The arrow heads also depict ongoing movements and prompt readers that all that is enfolded/unfolding during these research practisings are dynamic and because of intra-activity, difficult to halt or change. Thus, the arrows act as a semiotic device, but one heavily laden with material-discursive processes (Kuby and Christ, 2020). Rather than *representing* inter-relationality, the arrows *are* intra-activity, a relational materiality – a surfing, if you will, with the journeying of students becoming teachers and the enactings of PL-PE.

As has been the case throughout analysis, a rhizomatic approach reinforces that actors, like the lesson plan template, are already assemblages, and unravelling their ‘doings’ may help surface other ways in which they might be entangling elsewhere. Indeed, the idea of collateral realities (Law, 2011) is relevant for this particular research period and helps show the effects of relations among different or between different assemblages. The chapter structure cascades from Anecdotes 8.1 Interview with a Lesson Plan, and 8.2 Planning $\leftrightarrow$ Assessing, which together highlight the effects of relations as students were becoming teachers

during this period. Thereafter, some of the relations follow lines of movement of who-what might be entrenched, excluded or made present. Working in the double headed arrow spaces, the fleshiness or meshwork of relations, are being foregrounded.

Part I: Becoming teachers

Anecdote 8.1 - Interview with a Lesson Plan

Onto the lesson plans go notes about previous learning of the class, and then intentions of the next lesson. Designing this lesson includes knowledge about PE, about Scottish curriculum guidance, and how to make this lesson fun for the class. The plan is emerging on the screen in front of Holly and Sarah, digitally growing before their eyes. The text boxes on the lesson plan templates have their own titles which reflect the hierarchical cascade of connected activities guided by Scottish policy. Pressures are mounting - this plan has to be sent to the mentor two days before the lesson, and it has to be uploaded to the professional practice (teaching) file, to inform assessment decisions by teachers and tutors.

Working towards outcomes of a Curriculum for Excellence within and beyond my place of learning I am enjoying daily opportunities to participate in physical activities and sport, making use of available indoor and outdoor space. HWB 1-25a		Assess previous learning by observation and questioning
Learning Intentions We are learning - the basic boxing moves and how to make combinations of them - ways to make our technique better	Success Criteria I can - perform a range of punches, kicks and knee strikes with correct form - make combinations of these moves	
Working towards outcomes of a Curriculum for Excellence HWB2-22a I practice, consolidate and refine my skills to improve my performance. I am developing and sustaining my levels of fitness.		
Learning Intentions We are learning how to use equipment safely	Success Criteria I can: - Put/hit ball below waste - Aim for a target - Dribble around a set of cones - Keep close contact between golf club/hockey stick and ball.	Questioning for self – assessment can children reflect on their practice and what went well.
Learning Intentions We are learning to use our body in different ways to improve coordination and fitness.	Success Criteria In P.E. I can: - Participate in a variety of activities. - Attempt to move my body to increase skill. - Practice my activities to improve coordination and balance.	Observation – who needs additional support

Figure 12 Lesson Plan Excerpts, Student Planning and Assessment Intentions

In groups the class come up with their own 'would you rather' choice with boxing moves attached to each option and take turns doing these with the rest of the class.	Areas for development (what didn't work and why?)
Children have opportunity to describe a move they learned and used during the game. Stretch head to toes	1. Not encouraging children to share items, feel like many children were waiting for others to stop using and then would run out of time at a station and got disappointed. Noted by J.D. and I.I.
Plenary – What poses did you find difficult/easy? Do you enjoy yoga, why? Encourage that it is okay not to like it but must explain why.	2. Should have made an attempt to stay at javelin station to help children learn how to use as they were struggling to understand why just throwing it wouldn't work – needs to be the right way around.
Plenary – back in class, will discuss with children what activities they participated in, how well they think they participated, what skills do they think they practiced?	
Questioning for self reflection	3. Children are choosing and developing a variety of skills and are having opportunity to personalise their learning.

Figure 13 Lesson Plan Excerpt, Assessing and Evaluating

The class teacher, who is the mentor, gets to know the student over a six-week period and will work individually and collectively with university tutor to assess the student. No more than three 'Unsatisfactory' grades are allowed and so here is another pressure - to ensure planning and evaluating are well informed and thoughtful. Ideas are distilled into the white spaces on the template, and lessons are unpredictable. Being flexible is reflected in evaluations which are written at the bottom of the template – will it be yoga or will it be games? The to-ing and fro-ing of evaluating a lesson is the process of reflection, filling in white spaces – about teaching, pupil learning, and what might be best to 'do' next time round!

Lesson plan templates and ideas for design are introduced early in the ITE programme and students use this university template, which in effect keeps the design stable. Students are not encouraged to challenge the design of the template. However, when the textual referents gathered on the page are enacted, the lesson plan displays leakages. Where Learning Intentions (LI) and Success Criteria (SC) (Figure 12) are presented on plans, these are open to multiple possibilities, such as whether Sarah will teach yoga indoors, or a range of activities outside. During the research period, leakages brought about by the alternative lessons were accepted more than before the pandemic. Further, LI and SC in Figure

12 suggests predominance of the physical learning domain, but all domains are evident (Figure 14):

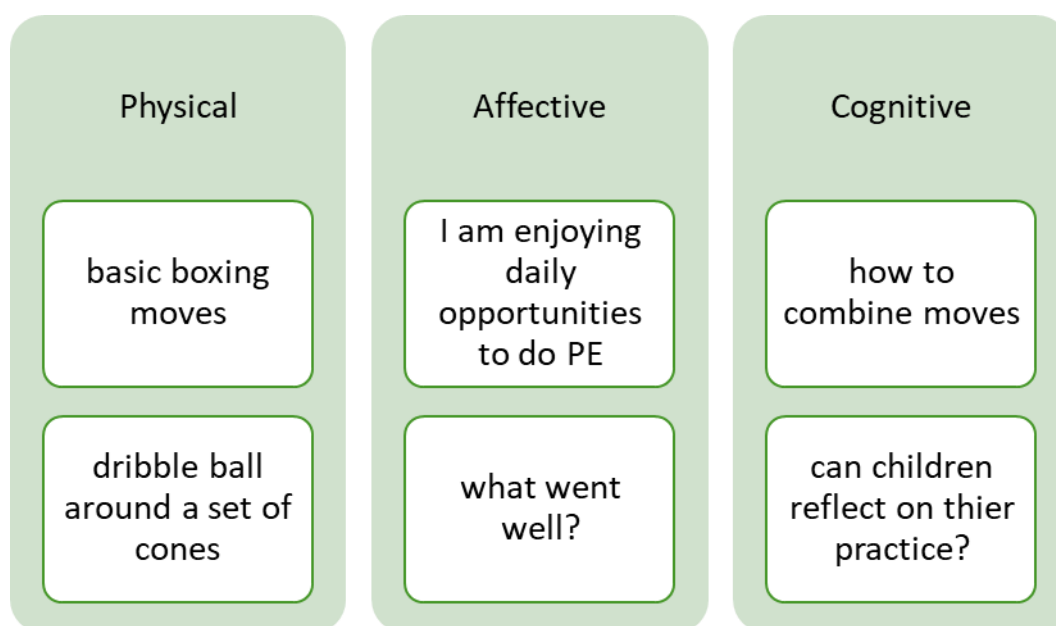


Figure 14 Domains of Learning Evident on Student Lesson Plans

To support assessment of pupils, Sarah and Holly employ observation, questioning or teach pupils how to self-assess and these are documented on plans also (Figure 12). In Figure 13 examples show that at times, pupils↔student-participant will discuss what was experienced in the lesson (what was difficult, describe certain movements, why were they practising certain skills). Further, during this third school placement, mentor↔student-participant are encouraged to discuss how to plan a series of continuous lessons across curriculum areas (such as science, art, literacy). For this, a Lesson *Outline* template is used. In terms of evaluating pupils, students expressed concerns and frustrations about assessment in PE, for which ideas often fell to the student to develop. The following short anecdote is a weaving of Sarah's and Holly's experiences during placements, drawn largely from their interviews. I have not used quotation marks to delineate their voices and have kept their linguistic nuances so they can be heard talking.

Anecdote 8.2 - Planning↔Assessing

In PE evaluation was very difficult because the planning was not as clarified as in, for example, numeracy. It is unfair, assessment is possible in every other

curriculum area, and this is quite easy to do, but this is not the same in PE. It should be - after all, PE is still a 'lesson.' In PE, assessment is not anywhere nearly as developed as in other areas of the curriculum. In literacy, we knew exactly what the next steps were going to be. It is frustrating that large classes, where we do not know pupils, means a lack of opportunity for progressing learning in PE. During placements, it is very hard for a student to turn to mentors and say 'actually, I don't think I want to do it this way'. And there were times where I did not agree with the PE environment that was created by mentors. Sometimes teachers were very woolly when asked about what they wanted to do for PE ... So, in numeracy they said 'I want you to teach ... time or data handling' and you know, 'here's the progression pathways and we're in the middle, do that one'. There was no progression, no impact during PE at this time, but here was one solution: whatever the context for learning in PE, generic ball skills associated with, for example, cricket, could be assessed in a manageable way because we are almost always able to play with a ball!

Sometimes, assessment in PE is all about safety, especially when we got equipment (re)introduced. Things like discus, boxing moves, hockey or golf clubs can be thrown or swung too far or too high and so it is sometimes frustrating to manage that tension between encouraging physical activity and seeking educational progression. In conjoined classes this was especially difficult - pupils saw the equipment and their mind and body were set on what that equipment was going to do. Where concentration was being developed during physical activity tasks, pupils were often not focused, cognitively, on what to do. However, only three or four pupils did not have something that they would want to do in relation to the equipment even in a class of about fifty 6–8-year-olds!

Anecdotes 8.1 and 8.2 provide entry points into thinking about how student-participants are becoming teachers. The lesson plan template begins as an A4-sized page. Presenting the lesson plan template helps to set the scene for how this actor, among many, contributes to students' lessons. Writing information into designated boxes on the page assists students as they develop teaching

capabilities. By breaking up tasks, often to build on and develop previous learning, tasks may become more manageable. The lesson plan functions to 'materialise' a lesson – or better, lesson plan is one actor in a PE (or PL-PE) lesson assemblage. The lesson plan itself is one product of 'ordered' practisings (Law, 2009) which seeks to provide a representation of a future and intended 'reality' – in this case, of teaching PL-PE. Although it appears on a plan as though how to achieve learning intentions are detailed, many (hidden/assumed/surprising) actors are included and implicated in creating or enacting lessons.

Lesson plan design is in relation *with* political realit(ies) of CfE (Scottish Executive, 2004), and the GTCS (2021) professional standards observed by all teachers and students. In what is an intended reality of securely demonstrating professional standards, there appears little opportunity for student-participants to enact a different politics. However, the breakdown by COVID-19 seemed to lessen the influence of planning and assessment documents (*HWB Experiences and Outcomes*, Scottish Government, 2009a; *Benchmarks PE*, Education Scotland, 2017), which ordinarily help student-participants to judge progression of the class and to make assessments of pupils (Holly, Interview, pp. 3 and 12). Documents are useful for providing guidance but during these placements, disruptions had occurred to change the experiences of planning and assessing. Another possibility for 'doing PE' opened out - students seemed to develop more holistic lessons.

Although the focus on developing physical competencies was something Erin and Sarah thought dominated lessons (see Chapter 7), Anecdote 8.2 shows awareness of cognitive aspects that were entangled in PL-PE (safety). Further, teaching the pupils to think about how physical activity made them feel (Sarah and Holly, Interviews) or how to provide peer assessment and how to give feedback (Holly, Interview) attends to affective, physical and cognitive domains of learning (as in Figure 14). Where pupils are becoming self-aware, and motivated to get better at physical skills, they become confident also – for example, by taking turns to show the rest of the class how to conduct boxing moves without injuring anyone nearby (Holly, Interview, p. 5). Student-participants were engaging in holistic practisings,

enacting PL-PE. In Anecdote 8.2, the nuance of language is also highlighted. For instance, calling primary school physical activities by a 'sport' name is avoided by Sarah where she refers to ball skills in the generic sense, yet she then refers to the sport of cricket. The association of sport with PE can be divisive (Carse et al., 2018), because it focuses on a sport and not holistic movement experiences (Kretchmar, 2000; Whitehead, 2010; Education Scotland, 2017; Wibowo et al., 2023). As explored in Chapter 2, this is one aspect of PE which continues to be addressed in the research literature, with the view to moving away from focus on sport-based practices.

The lesson plan template is compiled in a particular way yet might have been assembled differently. Law (2009, p. 5) states "that we're watching a form of politics, ontological politics". The associations developing in COVID-19—PE assemblages opened up other ways of doing PE *because* relations enabled different practisings. For, although lesson plan templates remained stable, lesson plans became less fixed. Thus, a less controlling lesson plan affected how student-participants could alter pedagogical approaches (Haerens et al., 2011). The sociomaterial posthuman approach shows that decentring the human opens up other ways of seeing relations that are working to enact power – such as here, among students becoming teachers—lesson plan template (which did not alter)—COVID-19 restrictions—less equipment—lesson plan content (which did alter)—dissolving ideas about progression or assessment. The ontological politics being enacted were foregrounded through altering pedagogical encounters.

Decentring the self, in Spinoza's sense, can be effected through pedagogically staged encounters with the world that allow things to teach us, revealing the resonances of our bodies and minds with those with which we might previously have felt no sense of kinship (O'Donnell, 2018, p. 827).

The things teaching *with* student-participants were multiple, and often not expected during this research period, but during practisings student-participants experienced unfamiliar resonances which are already intra-acting. In Spinoza's (2002) One Substance monism, the immanence of how actors might come

together is present in even the least predictable political environments as described here. Flexibility shown by students, to embrace very different actor-networks, was quite significant in this period of their ITE.

In this discussion about lesson plan template and *Standards for Provisional Registration* (SPR, GTCS, 2021), each is described as an ‘immutable’ object (Latour, 1986). Figure 15 shows how they have come to be immutable, based on political influences in their relative designs and production meshworks.

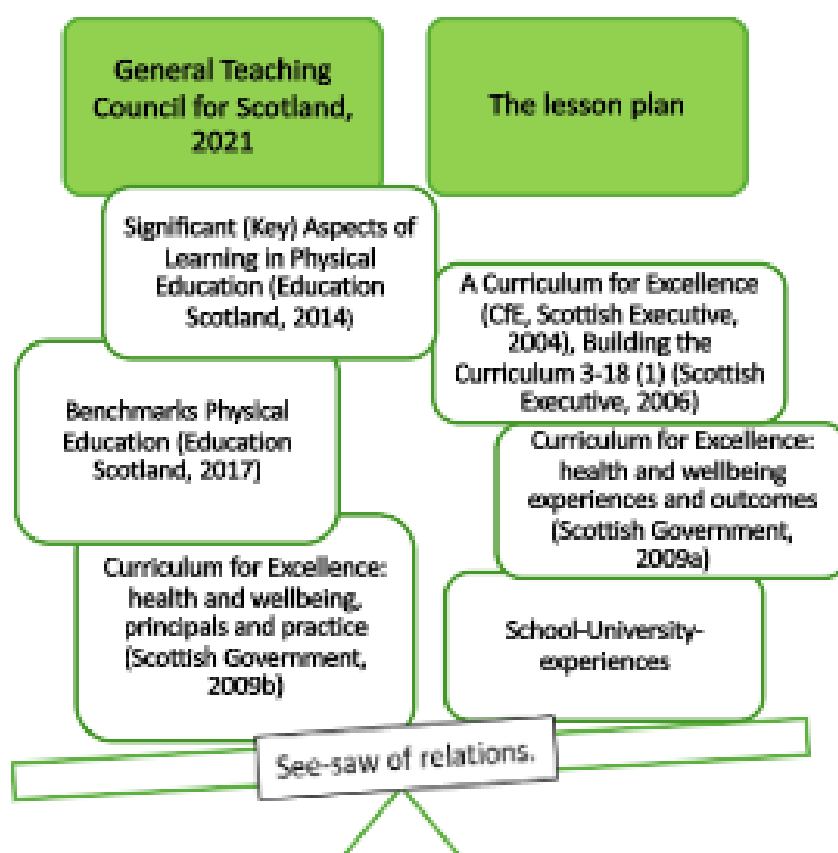


Figure 15 Immutable Objects - Balancing, or Juggling, Intra-activities

To be immutable, an actor such as a lesson plan template can be ‘carried around’ and reproduced (Latour, 1986; Hind and Lammes, 2015). Although this narrows and stabilises a page onto which students can place ideas for a lesson, which might be reassuring for becoming teachers, the plan is eventually enlarged, extended, explored *as* lesson. According to Latour (1986), immutable things (such as maps) carry their meaning, a certain perspective, and can also be ‘mobile’. Lesson plan

template mobility becomes evident as it is useful across multiple lessons, and as “combinable” with other immutable objects like the SPR File (Latour, 1986, p. 7).

Figure 15 is presented to show non-hierarchical actors that were mobilised during student journeys, to ‘honour’ the immutable things (lesson plan template and SPR). The movements of the see-saw are to emphasise that this is not a linear or static set of occurrences, but rather a four-dimensional presentation of actors. For instance, lesson plan *template* becomes part of a configuration of relations assembling to enact lesson *plans*. Relations include other nonhuman actors, such as the curriculum documents shown in Figure 15. In addition, physical activity ideas, PE equipment (or not) flow into and from the lesson plan *practisings* of PL-PE.

Whilst becoming teachers, however, creative lesson content has to be summarised and placed into the pre-determined ontoepistemological boxes (Fletcher and Beckey, 2023). ‘Choreographies’ (Law, 2009) of practisings involve a multitude of “knowledge practices” (Adams and Thompson, 2016, p. 10) at work across spacetimes, and these are all placed as text (with the odd sketch of gym hall layout), into the lesson plan boxes. The complexity of knowledges placed as text onto a lesson plan includes things like student experiences, curriculum documentation, websites for content ideas, and these then leak, spill or flow as a lesson is being enacted. The lesson plan boxes demand certain statements which show knowledge of various things – knowledges which are being shared with class mentor, digital SPR file, and possibly university lecturer. For example, PE lesson plans will show content – what physical activity skills will be practiced, as well as understanding how to breakdown and (re)build these skills to implement the planned activities. Relations and practisings experienced during ITE experiences are relevant for some of this knowledge and understanding (Gleddie and Morgan, 2021). Lesson plans also depict student-participant knowledges of what/how curriculum experiences and desired outcomes (Es and Os) in HWB (Scottish Government, 2009a) will be explored. Further, these are determined by *Benchmarks PE* (Education Scotland, 2017) which inform planning for

differentiated lessons (Scottish Government, 2009b; Gray et al., 2021). In a sense, presenting knowledges on lesson plans is part of the ‘cognitive capital’ and hierarchy (Braidotti, 2019) dominating what counts as neoliberal currency.

Alongside opportunities for developing relational capabilities during school placements, student-participants also expressed frustrations with things like *not* being able to enact policy documents. As seen in Anecdote 8.2, things like policy documents were engaging in assessment assemblages differently – and these seemed not to be conjoining or in co-responses (Ingold, 2016) with students becoming teachers. In becoming teachers, student-participants are also learning to negotiate and critically engage with politically predetermined policy, unaware that the actors governing the policies continue to be constrained also (Humes, 2022). This indicates wider societal-economic-political influences on education and on classroom practisings (Stenhouse, 1975). To provide opportunities for understanding *why* governing documents are relevant and philosophically important for education, ‘significant time’ is needed during ITE (Standish, 2007). Similarly, as explored in the Introduction Chapter, time, discussion and practice to build confidence and understanding of what PE might ‘look like’ (Elliot et al., 2013; Jess et al., 2016; Gleddie and Morgan, 2021), continue to be missing from ITE (Randall, 2023). There is continuing need for ways in which students become teachers, able to enact positive changes across education meshworks. During COVID-19 – as a breakdown – a multitude of experiences for student-participants was generated, and these included other realities.

The intra-activities where practisings were altered, such as by PE equipment (explored in Anecdote 8.3), are where relational differences were emerging (Hultman and Lenz Taguchi, 2010). Things like sharing and taking turns are expected in PE and PL-PE, but these realities were enacting because of *differences* due to some actors being absent (equipment, expected number of pupils). Here, this links to leakages from lesson planning, where sometimes, student-things afforded optional activities. Although things are already imbued with intra-activity and therefore, are quite predictable, it remains difficult to enact different realities

(Law, 2009). Given things like policies, lesson plan template, PE inputs from university, 'tag' games, student-teachers, each actor is already present and anticipates (re)enacting its role. Thus, "(A)n attempt to do something different, very different, might have been possible but it would not have been trivial. Enacting realities is not a trivial matter" (Law, 2009, p. 13). However, COVID-19 as breakdown meant that practices could be seen for being what Law (2009, p. 15) calls "non-coherent" realities. Further, non-coherence helps surface where different realities might become possibilities. For example, lessons moved 'off plan' to accommodate unexpected, unintended happenings in PE, where a teacher was absent, or new equipment could be introduced. Non-coherence is not problematic, since multiple realities provide entry points for noticing other possibilities – other PE practisings, including aspects of PL.

Anecdote 8.3 - Equipment, sensory overload and fun!

"Every big bit of gym equipment" – crash mats, boxes, wall bars, the lot – are all set up for pupils. If things are not just right though, some pupils will not take part - the material on the small box top doesn't 'feel' nice, or a pupils has on the 'wrong' shoes for gym! For the daredevil pupil, on the other hand, the tallest box top attracts her, she decides to stay at that activity station and repeatedly run up, bounce off a trampette (small trampoline) onto the box top, and jump off onto a crash mat! The mat makes a 'whoosh' noise as the air inside it is pushed out when it recoils with the weight of the pupil. It slides, just a little bit, along the wooden gym floor. She loves the feeling, the noise; it is sensory overload. Others in the class think it is "cute" that she is having fun, and each small group of pupils invite her into their queueing system. She does not move on to another activity station, girl—box—crashmat work with different pupil groups in turn. They know this is the first time in a long time that she has participated in gym. When restrictions were in place, Eileen worried that some pupils would not take part. But they did. With the right shoes on, spaces offered different sounds and freedoms – room to move, to run!

Applying diffractive thinking to Anecdote 8.3 highlights affects/effects of ripples between policy intention—restrictions, and crashmat—class meshworks. The sociomateriality of crash mat—pupils brings to the fore affective relations of joy, which keep returning in the scene in Anecdote 8.3, as other pupils circulate in-out of crashmat—box—girl assemblage. The diffractive strategy of interfering in a data-theory assemblage or investigating how a practice is being done shows the effects of the idea of ‘control’ during COVID-19—PE relations in this study. The powerful urges, liveliness, of thing—human intra-activities are overtaking what might seem a constraining assemblage enacted by UK Government—Education Scotland COVID-19 advice—PE lesson plan—PL-PE lessons. Clearly, the who-what is controlling is in flux since hygiene measures restricted the presence and activities of equipment, whilst other aspects in education were somewhat freer. The lesson plan and the crash mat show how an actor can push and pull those around it. Diffractive analysis illuminates affective realities, where effects from overlapping ripples of *expected* policy-informed practisings (such as Key Aspects of Learning in PE) with pupil—crash mat—box top are enacting joy, as in Anecdote 8.3. One potential line which may need (re)creating, is that students may not have developed confidence to teach PE through this placement, thereby adding to concerns about primary teachers (Elliot et al., 2013; Mcveagh et al., 2022). The implications of this last point for in-service teachers are discussed further in the next chapter.

The lesson plan template may be an immutable mobile (Figure 15) as students carry it around throughout placements and conform to university protocols. However, it has been seen that the lesson plan template is also a hive of intra-activity that alters when it meets other things. For example, whilst students are becoming teachers, they may also be learning to understand the politics of things like CfE and professional standards as these interweave as lessons are being enacted. Initial stability might provide familiarity, but the complexity of teaching emerges as different realities are enacted – such as trialling different pedagogical strategies when pupils seem disengaged with teaching content. Anecdote 8.4 tells of how some tensions or knots were (temporarily) released during placements.

Anecdote 8.4 - Becoming Teacher↔Emerging Confidence

Primary teachers have “everything to think about” and so modelling good practice in PE can be challenging, especially if confidence is lacking. It is lucky if a PE specialist visits and when they do, students meet, observe and model those practisings. Erin experiences this four times during one placement, whilst in contrast, Holly observed one PE specialist, and only once throughout her three placements. Seeing a specialist teacher of PE is rare because in some local authorities in Scotland, the role has been removed. However, a teacher with interest and confidence to teach PE will deliver lessons when colleagues have reduced contact time (RCT). At Sarah’s school two male staff were ‘designated the RCT time to teach PE because they have experience’. Most primary teachers are female, so this is an interesting observation. Where there are PE specialists and teachers with responsibilities for PE, they model for colleagues and thus fulfil a professional development role too. There appears a balance, however, between modelling and developing one’s practice. When observing Sarah, her class mentor asked about my visit and expressed concern about potential additions to workloads - was ‘another policy’ on PL about to be introduced?

Even when they are not comfortable teaching PE, class teachers are very good at giving feedback. Sometimes, when there is “quite a lot of conflict” (Erin, Interview, p. 5), students are offered to move to a more ‘chilled’ class! However, supportive mentor and head teacher (HT) meant Erin persevered, and found that the HT takes a ‘genuine interest’ in the class because she knows it needs a lot of support. The HT comes outside to watch PE, and sees that pupils are engaging well in the learning - Erin reflects on a really good placement experience. Role modelling can flip the other way too though, and when a class mentor finds out that Holly has a background in fitness and sport coaching, he asks her to take the PE lessons. With confidence, Holly’s boxing—Minecraft™ lesson plans show inclusivity as she takes account of previous learning and knowledge of the class. There are different tasks that pupils can choose from, such as stepping rather than skipping or following a “shorter route”. Holly has been asked to do all the PE in previous placements and

receives positive feedback from mentors (Image 11). The image shows encouraging tone, with comments on lesson structure and inclusion of other curriculum areas like literacy, as well as how Holly is caring for the class by being able to respond to needs as they arise, such as adapting tasks for hot weather.

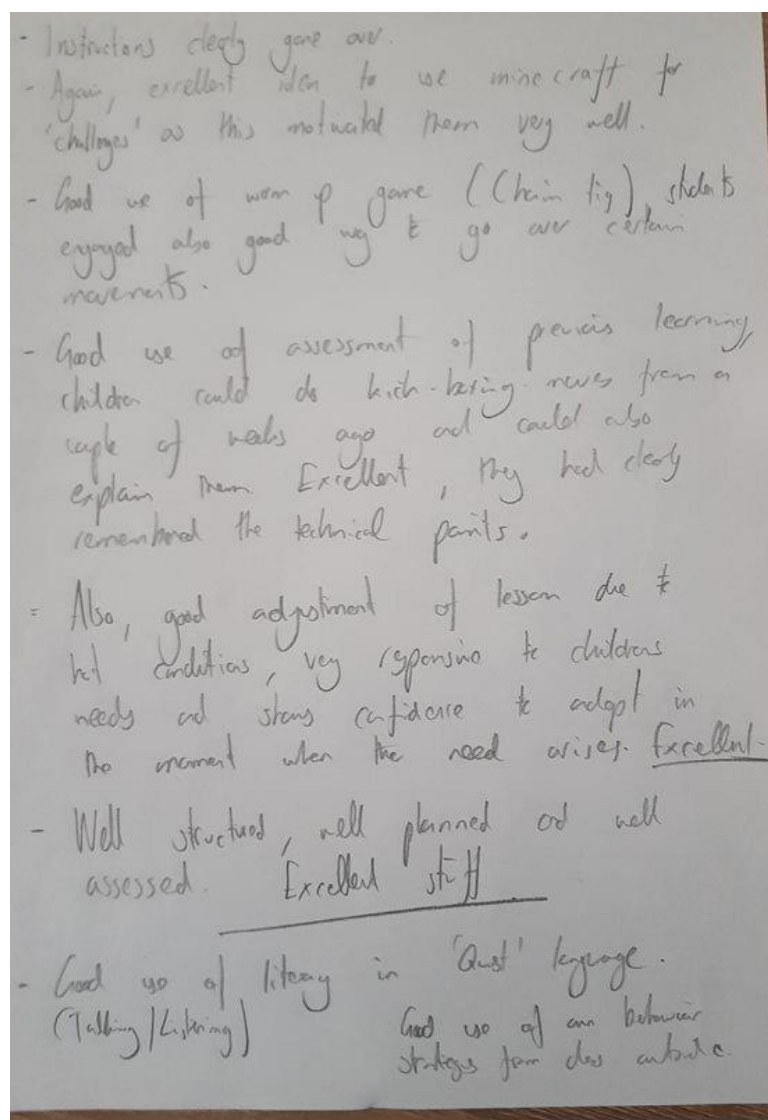


Image 11 Holly, Class Teacher Observation

Help with evaluating lessons encourages some students to focus on more than physical and reflect on affective experiences that are developing in pupils. Sharing equipment takes longer to learn about at age 6 and 7, and although Sarah feels disappointment because pupils lost practice time, she realises that there is still learning (Sarah, Lesson plan 25.5). At the other extreme, pupils surprise Holly (Interview, p. 7) because they are quieter and “anxious” in the classroom but become much livelier during PE. The pupils express joy, show capabilities, and are

“excited”. Mentors are sometimes impressed by how students and pupils are developing in PE.

Ongoing negotiations during PE exemplify the sense of perpetual movement, of forces enacting Spinozist (2002) ideas of *conatus* towards *hilaritas*, for instance where more powerful actors, such as school structures or class regimen, are (a)part of how students are becoming teachers. In jostling for opportunities to develop, whilst not feeling able to challenge teachers or structures, student-participants demonstrated cutting together-apart (Barad, 2007; 2013), where they had to work to (re)create meaningful relations in PL-PE lessons. Where Erin’s head teacher and Holly’s mentor seemed to value PE (Randall, 2023), these influences present a momentary continuity of positive experiences during PE and ITE. Barad (2013) suggests that these ‘scenes’ do not last, as described in how students are piecing together, through different agential cuts, different PL-PE from across spacetimes. For example, sometimes guidance on planning across subject areas, including PE (short, medium and longer-term) is part of conversations (Anecdote 8.4; Stoddart and Selanders, 2022). Otherwise, students seek to form coherent understandings of planning by observing classes taught by a PE lead teacher or specialist PE teacher. Anecdote 8.4 highlights the temporary stability offered when lines from across spacetimes become realised as something satisfactory, a knot, a convergence, wonder, a feeling that the lesson went well.

As developed from diffractive analysis presented in Chapter 3, how PL-PE and students are intra-relating are shown where parts of PL-PE are being pulled from some posthuman meshworks and parts of others are refused (Adams and Thompson, 2020). Where Holly and Sarah expressed tensions between their expectations and how the class (and class teachers) were enacting PE, lines from elsewhere (such as confidence in coaching capabilities and class teaching experiences) are becoming-with PL-PE, enacting another (diffracted) meshwork (Hultman and Lenz Taguchi, 2010). ‘Confidence’, for example, is pulled from Holly-as-coach across to teaching PL-PE. Where persevering with expectations of PE in school, students and pupils are enacting PL, especially where physical activity

participation is beyond ‘playing rounders’, and Holly (Interview, p. 6) can do some “actual teaching”. Actors from other meshworks included what was already known but were (re)emerging in new entangled situations.

During my observation visits and interviews, participants did not focus on the more managerialist, performativity-based outcomes associated with education (Standish, 2007), and with ITE. There was less conformity to the expectations which are ordinarily foregrounded. A sense of coping with differences presented each day during COVID-19 relates to Spinozist (2002) account of being human, always active, a force. In the entanglements of the posthuman world, Spinoza’s One Substance monism was brought to the fore. Time was applied to *doing* PE, which incurred a positive, slower attending to the affective (Deleuze, 1988; Spinoza, 2002), to the relational. Time and practice discussing educational philosophy may not always be facilitated during ITE programmes (Standish, 2007), so it appears that the disrupted/breakdown period was ripe for altering those time-poor opportunities. Erin’s positive experiences with PE specialists affected her as she reflected on having time to discuss planning, with reference to documentation (‘purple folder’) wherein Es and Os are already mapped in PE lesson sequences for primary teachers to use. Thus, lines enacting Erin-becoming-teacher were converging from relations among student—Es and Os—specialist—PE lessons, when given time to prepare. As noted in Anecdote 8.4, *during* PE lessons, the planned-for practices were often disrupted, demonstrating that time for pupils to practice was often sought by students.

In Part I the anecdotes and data images presented rhizomatic entry points across practisings of PL-PE and highlighted immutable mobiles - the lesson plan template and assessment requirements, as students were becoming teachers. The immutable mobility of lesson plan template translates one aspect of how students are becoming teachers because immutability creates (momentary) stability (Law and Mol, 2001), such as for lesson plans (completed templates) to be moved and understood across realities. These examples from across spacetimes were entangled with the posthuman and diffractive approaches to research and have

provided different ways to view how becoming teachers might be enacted. The following section develops how PL as multiple is made possible through the research approaches.

Part II: PL multiple and political

Throughout analysis-discussion chapters, actors have demonstrated their political activities, often at knotted points during student-participant experiences. When loosened, the detailed sociomateriality has allowed aspects of PL to become clearer, showing PL as multiple. In this second part, discussion contributes to how different political enactments of PL-PE were surfaced through sociomaterialism and posthumanist approaches.

Student-participants could not ‘see’ progression in pupils and as evidenced above in Anecdote 8.2, where assessment was discussed, tensions make interesting entry points for whether, how and why policies were enacted. There was a lack of coherence between assessment policy intentions and student intentions, showing the political differences occurring during placements, and as Law (2009, p. 15) suggests “practices are always more or less non-coherent”. Policy in this example, is in multiple meshworks but appears with varied political affect/effect. Assessment strategies are often focused on observing physical competence, skill-based practisings such as how a pupil is striking the ball with the golf club. This is commensurate with previous research suggesting that comparative methods tend to dominate primary teacher assessment strategies (Hay, 2006; Macken et al., 2020). Further, literature on primary teacher assessment methods in PE, presents claims that assessment is predominantly teacher-led (Ní Chróinín and Cosgrave, 2013). However, having understood that pupils could peer assess in the primary classroom, Holly taught pupils how to do this in PE. She encouraged self and peer-peer assessment, with options to feedback to her and/or the rest of the class. Holly showed the transference of knowledges from classroom to PE, in contrast with literature which says this has been inconsistent (Macken et al., 2020). Further, assessment strategies were incorporated at the lesson planning stage (Holly,

Lesson Plan, Boxing; Interview, p. 3). In teaching pupils how to provide more detailed feedback in PE, Holly (Interview, p. 4) states,

I had to go back and break that down and be like you know, for example, if we're doing a hook, these are the three things I want you to look out for ... and I want you to tell them how they're doing it.

If understood as a gathering of things located in a specific spacetime, experiences as described above by Holly, are enactments of affective relations at various levels of motion and rest (Deleuze, 1988; Spinoza, 2002). Assessing pupils in PE is an assemblage of policies—teacher expectation—student expectation—pupil activities—COVID-19 restrictions, and in this spacetime, differences in how-when-why-what to assess were brought to the fore.

Linearity of CfE 'progression' could not be enacted as suggested in some policy (Education Scotland, 2017), or as experienced in assemblages with other subject areas (Priestley and Humes, 2010; Hayward and Hutchison, 2013). Thus a "zigzagging" across spacetimes could replace linearity of lesson plan, delivery and ideas about assessment, more akin to "a rhizomatic style of thinking, [which] allows for multiple connections and lines of interaction that necessarily connect ... to many 'outsides'" (Braidotti, 2013b, p. 164). These implicate a different way of 'doing' and assessing PL-PE. Student-participants initially tried to align with linear expectations, but assessment soon became part of an alternative PL-PE where zigzagging was becoming accepted (perhaps through comfortable resignation) during these placements. Ripples from COVID-19 restrictions diffracted with ripples from assessment policy, and in these overlapping waves, students were treading water. Interestingly, ripples from PL-informed assessment strategies (charting progress) were not (yet) present.

The effects/affects occurring during PL-PE meant different realities were enacted alongside one another (Mol, 2002), across spacetimes. This line of thought is interwoven with Barad's (2013) work, referred to above, where intra-activity of actors *is* constant change, ongoing agential cuts which enact dynamic boundaries

(Barad, 2007). The juxtaposition of student-participants feeling both freed and restricted concurrently is an unfolding of past-present-futures because the world holds “memories” of traces (Barad, 2013, p. 29). As was discussed in Chapters 2 and 3, Merleau-Ponty (2012) and Whitehead (1987) have noted that interactions are held in the fabric of the world, ready to be recalled at any time. However, what Barad (2013) suggests is more that the world is full of intra-activity and assemblages emerge as things enact recognisable features/events. As examples of being freed and restricted, two lines are exposed here, both of which were enacting PL. One line of flight was the destabilising of lesson planning with increased pupil numbers and less equipment. Sarah’s plan was pushed to the background. An effect/affect of this difference was Sarah’s acceptance of the unpredictable environment, something which I experienced during an observation as a relaxed lesson ethos. The emergent, meaningful PL-PE was enacted by ongoing, reconfiguring cuts. Simultaneously, another line enacted the political power of restrictions as the tension between delivering a PE lesson and assessing pupils. Anecdotes exploring participant data (Chapter 7 and here) have shown how PL-PE was/were “being done” (Law, 2009, p. 12), being held stable in some instances, and still recognisable as PL-PE, becoming different realities. In research terms,

(T)he move to performativity ... allows us to ask questions about realities that are simultaneously analytical and political. We may begin to ask how they are done. We may ask how they are contested. We may also ask how – and indeed whether – they might be done differently. In short, we open ourselves to the possibilities of an ontological politics (Law, 2009, pp. 12-13).

Plans to assess, progress skill levels or address development needs in the PL-PE assemblages became more peripheral than students intended. Yet students sought to overcome differences in classroom-based assessments compared to assessment in PE. Planning for assessment in PE meant things reconfiguring in “parallels, alternatives, collaterals, streams of activity that never come together” (Law, 2004, p. 60). As presented in this chapter, ‘restriction’ as an actor, afforded

other ways in which students and practitioner were practising PE-PL. Students were (necessarily) intent on passing placements and in PE this included being highly reliant on coping with collateral, parallel and alternative activities because things like assessment did not develop coherently (Anecdote 8.2). As Law (2009, p. 15) notes, “(I)t is the enactment of collateral realities that turns what is being done in practice into what necessarily has to be”. Some lines which were presented on lesson plans, such as CfE policies, were not enacted but halted, and so student-participants were ‘improvising’ along lines of flight to relegate some and take up others (Ingold, 2013). There seemed less adherence to teaching practices than student-participants might have expected, as they improvised according to what made educational sense in their specific situations.

Specifically, how might one version of PL be chosen instead of another, at what cost, for what purpose, and who-what is absented, silenced, lauded or cajoled. Such judgements are political (Law, 2011), and Mol (2002, p. 165) asks “what reality should we live with?” As explored in Chapter 2, PL as multiple ‘thing’ is becoming evident across research literature – such as in systematic reviews (Edwards et al., 2018; Shearer et al., 2018), and in research which tests ‘tools’ that measure or assess PL (Goss et al., 2022; Sum et al., 2022; Sport for Life Canada, 2023). A minority of researchers draw from phenomenology (Lloyd, 2011; Durden-Myers et al., 2020), history (Cairney et al., 2019; Durden-Myers et al., 2022), materialist approaches (Young et al., 2021; Bartle, 2023) and conceptual/theoretical investigations (Whitehead, 2001, 2007; Dudley, 2015; Bailey, 2022; Durden-Myers and Bartle, 2023). PL is, I would argue, already multiple, always becoming *with* other actors, actors that are already intra-acting to create differences with each encounter (Hultman and Lenz Taguchi, 2010). Encounters include published works such as those listed above, which seek to show how to understand PL, and which have informed and are informing this research. In a way, PL research which calls for a definition may be too concerned with “*premature unification*” (Latour, 2005, p. 117, italics original). In education, lesson practisings rely on many things, with disruption or continuity the behest of how things are relating. As has been presented throughout this research,

‘versions’ of PL become relevant whilst relations are enacting, events unfolding, such as particular situated lesson-assemblages. Student practisings of PL remain immanent, and as students are becoming teachers, they too are ‘open’ to what is ‘not yet’ in PL-PE.

Some lines were loosened and presented in Anecdotes above, depicting where students were encouraging participation and enjoyment, motivating pupils, and building pupil confidence and competence in movement skills. Thus, physical competence is explored, even with larger classes and varying amounts of equipment. However, it cannot be shown yet whether these multiple realities are continuing, so that they might become unified at some point in futures. At times, stability is temporarily achieved but this invites more than one PL because of the uniqueness of actor contributions. Where more than one reality is enacted, is what Law (1992) calls ‘resistances’. It could be suggested that many resistances were practising, such as in pockets where PL multiple was afforded *because of* restrictions due to the pandemic. In student-participant futures, actors will be imbued with different meanings and potentialities that may or may not converge as PL-PE practisings. Latour suggests (2005, p. 116, *italics original*) that the idea of multiple is not simply many interpretations of the ‘same’ thing, but rather,

(I)t is the thing itself that has been allowed to be deployed as multiple and this allowed to be grasped through different viewpoints, before being possibly unified in some later stage depending on the abilities of the collective to unify them.

In the heterogeneous assemblings where PL-PE was enacting, the realities varied in stability but there is a further point, that social construction no longer does the job of helping explain how practisings are coming to be (Law, 2007). If there are multiple realities in which PL-PE is enacting, are these perhaps not PL but from different viewpoints (lesson plan, policy document, student, pupil) in different places? As exemplified in Mol’s (2002) work on the body in different atherosclerosis networks, multiplicity is a property of PL (and other things in the meshwork have their own properties too), not *human* interpretations of PL.

Although PL-PE is enacting across spacetimes in which student-participants may be one actor, PL-PE is *at once* in the school playground, on the university virtual learning environment and in a definition. At times, these meshworks will relate together, in part, or remain held apart, and be practisings across different but situated or localised (Mol, 2002) spacetimes also.

The political effects/affects incurred by/with COVID-19 included absencing things from PE, and this included CfE *Learning for Sustainability* policy (Scottish Government, 2016) which has clear political affiliation with wider global environmental concerns. For example, PE equipment, much of which is single use plastic, has not yet been given consideration in education, an example of silencing objects, making this particular issue absent (Adams and Thompson, 2016). Concern with sustainability of ‘things’ serves as an example of how (educational) artefacts are already imbued with meanings, have a ‘vitalist’ quality which permeates other things (Bennett, 2010). Things are already entangled with ethical, practical, functional, emotional, enabling, imagineering aspects in education, acting and connecting in multiple. Assigning ‘everything’ as political, however, was expressed as a concern by Latour (2007, p. 812):

the adjective “political” suffers the same fate as the adjective “social”: In being extending everywhere, they have both become meaningless.

Suggesting ‘everything’ as political fixes all human and nonhuman things as always politically involved and active which for Latour, does not invoke change even though change might be called for by some actors – such as health practitioners seeking to lessen morbid obesity. In different situations, actors may be political in that they effect differences, but some do not (Bennett, 2010). In the next chapter (Conclusion) I follow Latour (2007) and propose practical and realistic approaches to changes which can result from posthuman and sociomaterial responses to political concerns associated with PL-PE.

Any suggestion that PL is a ‘good’ or ‘the best’ way to ‘do’ movement because it will be the panacea for negative effects of inactivity, is not relevant as ultimately,

participating in movement and physical activities throughout life is continual co-responses with socio, politico, economic, personal, material (re)con-figurings in the world (Barad, 2008; Shotter, 2013). There is no 'good' or 'bad' (Law, 2007), just a diaspora of performativities continuing to make differences (Haraway, 1991). As Spinoza (2002) had argued, *conatus* is ongoing existence and it will always be towards *hilaritas*, well-being, not ill-being. Where there is ill-being, it is merely the lack of achieving wellness, or wellbeing. In both the Introduction and Chapter 2 warrant was presented for continued development of primary teacher confidence to teach PE. However, some of this literature focused on physical inactivity of humans and resultant health implications, including effects on the care of those who are ill. Moreover, directing (political) concerns to neoliberal effects of ill-health, such as increased human workforce absences, was presented as only one way of investigating how PL might inform PE and wider concerns about human inactivity. Neoliberalism increases focus upon education responsibilities but also reduces possibilities of PL and PE.

As a move away from neoliberal and healthism discourses associated with PE (Kretchmar, 2008; Gray et al., 2022) and PL-PE, interrogating "the material nature of relations" (Heuristic 7, Adams and Thompson, 2016, p. 81) draws attention to agency. As discussed briefly in Chapter 7, actors are never alone, and for agency to be attributed to things, it makes more sense to think of agency as distributed through human and nonhuman, and so politics as not solely a human concern. Others suggest that relations among the political and ontological seek to open out or 'question' "the ways in which reality happens" (Joronen and Häkli, 2017, p. 562). Political concerns are then, emergent and the structures within which these operate are also emergent (Bennett, 2010), but it is difficult to enact different politics from within the bounds of neoliberal societies. Student-participants, for instance, have expressed tensions whilst enacting what is a political situation, such as trying to assess pupils in PE.

The intra-activities of assessing include inherited assumptions about immutable curriculum policy documents, but the disruptions during this research period

relate to what Law and Singleton (2005) refer to as 'fire objects'. Relations connecting realities of joy or motivation in moving for example, were evident across meshworks, yet these were oftentimes sporadic, fire(work) like – consider Erin's surprise at how pupils from a class with 'conflict' were working together. There is scope to further investigate aspects of PL that were 'jumping' into life during the political breakdown of the pandemic. Slowly altering policy is one such area of interest, not least because taking account of wider intra-activity (such as local environment) is encouraged in CfE.

Some intra-activity of policy is, however, expressed by non-human intentionality, and student-participants are one actor in a meshwork, where forces or energies of things were enacting realities. Bennett (2004; 2010) explores this as a vital materialist perspective where "human intentionality can be agentic only if accompanied by a vast entourage of nonhumans" (Bennett, 2010, p. 108). In other words, agency is multi-directional, or "co-constitutive" (Introna, 2013, p. 4). When thinking differently with agency as distributed, questions include asking whether humans should be removed as having political mastery over things, or are humans excused responsibility on the grounds that things were involved in meshworks where, for example, environmental destruction has happened. If effects of agency become distributed, for example through policy enactment (Oosterhoff et al., 2023), to what-who are negative or unintended effects attributed? If agency is distributed to things does a 'blame' game place things as culprits, thus excusing humans (Joronen and Häkli, 2017)? How co(a)gency of human-nonhuman things informs thinking about wellbeing rather than inactivity and resultant non-communicable diseases, as discussed in Chapter 2, merits further discussion elsewhere.

In Part II the idea of PL multiple was explored in relation to how students were navigating teaching PE in schools during this politically different period. The work of influential actors found prominence during discussion about tensions, restrictions, resistances, and possibilities. Routines common to placement experiences were 'shaken up' by paying attention to what was present during this

research period. One example was how assessment proved to be difficult for students but when considered from a sociomaterialist approach, redistribution of actors surfaced alternative practices, such as attuning to the affective and pupil, peer and self-assessment. Different configurations of PL are opening out and this might engender positive lines of movement along which students becoming teachers can develop confidence to teach PE. This leads to the third part of this chapter, on *how* the research approaches afforded insights.

Part III Moving analyses

In this part of the chapter, I show how research approaches were working with me to understand PL-PE. As stated earlier, this is in part a response to Koro-Ljungberg et al. (2013) who asked whether methodology and content knowledges could be ‘blended’ without reinforcing binaries such as theory-practice in research. In seeking relational understandings of whether PL-PE ↔ philosophies/theories were enacting, Hultman and Lenz Taguchi (2010, p. 530) informed by Barad, provide guidance on how to do this kind of research, in which their example of girl-sand,

can be understood metaphorically as if the girl and the sand simultaneously ‘pose questions’ to each other in the process of trying to make themselves intelligible to each other as different kinds of matter in an active and ongoing relation (Barad, 2007).

The girl-sand relations created wonder for the authors of that research, and as was discussed in Chapters 3 and 5, (post)positivist empirical social research has viewed data as fixed, or ‘brute’ (St Pierre, 2013a), rather than as emerging, as relational and ‘mattering’. What mattered for my research, was how to interfere in ongoing intra-relations that glowed. As an example, where student-participants were seeking to develop confidence to teach PL-PE but practisings were not co-responding with curriculum policy (coherence), different actors – human and non-human – were shown as not pre-existing relations (Barad, 2007; Bodén et al., 2019). This kind of empirical data—emerging matters was political intra-activity and drew me into a meshwork with student interviews and lesson plans, hence the relevance and importance of posthuman and sociomaterial approaches to

inquiry into PL-PE. Inevitably, data-theory which mattered was at the behest of me, because researcher is entangled also (Barad, 2014). As noted in Chapter 4, I am also affected during the research (Michael and Munday, 2014; Bozalek and Zembylas, 2017), which will continue to produce different effects/affects in my PL practisings, such as how to refine and communicate PL when working with students.

To be clear, the discussion has been about PL as multiple rather than pluralist (Law, 2004; Mol, 2002), with the purpose of my research to open out PL, or aspects of it, as it manifests across spacetimes. Thus, the specific enactings of PL were explored not to provide fixed results or findings, and not to adhere PL into one version, as was the aim of some research explored in Chapter 2. In a footnote, Latour (2005, p. 116) stated “multiplicity is property of things, not of humans interpreting things”. For example, students were introduced to PL the year prior to becoming-with this research. They learned about PL as an approach to teaching, learning and assessing PE in primary schools. During placements in schools, they enacted aspects of PL-PE in their teaching practices and did so during a pandemic. Already, PL is multiple, from definition, documents, articles, books, micro-teaching, placements, lesson plans. Each meshwork provided opportunities for practisings of PL and each meshwork was held together differently and produced different, political effects (Mol, 1999). To make sense of PL in multiple realities, Law (2011, p. 5) suggests that,

(Y)ou have to start with the relations that produce (or don't produce) realities and objects and people of one kind or another ... a slow, deliberate, and appropriate process which explores, develops, revises and selects particular realities and particular identities and provisionally fits them together.

When investigating PL, empirical data came from across spacetimes, such as observing several lessons of one student-participant and one practitioner. Later I also interviewed both the student teacher and practitioner whom I had observed. Further, between each of these data collection timeframes I received lesson plans and evaluations from student-participants. When I interviewed participants via

Teams, most COVID-19 restrictions had been lifted in primary schools and so there was distance from which to reflect on lessons observed and lesson plans. This series of research events suggests linearity, but I would stress that knowledges and realities presented during analysis-discussions are expressions of the zig-zagging of relations among actors and it follows that there are multiple of these (Mol, 2002; Law, 2011). Insights could be gleaned from what was flowing *into* spacetimes where PL was being enacted (or not) – like lesson plan design – and from lines of flight coming *from* these spacetimes - such as the effects/affects of enacting lesson plan text. What is stabilising PL-PE or not, and how does this become evident to the researcher?

By entering the middle of ongoing practice, such as a PE lesson, it was worth thinking about the places-people-things and the part each plays in PL-PE assemblages. Each actor provokes different or new ways of being-in-the-world (Mannion, 2019). The affective learning domain became prominent as a flow through and around the research. Mulcahy (2012) purports that where there are connections in a situation the affective has been employed. In PL-PE affective and relational are part of practisings and if feelings of success and joy in movement are experienced by pupils, motivation and confidence will form part of the lesson assemblage. The affective, researcher, and PL-PE are inextricably entangled, and moments of temporary stability enabled me to enter the middle and investigate.

Chapter Conclusion

In this conclusion section, a summary is presented of how data-theory has addressed the guiding questions presented in the introduction to this chapter. To continue working in the entanglement and avoid linear ways of addressing the questions, I present key aspects arising from the analysis-discussion. Following this, I conclude by pulling together the last three data analysis—theory—discussion chapters. I begin with short contributions showing emerging responses to the guiding heuristics (presented here for recollection).

Set 1: What can be discerned about the gaps between practices and the realities they enact?

Who-what is entrenched? Who-what is excluded? What is made present? What is made absent? Are there any intruders?

Set 2: What kinds of passages are being improvised as entities thread their way through the ways of others (human and nonhuman)?

What lines of movement can be seen? How are lines of movement (or becomings) being re-directed?

It has been suggested in Chapter 6 that there are no ‘gaps’, for example that the ‘nets’ in ANT have no ‘in-betweens’ (Latour, 1996). Following Barad (2007), lesson plan↔practisings did not present ‘gaps’ since heterogeneous actors were already intra-acting and where converging, were enacting multiple realities. Practices are emergent and so gaps do not make sense since actors are already expressing intra-actions. Relations could be discerned through examples from the participants’ empirical data, such as among policy—lesson plan—practisings—PL-PE. Efforts to fulfil GTCS and university professional practice requirements further evidenced the importance of forces of affect in becoming teachers and PL-PE practisings. Although entrenched, immutable mobiles were often pushed to the background as effects from the breakdown through COVID-19 altered the activities of actors, such as during assessment practisings. At points such as these, lesson plans were shown to be mutable, or ‘fire objects’ (Law and Singleton, 2005) because of the occasional spurt of disruption, the liveliness of becoming a teacher. PL was seen by one class teacher as a potential intruder, as she questioned ‘another policy’ being included in already busy practisings. Similarly, in Chapters 2 and 6, I had expressed criticism of defining PL because this fixes it and acts as an obligatory point of passage (OPP; Callon, 1986). In a sense, seeking a definition also decreases the multiple spacetimes where PL might be enacting. Thus, rather than seeking fixed structured PL, it is worthwhile appreciating that tensions between lack of clarity and understanding are also actors in students becoming teachers.

PL-PE could be identified as stabilised in some meshworks – such as where student-participants recognised their increased confidence to teach PE by

developing pedagogical strategies that relied on relations among things. Examples included playing safely with equipment, pupil care, or encouraging enjoyment through participation in increasingly challenging physical activities (see Anecdotes 8.1-8.3). Further, threading through knotted bundles of lines were affective experiences such as motivation and enjoyment, which were being diffracted through the computer game Minecraft™ and physical activities such as boxing moves based on the capacities of characters in some Minecraft™ games (Anecdote 8.4). Further, connecting different ‘worlds’ such as gaming—classroom—motivation—boxing moves—fun was simultaneously absencing other things – in this case, previous PE practisings of ‘playing rounders’. Some actors demonstrated political strength by absencing others, whilst students sought to focus on things like assessment in PE with varying success. Students perhaps missed opportunities to learn how to assess aspects of PL such as motivation and enjoyment, where measuring is not appropriate, useful or desirable. Instead, the affective thread continues to resonate (Crowther et al., 2017), and pupil progress is ‘felt’ or attuned to by teacher (Lloyd, 2016), as it is by researcher.

This research has helped discern world-thing-human relations ongoing in PL-PE. In that sense, Adams and Thompson’s (2016) analytic heuristics have helped bring together binaries problematised at the beginning of this research. For instance, Ingold (2007, p. 7) refutes separation of materiality and material, saying,

(L)ike all other creatures, human beings do not exist on the ‘other side’ of materiality but swim in an ocean of materials.

The inside and outside of human and nonhuman movement in the world is a flux (Shusterman, 2012), a constant reforming, forming, dissolving, leaking, building in-with-of materials organic and not organic. Ingold (2007) argues against the word ‘materiality’ which seems to create boundaries, false/non-existent barriers which deaden the life of-in ‘materials’. Indeed, Spinoza (2002) had already written his axiom that whilst conceiving an idea of a boundary, there are already other spaces beyond that boundary by way of extension. Spinoza’s (2002) idea of perpetual motion, applied to doing this research, has meant thinking beyond

anthropocentric and Eurocentric research conventions. To do this was to embrace relational ways of investigating PL-PE, as introduced in Chapter 4.

This chapter concludes the three data analyses-discussion chapters of the thesis. Presenting data-with-theory in columns, and technique of pulling data from across spacetimes into anecdotes, with use of heuristics to guide analyses-discussion, were tools or devices to make the text work harder (Thomson, 2024), and by serving the purpose of *not* separating parts, of not de-dis-entangling the mess. Focus on whether PL-PE was enacting as students were becoming teachers is maintained throughout the three chapters. As part of becoming teachers, many actors traverse spacetimes as student-participants practiced PE during placements in primary schools. The complexity of the relations has been brought from data such as tweets (posts on X), virtual learning environments (VLE), lesson plans, class teacher observation notes, participant interviews, education policies. Multiple – sometimes overlapping – assemblages wherein PL-PE might be enacting consist of multi-directional swirling intra-actions that are not only bi-directional, such as from VLE to gym hall and back. Student-participants may benefit from learning about sociomaterial ways of engaging with education policy, for example, to show how they (students) are already intra-acting and being acted-upon by other things (Oosterhoff et al., 2023).

Spinoza's (2002) monist account of being human embeds affective force, which has been presented in these three analysis-discussion chapters through the practisings of student-participant becoming teachers. As Colebrook (2000, p. 85) states:

(I)f being is not a substance or ground but only the active becoming of qualities, then being might be interpreted positively as the assertion of force, a force not in opposition to (or in negation of) some posited other, but positive force.

For student-participants becoming teachers, it is worth remembering that things are 'becoming-meaningful' (Gatens in Colebrook, 2000, p. 86), they are 'not-yet'.

The final chapter presents concluding recommendations and suggestions for ITE and other stakeholder meshworks, as well as how to research PL-PE. Alternative possibilities of doing this doctoral work are discussed, and possible futures presented.

Chapter 9: What is there at this end point?

Following the preceding chapters, what is there at the end point? This doctoral study end point is a critical response to the two aims of the research – whether, how and in what ways PL was being enacted in students teaching PE, and how to investigate PL. I reiterate the research questions which guided my study, and note that responses to these have been entangled throughout analysis chapters and this one:

1. What relations are in play in student PL-PE practices?
2. How is PL translated through sociomaterial practices?
3. What are the implications of sociomaterial and posthuman understandings of PL?

The methodological contribution of my research is to PL, to education, and research. The sociomaterial and posthuman analysis has enlivened how the material and human are conjoined in the enactment of PL-PE, even though it might not have been named as such by the participants in the field studies. The focus on ITE provided an important situatedness to build on current understandings of PL. When COVID-19 interfered with practisings of PL-PE and research processes, the breakdown afforded opportunities and openings for ways of doing education differently.

In this final chapter, I present five considerations about education and research emerging from this doctoral study. I then share my experiences of interruptions and possibilities, that convention calls ‘limitations’, but which I see as “positive formulations of alternatives, alternatives that will themselves become the objects of later critique and reform” (Bennett, 2010, xv,). I provide ideas for stakeholders interested in how a sociomaterial and posthuman reading of PL might be encouraged-initiated-developed. The chapter concludes with recommendations or implications for what is yet to come. This includes addressing my introductory statement that I wanted to ‘shake the tree’ (Gough, 2006) of anthropocentric research approaches and open out understandings of PL and education. The five considerations about education and research are deemed achievable without resorting to managerial objectifying of how these approaches might be done. The approaches can be read as relating with the research questions, with three relating

to PL and students becoming teachers, and two to methodology of inquiry. Theory-data in this study has informed the following:

1. in an ITE programme which recognises the contribution of nonhumans to PL, PL-PE is enacted during student teaching
2. when the affective is foregrounded and viewed as an actor among many, what had previously been regarded as immutable thing becomes more fluid, and different ways for students becoming teachers are opened up
3. different ways of mobilising ITE are offered when the agency of human and nonhuman things is recognised and included in student support networks
4. investigating theory $\leftrightarrow$ empirical data requires different ways of doing methodology, and of presenting these. Postqualitative research offers resources for such an envisioning
5. posthuman and sociomaterial inquiries enact a four-dimensional approach to research, that challenges false bifurcations.

1. *In an ITE programme which recognises the contribution of nonhumans to PL, PL-PE is enacted during student teaching.*

I have shown that where PL *was* evident, it was not named, or defined as such (Young et al., 2022; Bailey et al., 2023) by students. Indeed, seeking an underlying ‘single’ reality reduces possibilities for (in this case) PL to emerge (Mol, 1999; Cresswell et al., 2010) and results in closure of PL. Student-participants in this study had experienced PL-PE during their primary ITE programmes and so it might have been expected that some understanding of PL would be demonstrated. There was contradictory evidence of this however, between student reflections and their practisings. In the former, student-participants articulated that they believed they focused on one aspect of PL – physical competence. Empirical data, such as during fieldwork showed that the affective (motivation or confidence) and cognitive (knowledge and understandings in PL) domains were enacted during PE lessons.

Examples of PL-PE became evident through the work of diffractive thinking, such as was seen in the ripples of theory overlapping with data. For instance, one

student had designed cards which depicted a game with Key Learning in PE documentation entangling with a ball being passed to a partner, whilst pupils had to spell a word – language development was diffracting through the cards too. Potential realities were brought to the fore when the materiality and presence of non-human things together with students, co-constituted agency in different ways (Bennett, 2010). My interpretations of PL are diffracted in this example too, in particular because these were haunted by sociomaterial and posthuman readings.

PL is not (yet) settled or defined sufficiently for practitioners, according to literature, outlined in Chapter 2, which called for definition and philosophical clarity. The undetermined nature of PL swirling around in current research has been beneficial for me, however, in making it possible to trace aspects of it, for it cannot “mask the networks that produce it” (Law, 1992, p. 385). Contradictorily, the IPLA (2017) definition was viewed as an OPP (Callon, 1986) with potential to close off possible places where PL may be enacted, whether that is in school PE, or other physical activity spaces. For people working in movement promoting environments, exploring aspects of PL with practitioners might help them identify how it looks, including using the philosophical ideas informing it. Since PL-PE contributed to developing student practices during this particular research period, the importance and relevance of maintaining PL in the curricula of primary ITE has further warrant.

2. *When the affective is foregrounded and viewed as an actor among many, what had previously been regarded as immutable thing becomes more fluid, and different ways for students becoming teachers are opened up.*

As has been made clear, student-participants completed a Foundation Course (IPLA, 2017) in PL during their PE inputs at university (ITE). A significant part of the course includes reflection on individual PL journeys. This reflection and discussion releases memories about times during students’ schooling and other physical activity experiences (perhaps being coached in swimming or football). The discussion which is opened out during explorations about PE experiences exemplifies the importance of traces, of “memory ... as embodied, selective, with

habitual lineages of body memories that bind us to the world” (O’Donnell, 2018, p. 826). In PL-PE some memories of physical activities can be wholly unwanted due to the misery experienced. It is incumbent on those involved in physical activities and movement practisings to reduce the miserable experiences and increase *hilaritas* (Spinoza, 2002) and the values inherent in being well. For student-teachers, dialogue and memory are entry points into foregrounding the affective through PL-PE.

This research offers a way of challenging the ‘cognitive capital’ (Braidotti, 2019) associated with neo-liberal societies and curriculum structures purporting to develop academic achievement. For example, assessment practices that usually rely largely on behaviourist, ends-driven, often fixed, criteria (Standish, 2016) were all but removed during the research period. Assessment guidance for PE is usually immutable, black boxed as benchmarks, and consequent assessment practices potentially restricted in pursuit of achieving the stated outcomes. During COVID-19, however, assessment was being undone, student-participants became better at trying other methods, such as pupil-peer assessment. Further, student-participants focused on enjoyment and engagement as gauges to progression in PE, thereby foregrounding the affective. It is clear by now, that my research in PL-PE advocates charting unique progress, where achievements are individually relevant and need not match an expected, written outcome or explicit criterion. Educational experiences are rather, relevant to a specific pupil at a specific time (Standish, 2016).

If, during ITE and practice in schools, an understanding of the social *and* material assemblages at work creating policies and practices are understood, then guidance can be better critiqued, and if necessary, altered to suit. For example, students might learn to attune to things like policy-as-actor-with-agency, which will aid how they can critically interrogate such documentation from a sociomaterialist perspective (Oosterhoff et al., 2023). Understanding how an emerging intra-activity of material *with* human could enable ITE students to respond differently to the words that are assigned authority in a policy,

reimagining the education they are enacting in their specific contexts. In relation to teachers, Mulcahy's (2012, pp. 22-23) reference to the affective in sociomaterial spaces resonates here:

(Net)working affective spaces and objects opens up the possibility for teachers to contest means-ends rationality and continue to create conditions for classroom learning, such that this learning, like affectivity itself, is lively, that is, not governed by a pre-set system of judgement – such as performance standards and related measures and metrics commonly are – and pre-set teaching outcomes.

Physical activities and movements along with things could be opened out with less prescriptive guidance (benchmarking) and wider imagineering as collective thing-pupil-teacher experimentation.

In PL-PE moving towards *hilaritas* is the importance of affect and of joy through meaningful physical activities and movement (Parry, 1998; Kretchmar, 2000; Beni et al., 2017). In pragmatic terms, where students becoming teachers are seeking to be inclusive in PL-PE they might think more literally about materials and how affect is developed, challenged or experienced by pupils. For example, what might pupils think-feel about plastic golf clubs or squidgy bouncy balls or running as fast as they can against the wind, intra-acting with different qualities of materials with different parts of their bodies. They might relate the plastic to the litter in the ocean, making a story from this, decentring and (re)envisioning human (O'Donnell, 2018). This creates singularities of particular experiencing in particular situations but relies on collectives of things (Gatens and Lloyd, 1999), or how a human might think about self-in-relations. In PL-PE perhaps a (re)turn to experiences like crawling, playing on the knees, on stomachs, not privileging sight and sound, will extend how pupils' worlds might become more physically active. These experiences are to challenge mind-body hierarchy, which Ingold (2004) refers to as the binary of 'head over heels', of head above with hands free to work tools. In primary PL-PE there is scope to prompt alternatives to feet and seated societies, which reduce or remove 'synaesthetic' experiences (Lloyd, 2011), with things-pupils giving rise to new imaginings.

3. *Different ways of mobilising ITE are offered when the agency of human and nonhuman things is recognised and included in student support networks.*

Recognising the co(a)gency (Michael, 2004) of things leads to a view of the world saturated in meanings which are not given solely by humans, and so things are already laden with values. At times during my research, however, things presented agentic potential that was not enacted, such as the water bottles brought outside on a hot day to rehydrate people, but which remained sidelined, as explored in Chapter 7. There cannot be an assumption that, although already animate with intra-activity, things will conjoin with something/one else. This perceived inactivity of bottle with human was an agential cut (Barad, 2007) which effected a temporary boundary with bottles being left out of the pupil-PE assemblage. The bottles were taken up in a later emerging activity when pupils walked back into the classroom sipping water. In another example, where conjoining with nonhumans occurred, such as online websites providing physical activity ideas for students to plan lessons with minimal equipment, this supportive relationship shows an entwining of posthumanist theory with Spinoza's work and a sociomaterialist sensibility. The example is one of many from the data-theory demonstrating that the inclusion of nonhuman things can provide meaningful contributions to understanding how students are becoming teachers.

Staff involved in supporting student-participants during placement experiences (head teachers, class mentors, PE specialists, university tutors) were exposed to different practisings also, reinforcing the importance of the particular situatedness for how things might be done differently. The aforementioned list of educators demonstrated a collective care as they supported not only one another, but also students. For instance, adaptability from class mentors and ITE tutors regarding teaching and assessment opportunities for students included the foregrounding of affective encounters – such as with pupils that students did not know very well, and staff who were coping with colleagues' absence and COVID-19. These were novel assemblages for ITE students, which, in turn, raises the question as to whether some of the affirmative differences have been retained as they move into

teaching jobs. From a posthuman research position, what *mattered* were social-with-material activities which contributed to positive practices for students. Student-teachers were enacting potentials to be “subjectively engaged ... caught up in the practice so that getting it right matters to her, where it matters not because of pressures” from external regimen (Standish, 2016, p. 635) such as placement expectations, but from the enjoyment afforded by teaching for teaching’s sake.

In the “unfolding emergence of the world” (MacLure, 2013a, pp. 659-660), the relational is consistently present as thing-human are co-responding *with* (Ingold, 2017) – such as the lesson plan template *with* Sarah *with* pupils *with* equipment *with* Becoming teachers involves an entangled and distributed meshwork of lines, and understandings emerge through specific practisings (Pellegrini and Parolin, 2021) along the way. There is not one outcome, therefore, not one epistemic object (St. Pierre, 2019) but emerging understandings embedded in ongoing relations. This doctoral research addresses wider calls for researchers to account for the contribution that posthumanist theory (Thompson and Adams, 2020) and posthumanist methodology (Ulmer, 2017) are making to understanding the ‘everyday’, and in this case, educational practisings. I have shown that no one actor can be held accountable, can be attributed as holder of expertise because of the necessarily posthuman practisings. However, within this collective there remain instances where ‘cutting the network’ to chart how students and/or teachers are developing, or how pupils are progressing, will be expected. A rethinking of how judgements are made in dynamic ways, engaging teacher-student-pupil-policy (Standish, 2015), seems a worthwhile future project.

4. Investigating theory↔empirical data requires different ways of doing methodology, and of presenting these. Postqualitative research offers resources for such an envisioning.

The second aim of this doctoral work was to retain the entanglement of which data and theory were a part. In Chapter 5, I discussed somatic analysis (Kieft et al.,

2019), that is, how I moved with theory and empirical data as a way of interfering with how to 'do' analysis. The ongoing task was also to avoid re-presenting data-theory and these movement-inspired devices demonstrate that research inherently requires attending to such devices (Law, 2004). In Chapters 6-8 I invited the reader to enter the middle of theoretical-empirical data and sought to present these as entangled and from across spacetimes, also in tune with the second aim of this doctoral work. Provocations such as conjoining images from empirical data, placing three columns on one page, and creating factional anecdotes, were ways of working with the researched-research and researcher, enacting the entanglements. The angst of re-producing, of representation, of challenging expertise of linearity, was inspired by Lather and Smithies (1997), Mol (2002) and ancient scrolls (Memorial Scrolls Trust, 2022). St. Pierre (2019, 2021, 2024b) encouraged these experimentations through her writings on postqualitative inquiry, and these chimed with my own passion for reading philosophical texts.

The experimental approaches were all attempts to displace the human from atop the cognitive hierarchy, to 'do' posthuman research, retain the entanglement, and to avoid re-presentationism. However, ultimately, were these strategies fruitful, how might they be 'judged' or valued, were they helpful and if so, for what-whom? What was done was less prescribed by 'a methodology' in part because of the pandemic, but in part because I reoriented from reading Spinoza, Merleau-Ponty, Braidotti, Lenz Taguchi, Bennett, Adams, Thompson, Barad, and St. Pierre. St. Pierre (2019, p. 13) advises doctoral students to

trust their reading to sustain them, trust the concepts they've studied that reorient their thought, and trust experimentation and creativity, which will be constituted differently in every post qualitative study.

The notion of trust-building and researcher-trust with new or no methodology is something I will explore with further reflections on this doctoral work.

Overall, and returning to the idea of data collection, gathering, encountering ... terminology becomes less of a concern. Rather, good faith in the relations among

data and not-data can be generative of understanding the research, in this case practisings of PL-PE. Data/not-data may create wonder, appeal, disdain, command attention, intrigue, concern, harm, hurt, joy and so on, and openness to methodological possibilities/differences brings many lines for future research practisings. Indeed, this is a challenge to qualitative research methods because data as agentic is working with researcher, is becoming-with, always emerging in relation-with (MacLure, 2013a). I think this an important contribution showing that difficult and slow postqualitative inquiry which embraces posthuman and sociomaterial sensibilities, is generative and respectful of all things.

5. Posthuman and sociomaterial inquiries enact a four-dimensional approach to research, that challenges false bifurcations.

The breaking down of object-subject, mind-body, theory-practice and other divides was afforded by posthuman and sociomaterial approaches which value the agentic properties of things. The (co)agency of things provided an entry point into the statement I made in the Introduction (Chapter 1) - that I left open whether or not the terms sociomaterialism and posthumanism were interchangeable. Each term does work in ways which draw attention to the commonly called 'social' world by insisting that matter, the material, is implicated, and entangled everywhere. Rather than breaking down binaries, perhaps recognising the relational is one way of enveloping both sociomaterial and posthuman terms. I am not pursuing further whether they are interchangeable terms, but will continue to use each where the actor makes most sense.

More than linguistic breaking down of binaries, the sense of ongoing immanence of relations (Deleuze and Guattari, 1994; Spinoza, 2002) explored during this investigation, have pushed 'human' out of its central spacetime. The four-dimensional has been afforded by pulling information from across spacetimes to prompt evidence of no 'gap' between/among things in relations. The interstices (Ingold, 2016), Möbius strips (MacLure, 2013a) of things coming together seems still to be suggestive of a con (with) joining (Ingold, 2016) – there is a join/are joins,

perhaps point(s) of translation(s). The 'no-gap' idea is further supported by Latour (1996, p. 16) who states that the 'nets' in actor-network theory, "have no "in between" to be filled in". Things as already imbued with intra-activity (Barad, 2003) further contributes to understanding the lack of a 'gap'. For me, the notion of a 'gap' is a vacuum, and (without being an astronomer or physicist) I would suggest that there are affective forces swirling in these spaces. This is what makes such spaces generative and/or silent. The already ongoing relations are not bounded in a linear sort of way but have a fluidity where matter is swirling temporally and spatially already (per)forming practisings.

Importantly, the prevalence of relations was highlighted because student-participants were catapulted into teaching practices with different expectations from university, school mentors and systems. Social-with-material actors were brought to the fore as interwoven, not separate entities, and as the effects of relations. During this particular research period it seemed easier to see the effects of relations among actors, and how actors were effects of relations (Decuyper and Simons, 2016). For example, things became scarcer, or more prominent, or valued, as different effects or activities were occurring through the touch/non-touch of hand sanitisers in corridors, spacing signs on floors, health and safety notices to teachers, student-participants and me. The rhizomatic approach to investigating what-who-how were relating allowed multiple encounters across meshworks of PL-PE, and four-dimensional multiple understandings to be presented in this research.

Researcher Entanglements

More questions have arisen from this investigation than are 'answered' but the point is not to foreclose. As Law (2004) warns, there may come different ways of relating to the mess that raise more questions because there is much to unravel, to follow - whether to dead-ends or lines that fizzle out (Adams and Thompson, 2016). 'Vagueness' does not mean 'methodological failure' (Law, 2004, p. 14).

A posthuman or more-than-human orientation insists that the researcher learns to think differently, creatively and critically about their research, the theories upon which they draw, the process and outcomes related to the doing of research and the involvement of researcher and the researched (Thompson and Adams, 2020, p. 338).

A purpose of this research was to put into practice the idea of methodology which has at its core, dynamism and fluidity, a move towards postqualitative inquiry (St. Pierre, 2019), to investigate PL which is 'movement throughout life'. There are expectations of how a researcher encounters, understands, includes and works with data. Being open to possibilities in self, research, and researched was done, in part, by seeking to minimize conventional, positivist-informed 'scientific' methods, all that has been taught to me until part way through this doctoral work. Thus,

(T)o understand better, it seems, you must hold in abeyance what you already know because there are preconceptions here that will otherwise stand in your way (Standish, 2001, p. 505).

It is expected that the researcher will follow recognisable (largely) postpositivist paradigm tendencies to reduce bias, minimise influence on the research, and researched. However, part of the messiness of research includes oscillating, or dwelling in the entanglements and it is not possible or desirable in posthuman and sociomaterial educational research to tidy things up. Informing posthuman and sociomaterial research is a different way of understanding subject-object relations, and how to explore such relations. As Hultin (2019, p. 93) suggests, knowledge is not 'obtained' "by creating representations at a distance, but rather from a direct material engagement with the world" and that requires being in the middle *with* theory and data. To avoid reduction and representation of that which is known, I sought to show "the *suppleness of both theory and data*" (Jackson and Mazzei, 2013, p. 265, italics original), and the details and nuances of practices.

As Ingold suggests (2016, p. 16, italics original), in walking – sometimes literally - with student-participants, "I *become* my walking, and that my walking walks me. I am there, inside of it, animated by its rhythm"" - that is, I am becoming-with doing

the research. I have been ‘modified’ as I have ‘inhabited’ this doctoral work (Ingold, 2016, p. 16). Further, by not privileging one thing (human) at the expense of another, then conjoining in ways which “reshape the self and its interests” (Bennett, 2010, p. 122), allows human capacities – including those of researcher – to transform whilst having concern for other things. The entanglements in this research were presented through the text and image to show multiple walks, multiple lines. In terms of researcher-research journeying, this writing is not an end point but part of ongoing lines, some of which will appear in publications and practisings. This doctoral writing was an opportunity to pause and “write about my thoughts and arguments as they are at the time being” (Mercieca, 2011, p. 2). In writing differently I presented tensions, such as using plural where singular makes more grammatical sense (practisings), or using neologisms (meshwork, spacetimes), symbols/devices ($\leftrightarrow$), and it is hoped that relevant use of these devices became persuasive. These methods of communication, prompts for thinking, were important because the sense of *conatus*, of moving, is the thread running through the work and I did not want to halt things as they were playing with/on/through the written text. From the start, with inquisitive and tenacious intent, with COVID-19, I have developed my research understanding. I appreciate my ethical entanglement and through experimentation and reading, have made a sound contribution to the doings of research.

Theoretical Reprise

Spinoza’s ontological monism, where matter is One Substance and relies on motion and rest, makes a unique and significant contribution to understanding PL. Indeed, monism is often related to flat ontology (Fox and Alldred, 2018), and for PL, thinking “from” the human body as “a dynamic centre of unfolding” (Ingold, 2012, p. 437) among many bodies, has helped surface the multiple ways in which movement can be evidenced. Throughout my investigation, the dynamism of PL was demonstrable in many ‘spacetimematterings’ (Barad, 2014) in part due to decentring the human, and including ‘things’ in the discussions about relations. The ethicoontoepistemological became evident through posthumanist research which embraces a vital materialist perspective (Bennett, 2010) and has helped

show where ‘bodies’ have been co-responding (Ingold, 2016) to enact at least aspects of PL. Acknowledging practisings as becomings, and as enacting multiple realities was a shift from the ‘out-there’ of positivist and (arguably) Anglo-westernised ontological positioning. Thus, multiple realities were observed by first, attuning to emerging practisings in detail, with some realities becoming evident in the hereafter.

A ground bass has been provided by several philosophies throughout this research. Phenomenology, monism, existentialism, *conatus*, posthumanism, sociomaterialism, ethicoontoepistemology, diffraction, and postqualitative inquiry were entangled with the rumblings of empirical data. Diffracting these through one another has provided ways of opening out *how* to do investigating educational movement. Entering the middle of things assembling, it has become apparent that attending to detail allows more things in any assemblage to speak. As introduced in Chapter 5, writing anecdotes showed how to move away from reliance on only the discursive (Barad, 2003; Markula, 2023), and as such makes an important contribution to how researchers might implement sociomaterial and posthuman methodological analyses. Following and diffracting the empirical lures through theories meant also “tracing responses and passages” (Adams and Thompson, 2016, p. 81) and continuing to follow the lines. Doing these analyses by diving into meshworks meant loosening the lines converging by looking through the detail, and then seeking the relational, the ‘co-responses’ among things (Ingold, 2012; 2016). Or in another way, investigating the ruptures, leaks and (dis)continuities. In whatever way these descriptions are working, there were ‘matters’ to follow. However, there were ‘interruptions’, and these are acknowledged below as contributing to ongoing research practisings.

Interruptions or Opportunities

This sub-heading is possibly better known as ‘limitations’ but things do not always behave, and expectations can be disrupted. Hence the sub-heading I have chosen makes more sense here because relations are always immanent. Sometimes, only

a minor nudge of affect – motion or rest – alters how actors are relating and so in other spacetimes, these are not limits, but opportunities. I provide several examples here, beginning with methodological and performative aspects of the research, and then reflecting on subject-related matters.

Participant recruitment was affected by particular socio-political circumstances (see Chapter 4). Four (human) participants contributed to this research - three ITE students, plus one PE specialist teacher. However, relevant points relating to student-participants include: one student, Erin, continued to tweet/post using the hashtag beyond the data collection period, a sign of connectivity; several other students informally expressed their desire to be connected to the project but could not secure head teacher consent. Negrin et al. (2022) explored similar reasons for participants' ongoing participation, for example, topic relevance or importance, desire to share insights. Further, Erin may have wanted to support her lecturer or want to share information from her placement experiences about in-service teacher confidence to teach PE. These are conjectures, but important reflections and introspections of research, researcher and researched, beyond the timeframe originally discussed. Erin's tweets/posts exist as non-data. The University ethical procedures which foregrounded empirical data collection did not include explicit agreement to follow that line; however, it seems disrespectful to ignore the continuing presentation of a participant's ideas and contributions knowingly and voluntarily shared. On a similar point, a *potential* student-participant tweeted twice in the timeframe but had not signed and returned a consent form. I did not include either of these examples as data but with some trouble, could have secured retrospective ethical consent. The orbit of data does not always correspond with research timeframe, thereby raising the question of returning to data used and unused.

The currency of empirical data from my research could be considered 'out of date' particularly because they were affected by special circumstances. However, at the beginning of this doctoral work, I stated clearly that COVID-19 was one actor of many, and it caused a breakdown (Adams and Thompson, 2016). The message I

would like readers to take away from that, is that student-participants, PL and research practisings were all foregrounded, and what is normatively acquiesced in ITE – such as lesson plan templates – was also surfaced. These activities provide opportunities, futures in which to see and do differently (Tesar, 2021).

The use of different or unconventional language is sometimes necessary to challenge ways of thinking about things in education and doing research. I am open to the risk of inappropriate communication, such as experimenting with language and presentation, such as ‘PL-PE’. However, following Standish (2001, p. 516) there is “a political and ethical obligation to question the nature of education, to be open to such a questioning, and this requires a different language”. Hence hyphenating words or using double-headed arrows to show conjoining/all-in-oneness or multiple directional relations, were tools to enlarge the ordinary meanings of words that would have been assumed had I not included some additional ‘apparatus’. Other theorists have already incorporated devices like neologisms (‘spacetime’, ‘ethicoontoepistemology’, Barad, 2007), to clarify ideas of entanglement for me and other readers. Indeed, I have responded to Latour (2014) and Whitehead (1938) whom I already presented on p. 24 as prompting the research lexicon to be extended.

Inevitably, certain approaches and research questions guided the research journey, and so aspects of PL research were not fully addressed. For instance, policy analysis did not feature, and this could have informed activities that are ongoing across countries. Indeed, in their meta-analysis of literature reviews, Carl et al. (2023b, p. 1068) identify “policy aspects” as a ‘blank spot’. This is relevant for Scottish policy in particular, since there is little evidence of PL informing PE or wellbeing education policy at this time (Milne, 2024). Indeed, PL could continue to be an effective/affective addition to multiple policy areas, such as health (Cornish et al., 2020), active transport (Davis and Whyte, 2022), urban planning and the built environment (Panter et al., 2019), sport (Quennerstedt et al., 2021) and political discussions (Carl et al., 2023b).

Missing from my research were contributions from male primary ITE students, although the invitation was to all students in the relevant year groups. Bowman and Waite (2003) had similar issues in recruiting males for their research in psychology, a subject area in which there may be similar gender differences as in primary education. Another point here is that students participating in research whilst in their university programme, was beneficial for multiple reasons such as increasing understanding of research processes and possible limitations, and continued academic success (Bowman and Waite, 2003). Some students may inhabit more than one reality, or none (Star and Griesemer, 1989). How do marginalised people shift or oscillate to participate in research about physical activity, movement, or PL-PE? Based on some experiences during schooling, the subject might not have attracted many participants for that reason alone!

The other group of humans missing were pupils, and this was deliberate because focus was on student understandings and enactments of PL. There is an opening here, for future research which investigates how and why participants are enacting PL in schools, community organisations, sports clubs, older adult leisure classes or everyday lifeworld moving. There are pockets of such research but scope to also include the methodological approaches engaged in my research.

No fixed end points are stated in these conclusions, but there are openings, possibilities for becoming teachers, for becoming researcher and for research. For example, as stated above, the student-participant who continued to tweet/post embodies the notion of ongoing. This “not-data” (Somerville, 2016, p. 1162) is digitally traceable, is available to her (now) in-service teacher’s network, to anyone when searching for the research hashtag.

The delightful/frustrating paradox of [arts] education is that, just like the [art] forms embedded within, it is not amenable to reduction, not amenable to we whitefella’s accustomed processes of making something complex into something simple (Yunkaporta, 2019). Finding our way

through this elliptical thicket without instrumentalising, romanticising, simplifying or obfuscating is a serious and vital task (Thomson, 2024, p. 16).

Ultimately, PL moves and is enacting differently in accordance with place, space, culture, and “conceptions never stand still” (Burnett et al., 2022). The fear of the ‘to-come’ (Standish, 2001), the not yet, includes the lack of fixed policy ‘outcomes’ from my research in the way that might have been expected. But that might have meant instrumentalising, simplifying, romanticising, which was not the intention when messiness was invited into the research assemblage.

The desire to avoid reducing PL-PE and ITE to something simple could have led to less of the above ‘interruptions’, which is why they are more like opportunities. Ideas presented in the next section are tethered to the theory-data to avoid what Thomson (2024) above says might be romanticising, and I share emerging possibilities for PL and further research.

Emerging implications

There are several lines of flight which emerged during the research and writing of this doctoral study, these are listed in the Front Matter (p. 12). The articles referred to in that list have moved into other discussions and may be being critiqued as they travel and conjoin with other actors. The articles are fluid things (Law and Mol, 2001; Law and Singleton, 2005) as PL continues to be explored. It seems,

research findings can be more about meaning-making processes than outcomes, more about connecting and living than arriving, and more about exploration than delivery (Koro-Ljungberg, 2016, p. 19).

The following emerging implications are acting as springboard for new research. Importantly, the implications inform primary ITE, wider higher education discussions and health, sport, transport and urban design sectors in which movement is entangled. It is to implications for ITE and higher education more widely that I turn first.

Knowledge(s)

In the United Kingdom, ITE is situated in higher education more widely, and discussions about teacher education programmes include asking about the place of knowledge in these curricula (Barnett, 2009; Biesta, 2012). It was seen in Chapter 2 that knowledges in western curricula at this time, tend to focus on trans-national concerns with human rights, sustainability and how outcomes can be reported across the global education community (Priestley, 2021). In PE, knowledges remain epistemological in focus in spite of a multitude of affective, social as well as physical benefits of participating in the subject area (Thorburn, 2007; Kirk, 2010). The sociomaterial and posthuman influences in this doctoral study demonstrated that the relations among knowledge-knower-known were ‘radically entangled’ (Greets and Carsten, 2019), and opportunities to practice movements are in-where-with emergent knowing. I would like to highlight the example of how knowledge is understood in ITE and assessment across education, and how knowledges might be done differently.

Currently, knowledge is included in planning processes as linear (Fletcher and Beckey, 2023) and includes ideas about how to formatively or summatively assess pupils. Students produce lesson plans for SPR files, in some respects as a means-ends relationship, so how can the idea that these are a ‘product’ to be assessed, be shaken up? Stenhouse (1975) had suggested seeking more naturalistic or narrative approaches to lesson planning and assessing. This is a more adaptive, reactive, flexible approach which I suggest, participants in my research enacted. It became clear that ‘the plan’ was not one actor but a sociomaterial assemblage, with each actor already enlivened with intra-activity. For example, adaptability was surfaced when students and pupils were enacting self-assessment and peer assessment strategies. Specifically, in relation to assessment of PL-PE, it was suggested that an ipsative ‘charting of progress’ (Whitehead, 2010), of ‘what-how-why’ things have been performed, *a posteriori* (Green et al., 2018) may be more appropriate. Although indicating a looking back on pupil progress, this is done to show forward momentum of how pupils are developing skills, motivation - such as

engagement, and understanding of how to solve movement problems. Next steps are future-facing, challenging pupils, but from their own unique starting points. Moreover, charting progress appreciates that pupils' development of, for example, ball skills might occur at a different pace than balancing and core strength movements. The posthuman Spinozist-informed approach taken here commits to "articulating the vibrancy, animation and provisional nature of human-nonhuman practices" (Thompson and Adams, 2020, p. 344) and in so doing, demonstrates the *not yet* of knowledges as students are becoming teachers and in movement practisings.

As shown in Chapter 2, eight hours is allocated to teaching PE as subject area on primary ITE programmes, in Scotland at least. Once in-service, primary teachers request 'more PE' (Elliot et al., 2013; Mifsud and Day, 2023). The contribution of my research includes embedding and embodying philosophical understanding for students learning to teach PE, and PL affords students confidence to do so. For example, existentially prior experiences of PE will inform student perspectives when they enter ITE (Whitehead, 2010; Gleddie and Morgan, 2021). Whether viewed as positive or not, students can re-visit these experiences during ITE PE inputs (Taplin, 2013) and begin to enact different futures. However, revisiting student PE journeys and introducing 'new' alternative perspectives on teaching PE requires time and application (Flemons, 2013), a problem discussed throughout my work. Challenging and changing previous feelings, attitudes and approaches to engrained experiences of PE after graduation, is probably impossible (Taplin, 2013), so it is worth involving such challenges early in ITE. Whilst continued professional development is recommended for in-service teachers, offering 'more' is not the only line of flight that could help improve teacher confidence and competence to teach PL-PE. From the research perspectives entangled in this doctoral work, there is need for a conjoining of key human actors (lecturer, teacher) with understandings of PL, and opportunities for PL to emerge *in the practisings* of PL-PE.

Where does knowledge(s) come from?

Addressing calls for ways to develop confidence to teach PE, PL-PE offers an accessible and deep understanding of what PE experiences *could be* for pupils. However, professional development/learning in education has been shown to require sustained and supported initiatives to have lasting effects (Makopoulou and Armour, 2011; Century and Cassata, 2016). In primary schools, head teachers tend to guide the provision of professional learning, and like Erin's experiences in Chapter 7, this leadership works best when demonstrating interest from an ethic of care perspective (Colville et al., 2021). Other ways of providing development include distribution of leadership to enhance relations among all levels of school staff (Forde and Torrance, 2021). Support might include other professionals, colleagues, and learning that is situated and relevant to the particular environment works best (Durden-Myers and Keegan, 2019). Goodyear and Casey (2015) also found in the context of secondary education (ages 12-18) that PE teachers were more likely to sustain changes in practice if they were part of a learning community, guided or facilitated by an external 'expert' or in their case, researcher. The term 'expert' however, can be associated with power imbalance, but careful planning and consideration of *how* professional development is shared can minimise this, whether in schools, or related physical activity settings such as community sport development (Durden-Myers and Mackintosh, 2024).

Perspectives on effective professional development vary according not only to teacher needs, but also stage of career, and pupil experiences (Darling-Hammond et al., 2017). Care of how professional learning/development might be construed, for example as "utopian" and not grounded in the needs, contexts and "realities" of teachers (Beni et al., 2022, p. 577) means creating a supportive ethos for ongoing learning. Placing in-service teachers as active in the course of their professional development has been a successful and collegiate approach (Parker and Patton, 2016; Yildizer and Munusturlar, 2022). Further, professional practisings are already ongoing sociomaterial assemblages and researching with a posthuman approach might alter how other practitioners, such as in health and care work, develop understandings of PL alongside teachers.

In widening the scope of this posthuman research in education and PL, planetary health takes on different meanings – whether in the sense of ecosophy (Loland, 1996), ethology (Spinoza, 2002), or ecology (Carl et al., 2024), all of which include vibrant non-human life (*zoe*) (Braidotti, 2006; 2019). Research which accounts for the distributed, posthuman practisings of PL-PE being presented here, has mileage in contributing to the debate and developing ideas-practisings across stakeholders referred to above. Knowledges will be more akin with the earth's health, and with Indigenous ways of enacting movement and physical activities towards *hilaritas* which is different from present practisings, that are, largely, individualist and reductionist.

PL across stakeholders

A tangible outcome of my research has already been initiated through strategic discussions with key Scottish stakeholders relating to how PL and PL-PE might be embedded across sectors. The implications of this doctoral work for other sectors have been referred to throughout and include secondary schooling (Durden-Myers and Bartle, 2023) and tertiary education, health services such as ante-natal care, nurse education and health care practitioners (Cornish et al., 2020), gerontologists (Petrusevski et al., 2024), and physiotherapists. A commonality in the aforementioned stakeholder literature is that each seeks better understanding of PL. To be cautious, however, is to avoid falling into the neoliberal responses to the global obesity and inactivity pandemic, as outlined in the Introduction (Chapter 1). PL might become more prominent and, if understood as a lifelong, holistic approach to *hilaritas* this may lessen focus on extrinsic motivations for things like weight loss. There are already 'roadmaps' for collaboration among multiple sectors and organisations, such as through the All-Island Consensus on PL (Sport Ireland, 2022) and the PL Consensus England (Sport England, 2023). My contribution to the latter is one of many entangled lines. For instance, I am IPLA Research Lead, with increasing academic and professional profiles in PL research, therefore, I am already intra-activity which can now drive and contribute to multi-sector developments of PL in Scotland.

No matter what sector, provision of movement opportunities does not mean people will continue to move. For example, although understanding the benefits to skeleton, physiology and so on, undergraduate physiologists were found to be physically inactive due, largely, to internal lack of motivation resulting from previous school experiences (Ranasinghe et al., 2016). Similar outcomes were found in a Croatian study on secondary PE and the relationship between fitness and PL (Gilic, et al., 2022), with knowledge and understanding – the cognitive domain – being least developed in high school pupils. However, the latter study does state that PE in Croatia tends to focus on physical fitness and motor skills, with further attention to affective and cognitive domains recommended. This might not be particular to Croatia, as was outlined in Chapters 1 and 2 of my work. In PE teacher education (PETE), ITE educators are encouraged to explore beliefs and values of students to then develop PL-enriched curricula (Flemons, et al., 2018). This entails developing students' capacities to reorient previous, and deeply held attitudes about what PE is, because in PETE students already have a love of movement. As is the case with in-service primary teachers, time in ITE is limited to discuss dispositions, and there remains little scope to develop understanding of PL once a teacher in schools (Stoddart and Selanders, 2022), so it seems incumbent on ITE to make provision for PL in PETE.

PL is also relevant to those designing and creating urban environments that invite people to move more (Xue and Warner, 2023), to play in their everyday environments, as was mentioned in relation to parkour in Chapter 2 (Strafford et al., 2021). Coaches, community volunteers who work with older people, or those working with disabled or immobile members of communities, might experience a different way of understanding PL, based on the posthuman and sociomaterial work undertaken here. These are future pathways for enacting the doctoral work done here so far, that can contribute to Scottish cross sector development mentioned above.

In sync with current policy in Scottish education (Education Scotland, various) lifelong learning is an inherent and necessary part of PL. PL is not limited by the formal schooling timeframe because it is a life journey. Thus, continuing research into physical activity as sustainable and inherent to the lives of pupils-people throughout adulthood is valuable. Valuing, and being responsible for lifelong physical activity, are also consistently recognised internationally as an element of the definition of PL (Edwards et al., 2017; Sum and Whitehead, 2021; Li et al., 2022), and as relevant and worthwhile (Shearer et al., 2018). Sustainability of an attitude cannot be measured in the current thesis and is not a thread I would endeavour to follow. However, an important part of addressing Research Question 3, which asked about implications of sociomaterial and posthuman understandings of PL, means finding out whether a level of knowledge and understanding to continue physical activity is experienced (and retained?) by student-teachers and primary school pupils. In other words, does translation of the philosophy of PL to teacher education and to praxis in PE enable *becoming*?

Finally, the affective is foregrounded by the method of including the material early in the research. I asked participants to bring something that showed what PL meant to them at the time of interview. Such artefacts acted as emotional prompts, as a way of entering the middle in a sociomaterial exchange, shifting from cognitive bias in these research encounters (Mulcahy, 2012). Affective happenings caused a change, a 'threshold' was passed (Massumi, 2002) and if those happenings can be grasped and trajectory shifted towards different PL-PE, then this appears positive.

Another interpretation of the artefact is that it provides a superficial or 'artificial metaphor' (Steger, 2007), thereby giving only a glimpse into *human* association, during a particular spacetime. As has been noted with heuristic devices, these are not claiming to provide 'truths', as this resorts to a positivist paradigm. Rather, in combination with other theory-data and ongoing analyses, the artefact is metaphor and actual, virtual and prompt all at once. The words spoken by four participants during interviews demonstrate an emerging collective understanding

of PL. Words were played with, moved around, cut-together-apart by me. This was “working with data in a way that vividly brings forth or provides glimpses into the qualities of the phenomenon” (Crowther et al., 2017, p. 832). It was like having PL interference on repeat in the background as I continued to complete this doctoral work. The participants said:

physical literacy is something that develops over time when the correct support and materials are offered, similar to a seed, like coming into a flower with water and sunlight and encouragement I played with the primary ones, hula hoop, they were confident to take these chances to try, it was more the trying than the ability physical literacy I think it’s all about movement, movement more than anything I have to hold this [tennis ball] because my dogs are in here [laughs], it moves if you touch it, the key to it all, with younger children, is understanding about ‘space bubble,’ kids’ bubbles, opportunities to develop skills at the right time, the skills are just introduced through basic movement, everyday movements at a younger age physical literacy comes from that understanding, control of your body movement, control of, everything, it’s levels, it’s direction, it’s all the ‘stuff’ to be ... proficient at, that you make bubbles with something that moves, movement is physical literacy

Conclusion

As was presented in Chapters 2 and 6 of this thesis, concepts are not fixed (Hardman, 2019), definitions are not static (hooks, 1994), and the approach taken in my work was entangled with movement – metaphorical and literal. For example, I attuned to ways in which to understand whether-how-why PL was enacting in student PE by viewing concepts or definitions as ‘tools’ (Lenz Taguchi and St. Pierre, 2017; Neimanis, 2017) – as actors in assemblages, as already full of intra-activity, contributing in various ways to the analyses. Drawing from multiple theories, empirical data and endeavouring to honour the entangled lines and knots in the research, I extended or opened out Whiteheadian (2001; 2010) PL by including all Bodies (Spinoza, 2002) in PL-PE practisings. Becoming teachers as a meshwork has been shown to be human-nonhuman and not the sole preserve of

human subject. In becoming teachers, the multiple spacetimes during which this was occurring were partially de-tangled here to find out whether, why and how PL-PE was inhabiting student-participant journeys.

For education, whilst showing how PL is enacting in primary ITE PE, curriculum theory might be foregrounded to encourage thinking-doing curriculum differently. That is, opened out to more explicitly accommodate (post)phenomenological and affective-relational approaches, and lessen behaviourist conceptions and enactings of curricula (Standish, 2007; van Manen, 2012; Shusterman, 2012). With specific regard to PE and PL, the difficulties in the *process* of producing policy without contention, and which will be understood by practitioners, has been made visible (l'Anson et al., 2017). Policy writing processes would merit from being transparent because this is preferable to a 'consensus thinking' or product driven outcome (l'Anson et al., 2017). For research, investigating PL with the philosophical postulates might not be problematic if PL as multiple is foregrounded. The sociomaterial notion of translation helped make things visible in-of-as assemblages, adding to this growing area of PL and PE research. The methodological meshwork can contribute to opening other ways of doing research in education as it refuses foreclosing and acknowledges entanglements.

Due to the breakdown, discussions in Chapters 7 and 8 showed tantalising glimmers for disrupting the routinisation of teaching and learning in primary ITE PE, and wider education environments. As returns to pre-COVID-19 breakdown are occurring, these opportunities seem to be shrinking. Sustainability of different realities seems to have been reduced, with familiar routines in ITE returning. This return gives me a sense of disappointment, "reflecting ongoing structural inequalities, [and] perceptions of social status" (Culp, 2020, p. 156). For work in ITE and PL-PE, I take up Braidotti's (2005) affirmative ethical approach, to optimising different ways of teaching and learning with student groups. It remains a political imperative to share as a source of optimism, different relations (in PL-PE) as possibilities (St. Pierre, 2024a). Posthumanism has opened this way of theorising the liveliness of human-nonhuman things, such as imaginary data like

the TV remote control. Indeed, providing encounters, co-responses with things during PL-PE, is collective relational practisings, traces of which will remain (Ingold, 2016; Zourabichvili, 2020) as students are becoming teachers and pupils are doing physical activities. There is disruptive work to be done regarding the already-present injustices when some pupils are coming to PE, such as assessment practices based on western, white, male, ways of knowing (Culp, 2020).

The IPLA (2017) definition of PL seems to be an obligatory point of passage (OPP; Callon, 1986), a traditional enquiry-based starting point, but also closing off PL such that practitioners are not-yet open to seeing the different effects/affects of it. For students becoming teachers, the understandings through practices of PL-PE may be partial or embryonic but have been shown in the theory-data of my research to be evident. My methodological contribution has unleashed a cascade of ways to investigate movement based on everyday education events. Finally, it might be worth *not* 'imposing order on a part of the social world' (Law, 1987) but rather enlisting *dis*-orderly behaviours where posthuman sociomaterial worlds flourish in ongoing messy existence.

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Appendix A: Data Source and Type

Data source & participants	Type of data	Specific data
Primary school playground, Sarah (MAEd)	Observations x2 over 2 days	Primary 2 (P.2) x 2, joint with P.2/3 class (42 pupils). First day on grass, second day on tarmac playground.
Primary school playground, Eileen (PE teacher)	Observations x2 in one day	P.1 x 2 P.2 x 2
Sarah	Lesson Plans with Evaluations x5	Sent as digital copy from student SPR Folder
Sarah	Tweet/X post x1	Short text prior to observations
Erin (MAEd)	Tweets/X posts x3	All three were short text with images
Holly (PGDE)	Lesson Plans with Evaluations x4 Teacher Observation comments x1	Photographs from student typed copy. Photograph from Holly, of teacher handwritten document.
Sarah	Teams Interview 24.6.21	Artefact: a tennis ball. Transcribed (thanks to University IT Trudie for help!)
Erin	Teams Interview 22.7.21	Artefact: a plant seed. Transcribed
Holly	Walking Interview 5.8.21. Recorded using mobile phone University Teams app.	Artefact (not present but decided before interview): a hula hoop. Transcribed audio from mobile phone, via Teams. Deleted app and recording from phone.
Eileen	Teams Interview 20.8.21	Artefact: liquid bubbles. Transcribed.

Appendix B: Interview Topic/Discussion Areas

(Re)Confirmed consent to record at the start of each interview, and for content to be used in analysis. Participants had two weeks after recording day to withdraw data.

Participants were asked to bring something which represented physical literacy for them at that moment. The following were my notes as to areas I would like to ask about, with openness to listening to participants and prompting according to what they shared.

Open by asking participants to please explain what was brought to represent physical literacy, and what they understand by physical literacy.

Placement context: to gain background understanding of their school, class stage, COVID-19 situation. What was their PE teaching or observing experience, and what other staff were involved (such as mentor, another teacher, or PE specialist teacher).

Planning during placement: what considerations were there such as teacher input, Education Scotland documentation (PE Benchmarks and similar), school plan, your knowledge, and sources of content (such as websites, university, teachers, and so on).

Unpack if SAoLs were used (PE Benchmarks), and any examples please share.

Unpack other factors, such as needs of the class, any examples please share.

Assessment of PE (and possibly PL): were you able to engage in assessing pupils or discussing assessment with mentors, share examples if possible.

Prompt for aspects of PL: building confidence, motivation, knowledge and understanding, physical competence, and valuing physical activity, the idea of lifelong physical activity, share examples if possible.

Support throughout placement related to PE: what-who in the local authority or school (such as Progression Pathway Files, PE Specialist, Active Schools, and so on).

Thank you, et cetera.