



THE UNIVERSITY *of* EDINBURGH

## Edinburgh Research Explorer

### Critical engagement with digital health

A socio-material analysis of physical education teachers' digital health mind maps

**Citation for published version:**

Maclsaac, S, Gray, S, Camacho-Miñano, MJ, Rich, E & Kumpulainen, K 2024, 'Critical engagement with digital health: A socio-material analysis of physical education teachers' digital health mind maps', *Health Education Journal*, vol. 83, no. 4, pp. 1-13. <https://doi.org/10.1177/00178969241255222>

**Digital Object Identifier (DOI):**

[10.1177/00178969241255222](https://doi.org/10.1177/00178969241255222)

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Publisher's PDF, also known as Version of record

**Published In:**

Health Education Journal

**General rights**

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact [openaccess@ed.ac.uk](mailto:openaccess@ed.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.



## Critical engagement with digital health: A socio-material analysis of physical education teachers' digital health mind maps

Health Education Journal

2024, Vol. 83(4) 437–449

© The Author(s) 2024



Article reuse guidelines:

[sagepub.com/journals-permissions](https://sagepub.com/journals-permissions)

DOI: 10.1177/00178969241255222

[journals.sagepub.com/home/hej](https://journals.sagepub.com/home/hej)



Sarah Maclsaac<sup>a</sup>, Shirley Gray<sup>a</sup>,  
Maria José Camacho-Miñano<sup>b</sup>,  
Emma Rich<sup>c</sup> and Kristiina Kumpulainen<sup>d</sup>

<sup>a</sup>Moray House School of Education and Sport, The University of Edinburgh, Edinburgh, UK

<sup>b</sup>Department of Languages, Arts and Physical Education, Complutense University of Madrid, Madrid, Spain

<sup>c</sup>Department for Health, University of Bath, Bath, UK

<sup>d</sup>Faculty of Education, The University of British Columbia, Vancouver, BC, Canada

### Abstract

**Objective:** This paper forms part of a DigihealthPE project in which we have been working with physical education (PE) teachers to co-create critical and embodied digital health pedagogies. As part of the project, we invited PE teachers to mind map their personal engagements with digital health technologies. We aimed to explore the potential openings and opportunities (and limitations) within these maps for critical thinking and action.

**Method:** Data were generated during a workshop with 12 PE teachers in Scotland. Informed by new materialism, we focus on the human and non-human factors and intra-actions evident within six narrative portraits generated from teachers' mind maps.

**Results:** Our findings suggest that teachers were engaging complexly and extensively with digital health technologies, which we considered an opening for further critical work. Importantly, experiences of strong (negative) affect had the potential to transform engagements with digital health technologies.

**Conclusion:** We conclude by exploring how the process of mind mapping helped us to see further opportunities for supporting teachers to engage critically with digital health technologies. We also argue that new materialist-informed critical practices in education may have transformative potential for helping teachers and pupils to engage critically with the moving body, technology and health.

### Keywords

Critical pedagogy, digital health technologies, new materialism, physical education

---

### Corresponding author:

Sarah Maclsaac, Moray House School of Education and Sport, The University of Edinburgh, Holyrood Road, Edinburgh EH8 8AQ, UK.

Email: [sarah.macisaac@ed.ac.uk](mailto:sarah.macisaac@ed.ac.uk)

## Introduction

Schools are often regarded sites for health education and promotion, with subjects such as physical education (PE) considered especially important for supporting young people to live physically active lives. However, some young people can feel marginalised and excluded in PE, often in relation to discourses of health, body size and shape (Quennerstedt et al., 2021; Sykes and McPhail, 2008). Despite this, PE does harbour great potential for critical, embodied and transformative practices that can enable young people to appreciate and value their bodies (Fitzpatrick, 2019). The PE teacher can be hugely influential in creating an environment in which individuals feel safe and supported to engage critically with bodily discourse and there are teachers who are troubled by PE practices that marginalise and/or stigmatise certain groups of students (Fitzpatrick and Russell, 2015). However, while some research has explored embodied approaches to critical learning (Azzarito et al., 2016, 2017), there is a need for more research where the moving, sensing, emotional, relational, *body in context* is central to the construction of new knowledge (Lambert et al., 2022).

Critical pedagogy has to be meaningful and connected with pupils' and teachers' wider lives (Freire, 1970). Relatedly, recent research has highlighted how digital health technologies, such as social media and wearable devices, have become increasingly significant to how young people understand and experience their bodies, influencing their lives and social interactions in and out of school (Goodyear et al., 2019; MacIsaac et al., 2018; Vandenbosch et al., 2022). While this is not necessarily 'good' or 'bad' (Lupton, 2015), such technologies can encourage individuals to engage in disembodied self-monitoring and/or extreme diet and exercise practices (Camacho-Miñano et al., 2019; Goodyear et al., 2019). Many young people have also reported that they find it difficult to assess the credibility of information obtained from digital sources (Rich et al., 2020). Critical and embodied approaches to digital health learning may support young people to challenge such perspectives and practices and potentially encourage them to engage with digital health technologies creatively and diversely.

With a view towards developing some of these critical and embodied practices, we developed the DigiHealthPE project (Camacho-Miñano et al., 2024). This project involved co-creating pedagogical activities with in-service PE teachers during professional learning workshops, both in Scotland and in Spain. This paper focuses on a workshop conducted in Scotland, specifically a pre-workshop activity where we asked participants to create mind maps of their personal engagements with digital health technologies in order to consider their own embodied learning as the first step for developing critical pedagogies in PE (Lambert et al., 2022).

## A new materialist approach

The pedagogical approach adopted within workshops was informed by new materialism. Much work on digital engagement and learning has examined the discourses through which people come to make sense of digital technologies and practices, often using a Foucauldian perspective (Camacho-Miñano et al., 2019; Goodyear et al., 2019). This work has explored forms of bodily regulation, surveillance and monitoring, while analysing the powerful discursive forces that act upon the body. New materialist approaches differ in that they understand discourse as one element entangled with other material things, bodies, spaces and technological practices (Lupton, 2019a, 2019b). This means asking how digital technologies and teachers *become* and *emerge* within and through entangled practices. It also means turning attention beyond what digital technologies mean, towards a focus on what they *do* – 'as generative material, rather than passive objects' (Flore, 2022: 3). As such, our attention turns to 'intra-actions' between the human and non-human and the social and material (Barad, 2007). Rather than framing teachers and digital health

technologies as discrete and separate entities that ‘interact’, Barad’s concept helps us understand how teachers only ‘become’ through entanglements between human and non-human entities. This mutual constitution can be described as a ‘more-than-human’ perspective. From a pedagogical perspective, we were interested in the practices and knowledge that emerge from these more-than-human intra-actions (Thorpe et al., 2020). Rather than teachers being at the centre of ‘meaning making’, orientations and practices towards technologies emerge *relationally*, with both discursive and material phenomena being important foci of analysis (Barad, 2007).

Drawing on Barad (2007: 152), the relationship between digital (matter) and humans is inextricable, creating affordances for what they can become and through which they are mutually affective (Clark and Thorpe, 2020; Flore, 2022). The idea of distributed agency (Coole et al., 2010; Fullagar and Pavlidis, 2021) is therefore crucial in moving away from rational choice models and neoliberal notion of ‘self’. This paper, therefore, aims to explore teachers’ personal engagements with digital health technologies and to analyse how mind mapping might support critical thinking and action (for the teachers and for us as researchers) with digital health technologies. More specifically, we consider:

- What possibilities for critical thinking and action are opened or limited by teachers’ mind mapping of their personal engagements with digital health technologies?
- What opportunities emerge for supporting teachers to engage critically with digital health technologies through their engagement in mind mapping?

## Methodology

### *The workshop: a brief overview*

The workshop was developed using design thinking, a collaborative approach to identifying and creatively solving complex problems (Henriksen et al., 2020), and included an online introductory session followed by a main face-to-face session (5 hours in total). Both sessions comprised a variety of participatory activities such as a video, short presentations, small group and whole group discussions, and during the face-to-face session only, practical PE activities. Practical activities were offered as examples of critical digital health pedagogies, encouraging participants to move, feel and disrupt (Stolz, 2015). Aligned with Lambert et al.’s (2022) ‘attributes’ for embodied learning, they encouraged the participants to work together to engage in critical reflection, sensing and meaning making. For example, participants had to select and engage in a ‘fitness’ video from YouTube and reflect on their reasons for selecting the video and how they ‘felt’ during the video – feelings that could be both positive and negative. They then had to create their own TikTok-style video using their moving bodies to share their critical reflections and experiences. The principles that underpinned these critical and embodied activities were then used as a framework to guide the participants to collaboratively generate their own pedagogical activities (Camacho-Miñano et al., 2024). During a follow-up phase, participants were invited to voluntarily implement one activity designed at their school with their own students and then share their experience of implementing these activities with us via WhatsApp.

### *Participants and sampling*

Details of our workshop were circulated via email to all PE teachers in one of Scotland’s major cities. Through volunteer sampling, 12 teachers attended (5 women and 7 men), ranging from newly qualified teachers to those with up to 20 years teaching experience. Notably, most participants were in their

20s with only 3 aged 35+. All participants taught in city-centre comprehensive secondary schools, except for one who taught in a school for pupils with additional support needs. Some had specific roles within their school in relation to general pupil support or supporting pupil engagements with digital health technologies. All participants also had an interest in engaging critically with digital health technologies and had some background in doing so already. As such, our findings are not representative of all teachers, and further insights could be gained from involving a more diverse sample, including those less inclined to engage in digital practices. That said, we did not set out to produce findings generalisable to a population, rather we aimed to work with teachers who were motivated to explore new and critical ways of working with digital technology for health in PE.

### *Data collection—the mind maps*

Prior to the workshop, we invited the teachers to create a mind map, a visual representation of all the digital technologies that they use to ‘learn about or to develop healthy lifestyles’. They were provided with a guide to develop their mind map, encouraging them to identify the individuals, groups and organisations that might form their own digital health assemblages, as well as any other elements such as data, feelings or actions. The guide also encouraged participants to establish the relationships between the different elements, using arrows to highlight the direction of the relationships and to submit an audio recording explaining their mind map verbally. Participants sent their visual mind maps and supporting audios to a researcher phone number via WhatsApp. Guided by our research questions, we understood mind mapping as a creative and (largely) visual meaning-seeking process (Jusslin and Østern, 2020), not intended to describe or explain, but to explore the capacities of human and non-human relations to shape meaning(s), create action(s) and contribute to change (Thorpe et al., 2020). This arts-based method helped us in ‘re-focusing attention away from text-based practice [and afford] more space for the sensory, emotional and material dimensions of knowledge production to emerge’ (Thorpe et al., 2020: 47). Underpinned by new materialist thinking, we wanted to identify both the human and non-human factors within the research-learning assemblage, and that cut across micro and macro levels of social production (Fox and Alldred, 2017).

### *Data analysis*

Our analysis sought to trace the affects, sensations and embodied states that were generated within the entanglements created through the maps. This process involved several stages. During the initial stage (data familiarisation), the first three authors examined each of the mind maps, while listening to, and (re)reading transcripts of, the teachers’ narrations of their mind maps. The third author subsequently developed a table consisting of headings that enabled the researchers to pay specific attention to the following human and non-human elements: companies, devices, applications and platforms within each mind map; digital technology affordances; data produced; emergent actions and health behaviours; emergent feelings and emotions; people; time and space; discourses and knowledge and connections to PE practice.

The first three authors used this table to co-analyse a sample of the teachers’ mind maps and audio transcripts. This encouraged the researchers to focus their analysis on matter (rather than text), on relational networks and assemblages that affect and are affected and on identifying capacities to contribute to social production (Fox and Alldred, 2017). They then carried out the same process individually (with the teacher data shared equally between them). Subsequently, they arranged one-to-one meetings using their tables to discuss the more than digital dimensions within each mind map, their relational connections and the affective capacities generated through their intra-actions. These discussions were recorded and transcribed verbatim.

Following these discussions, six teachers were identified around which to develop case study narratives. These narratives represented both male and female teachers, as well as a ‘range’ in terms of critical (embodied and discursive) engagements with digital health technology. This ‘agential cut’ (Barad, 2007) was made given that co-developing critical digital health pedagogies was a key aim of the subsequent teacher workshop. Doing this enabled us to explore the human and non-human factors with transformative capacities and reflect upon the various assemblages (contextual and affective experiences) that might *move* teachers towards becoming more critical.

To develop our case study narratives, we were guided by the methodological approach of ‘making narrative portraits’ (Lupton, 2022; Rodríguez-Dorans and Jacobs, 2020). This process involved working with all the data generated, by the teachers *and* the researchers. Through this, we were able to identify ‘phenomena of interest’ (digital technologies), while also considering ‘time’, ‘space’ and ‘key events’, at times using direct quotations from the teachers (Rodríguez-Dorans and Jacobs, 2020), but also, reflecting our socio-material perspective, seeking to uncover relational connections and affective capacities. This approach allowed us to de-centre teacher ‘voice’, and in doing so, demonstrate the capacities for human *and* non-human to affect and be affected.

In the final stage of the analysis process, influenced by post-qualitative inquiry (Thorpe et al., 2020), we worked with the case study narratives, not to reveal what they were, but rather to explore what they have the *potential to do*. Thus, we read all six case studies and ‘thinking with theory’ (Lupton, 2019b: 2002), engaged in dialogue to uncover relational flows, affects and emergent capacities – while also paying attention to our own senses, to those moments that ‘glowed’ through our own entanglements with the data (MacLure, 2013: 661).

### ***Ethical considerations***

The University of Edinburgh School of Education and Sport ethics committee granted ethical approval for the study (7 October 2021, reference number: SGRA02092021). All participants were provided with an information sheet detailing the research, the workshops and potential uses of data before voluntary consenting in writing to participate in the study. Additional ethical considerations were taken in relation to the use of WhatsApp to gather data. The main challenge faced during the mind mapping phase of data collection was ensuring that both participants and researchers handled data securely. Guided by previous research using WhatsApp (Kaufmann and Peil, 2020), we worked with our university director of ethics to develop a guide for researchers and participants instructing them how to switch off synchronisation of data and auto-download functionalities and informing them about the platform’s rules for data management through end-to-end encryption, which ensured that only they and the researcher they were communicating with (via a research phone number) could access what they had sent. Our main limitation was that we could not be sure that all participants would follow our guidance, something we were clear about when applying for ethical approval. The telephone used by the researchers was password protected and the telephone and number were only used for the investigation. Any messages received from participants were immediately anonymised and transferred to a secure university server. Therefore, the confidentiality of participant’s data was ensured, and pseudonyms were used throughout the paper.

### **Uncovering the potential of the mind maps**

Expanded narratives and original mind maps may be accessed via the following link: <https://doi.org/10.7488/ds/7726>. Below, we present three moments of ‘glow’ (MacLure, 2013) that emerged through our intra-actions with the narratives. First, the teachers intra-acted with digital health technologies complexly and extensively which, through our reading, had the potential to generate

‘openings’ for critical inquiry. Second, these intra-actions affected and ‘moved’ participants, transforming the ways that they felt about, experienced and subsequently engaged with digital health technologies. Third, engaging with these technologies critically was an ongoing process, impacted by many relations, affective forces and capacities. We argue that being aware of such relations, affective forces and capacities allows further ‘openings’ to emerge for working with and supporting teachers to engage critically with digital health technologies.

### *Complex and extensive teacher mind maps*

Almost all the teachers created complex mind maps, implicating an extensive amount and range of digital technology, applications and social media, within their ‘digital health assemblages’. They indicated that they engaged frequently with digital health technologies, often daily. For example:

From Rory’s map, it appears as though every aspect of his life and his health connect to the digital. Included on the map are tracking and training technology and applications, audio-visual and education applications, food-related applications, social media and PE teaching applications. Examples of just some of the specific features of his digital health assemblage include: Club Right Fitness App, Strava, Snow and OS Maps, Apple Watch, Apple Fitness, Apple Health, Pitchero, Gymsharks, Myproteins, Headspace, Spotify, Audible, Netflix Delivery, Ubeats, Too Good To Go, Instagram, Facebook, Twitter, LinkedIn, the Covid Track and Trace app and several PE teaching applications including Home Court, Interval Timer and Sworkit. Rory is very aware of the affordances these apps offer particularly in relation to ‘drawing his health-related data together’.

And,

David has included, social media such as Twitter, Snapchat, TikTok, Facebook and YouTube. He also uses his phone, smartwatch, Garmin and Strava, as well as online news channels and websites. Interestingly, his mind map also includes media such as Disney Plus, Netflix and Amazon prime. Through this mind map, and his narration of this mind map, he seems to understand the multiple connections between various devices, apps, social media, the internet and online media.

Participants also appeared to be skilful ‘producers’ of digital health technologies (Bruns, 2008) with a sophisticated awareness of what the technologies do; how they connect to each other; the data they produce; who data is shared with and how their intra-actions with this technology affect them in both positive and negative ways. For example:

Lily details how she extensively engages with social media such as TikTok and Instagram to learn about health. Here she engages with other people – influencers, physical trainers and health professionals who provide ‘lots of different advice and different knowledge’. These technologies group content together which is easily accessible on ‘for you’ pages, created via algorithmic means to provide content tailored to Lily. Lily shows awareness of this, explaining that a lot of the people who influence her are not always those that she ‘follows’, ‘they just come up on my page just through the algorithm’. The algorithmic affordances of TikTok and Instagram have led Lily to be surrounded within the online realm by diet related influencers and information. As she explains, ‘diet culture can be very prominent within social media and TikTok. You see so many videos about what I eat in a day, different foods to try’. She talks a lot about the negative affects she experiences through her engagements with this realm. For example, she experiences feelings of not being good enough and pressure to engage is self-regulation, especially as she compares herself to others, as she explains, ‘this leads to, sometimes for me, a comparison of others. I’m self-critical of, ‘oh well if they look like that, why don’t I?’ Or, ‘if this is what they eat in a day, I should try and eat certain foods like that’.

These intra-actions were rather narrowly (but extensively) focused on body monitoring and tracking. However, there is potential for us to explore with these teachers different ways of thinking about and intra-acting with digital health technologies, especially given their willingness to engage with the technologies and their awareness of the complexity and intricacy of how these technologies work. Importantly, the act of mind mapping may encourage teachers to make new connections between technologies and potentially create new patterns of behaviour, whether these be in their personal lives or their professional practice. Mind mapping invited the teachers to organise their ‘digital-health’ lives in a creative, material way—enabling them (and the researchers) to *see* this life, making new connections across components of their assemblage. For example, many of the teachers explained that they used social media to acquire health knowledge either for themselves or for their teaching. Although we did not explicitly ask the teachers to highlight connections with their teaching in their maps, many did this and referred to their work with pupils. Working creatively with their mind map, they might be encouraged to notice ways to use the same platforms and functions (affordances) to construct different forms of knowledge, forms that help them and their pupils to question, critique and even challenge other components of their digital (health) lives. Importantly, this idea emerged from *our* intra-actions with the mind maps, as evidenced in the conclusion of David’s narrative which stated:

Given the multiple and multidirectional connections he makes across the components of his assemblage, and the deep level of understanding about what digital technology does for him and what he does with digital technology, there is scope for this teacher to become more critical. For example, he might be able to use the knowledge he gains from news articles and documentaries as a basis to critique the influencers that he follows, and to support his pupils to do the same.

The development of new relational connections might be facilitated by drawing attention to those areas of their mind map that reflect a form of health that moves beyond merely improving physical health, for example, those focused on improving mood, mental health and emotions. However, we have also learned through this mind-mapping process that for teachers to think and do digital health differently an embodied, and therefore *situated*, approach is essential. This implies that other features of the assemblage, for example bodies, spaces, places and people will also shape the affective forces that emerge. Extensive use does not bring the affective capacities *per se*, but does so in relation to other human and non-human affects.

### *Working with digital technology: the potential of moving and being moved*

Most of the participants’ engagements with digital technology reflected the purpose for which these technologies were originally intended – to gather information about and for their bodies to work upon and ‘improve’ themselves. For example, to track their runs, steps, heart rate and weight, in order to compare their ‘past’ and ‘present’ metrics and to compare against others in order to improve and/or maintain health, fitness and appearance. They also engaged with the technology when ‘working’ to embody certain ideals. For example:

Emily has used, and continues to use, wearable technologies (such as her whoop band) to collate data about her body and behaviours such as her heart rate, step counts and sleep and has been able to explore and analyse her ‘datafied self’ (Rich and Miah, 2017: 87).

And, in David’s narrative:



There are also relational connections (for example his intra-actions with recipe websites) within this assemblage that come together to shape how he thinks and acts around diet and weight—or more specifically: ‘gaining weight and kinda losing weight through kinda cutting phases’. Importantly, within this assemblage he also mentions ‘men’s fitness’, ‘gym workouts’ and in particular, ‘protein’. The relational connections here come together to produce, and are produced by, understandings and behaviours aligned to a narrow conception of masculine health, one linked to a body that is muscular and toned/defined.

Entangled within these assemblages were public health messages related to keeping active and maintaining a healthy body, underpinned by discourses associated with risk, norms and the neoliberal imperative of taking responsibility for one’s own body (Fotopoulou and O’Riordan, 2017). The teachers also appeared to have an affective attachment towards embodying such ‘ideals’, as evidenced in the ways that they sought potential forces such as the ‘motivation’ to move and ‘improve’ their bodies. For example, Jennifer’s narrative highlights how:

She also utilises methods to corroborate and question her smart scale data, for example, using a mirror or looking at pictures of herself to ‘see how my weight was in relation to how my body was actually looking’. Despite some distrust in her data, she details how motivational affects (or more accurately her desire to seek and gain these affects) draw her towards engaging with these technologies. She understands the technologies are ‘supposed to’ motivate her. However, she does not always feel motivated so tries new technologies or ways of engaging with the technologies to seek this affect further.

Interestingly, while the participants sought to be motivated *by* the digital technology, in many cases it was the more negative affects of guilt and obsession that were *felt*. For example, in Lily’s narrative:

She explains how her engagement with her Apple watch affects her similarly (‘another big digital technology that I use to inform and influence my health’). For example: ‘I do sometimes become a little bit obsessive and a little bit guilty when looking at my apple watch and my health app on my phone about telling me my steps, telling me how many calories I’ve burned. And I feel responsible to maintain the move goal each day and to also try and beat my friends and family which I think is sometimes good for a bit of a competition but when it’s everyday activity, it’s not, it’s not always the best’.

In a sense, these teachers were perceiving the body as something that is affected (externally by the technology), rather than a living, breathing, sensing, experiencing and relational organism that has the capacity to affect and move in and for other ways of being (healthy). That said, a few of the teachers understood health in a broader and more holistic way, engaging with digital technology, not to do work on their body, but to feel or experience their body in more positive ways. Rory, for example, used Spotify to generate a playlist to help him to relax or change his mood. This is similar to Emily from the following excerpt:

Emily explains how she has also engaged with meditation and mental health apps such as Headspace and Spotify podcasts around topics like mindfulness, which have encouraged her to think of her health in more holistic terms. Interestingly, she explains how these technologies have similar affordances – reminders, notification and daily streaks – which she considers to have had a positive influence on her, for example encouraging her to make mindfulness part of her daily routine. As she explains: ‘I wouldn’t say that I’m using [it] in a way that I’m, that I’m trying to get as big a streak as possible. I’m almost using it to learn and develop my own ability and experience in terms of meditation . . . One of the things about Spotify is it must also have almost like an algorithm where once I’ve listened to a few health related podcasts, it suggests some other ones which is quite useful for me’. Therefore, she is aware of her own ability to affect the non-human and shape the content that the applications push to her.

The above reflects an embodied engagement with digital technology, in which the teachers through their sensing, feeling and emotional bodies have come to think about and intra-act with digital technology in different ways. This has created an opportunity, or an opening (for us and potentially the participants) to think differently about human and non-human intra-actions for health. The sensing, feeling and emotional body – in other words, the connected and relational body – has moved the teachers to uncover new affordances and make new connections within their (digital) environment to support their health and well-being. To capitalise on these affordances, teachers must understand how their sensing and feeling bodies in different contexts are implicated in the decisions they make about their health.

### *Moving towards critical*

Through intra-acting with the mind maps, we noticed some of the teachers engaged in a more critical perspective towards digital health, considering the (negative) consequences of technology for both themselves and their pupils. Within Rory's narrative, for example questions are raised about the quality of online material accessed:

Much of Rory's digi-tech use is focused on his physical health/fitness. This might be described as a common way of working with digital technology for health . . . That said, there is evidence he is aware that the quality of the information provided can vary, and that he would 'follow up by being critical of it'.

In exploring these critical perspectives further, it emerged that they had formed over time and through a dense web of relations, affective forces and capacities (e.g. social, experiential, physical and spatial). However, it was often through the negative affects produced through participants' entanglements with digital health technology that new capacities emerged. This was especially the case with Lily:

Despite a knowledge of how certain algorithms work, of how knowledge on social media can be misleading, of how influencers are not necessarily health professionals or might be presenting censored versions of their lives, she explains that she is still very affected by online content, by influencers and by the comparisons that she makes with others: 'They aren't professionals or they might not be, well they might not be knowledgeable about certain ideas around health and it's an individual thing that each person shouldn't compare themselves with other people. But that being said, I do find myself comparing myself to other people through social media, through my apple watch and listening to people on podcasts as well'. This tension is especially evident in her frustration with her Apple watch, which she wishes would not negatively affect her. As she explains, 'I have to like kinda reign myself in a few times and I'm like, 'it's just a watch' (Lily).

Experiencing negative affect is not necessarily desirable. However, it may be possible for us to support these teachers in mobilising these feelings and experiences as an embodied process that generates the capacity for critical action. When analysing the mind maps, we were able to see the capacity that affect (embodiment) can have on the digital health assemblage, disrupting some relations and establishing new ones, forcing new patterns of behaviour to emerge. For example, from the negative affects produced through Emily's assemblage, new relational connections and affective forces have emerged:

Emily has moved from engaging with digital health technologies in ways which 'wouldn't have had a positive impact' and which made her 'feel a bit rubbish' to an engagement which she frames more

positively . . . For example, she details her relationship with wearable technologies as being ‘quite addictive in that because you have tae wear it 24/7’ and how she has felt ‘unsettled’ when the connection between her own body and the technology has been broken. For example: ‘If it needs charged or if I have not got it on, I’m almost like, oh this is gonnae affect my data and it becomes quite negative in that sense’ . . . Therefore, she is aware of her own ability to affect the non-human and shape the content that the applications push to her.

And,

A further aspect of a counter assemblage is evident in how she has endeavoured to reflect critically upon her data, as she herself explains: ‘So I think when I am using that app I try and think quite critically about what, why my data might come up as a certain way depending on what I have done that day’. This endeavour to critically reflect coupled with an exposure to counter discourses through mental health apps seems to have intra-acted with strong affective forces (such as anxiety, pressure, addiction) to prompt her to do things differently. In this process, these affective forces have shifted or weakened over time as they have been countered by more positive affects. Emily explains how she now uses apps such as Strava and Instagram as a ‘fun way tae support my friends’.

Importantly, through our (the researchers’) intra-actions with the teachers’ mind maps, we recognise these affective forces to lead to the emergence of a pedagogical capacity (Cooper and Sandlin, 2020). Considering affect as a way of working with teachers can move them not only to think differently about digital technology for health, but to ‘do’ digital health differently. This will take time, and doing so successfully is likely not possible in a ‘one-off’ professional learning workshop. However, we can help individuals to pay attention to their moving, sensing, feeling body and to understand their embodiment as a powerful force to seek new ways of feeling, being and working with digital technology for health.

## Discussion and conclusions

The initial intention of this mind-mapping activity was to identify the human and non-human agents entangled within teachers’ personal digital health technology and social media practices. However, a new materialist analysis did more than just identify and map relations – it provided us with the potential for working with these teachers differently. As we engaged with the teachers’ mind maps and narratives, openings for supporting them to engage critically with digital health technologies became clear.

Teachers who are willing to *work with* such technologies may be open to exploring new possibilities and innovative ways of engaging critically with them. Previous research has evidenced that there are PE teachers willing to engage with critical practices (Fitzpatrick, 2019; Gerdin et al., 2018); however, doing so can be challenging, and ongoing support is often necessary (Alfrey and O’Connor, 2020). For example, despite a willingness of our participants to engage critically with digital health technologies, there was evidence that discourses and practices around bodywork – disciplining, monitoring and ‘improving’ bodies – were dominant in a number of the teachers’ digital health engagements. The dominance of bodywork narratives has long been reported among PE teachers, even among those exposed to ‘counter’ discourses (Barker et al., 2021). When analysing these tensions through a new materialist lens, we can see how these discourses can lead to strong negative affects, for example feelings of guilt and obsession. However, over time these affects can lead to transformation within certain assemblages. In our participants, negative affects, in some instances, intra-acted with various forms of knowledge and entangled with human (such as the

body, feelings/sensations, family, friends and influencers) and non-human (such as data, devices and physical spaces) elements to enable ‘new lines of flight’ for being critical to emerge.

The key challenge going forwards is to investigate how we can contribute *positively* towards teachers’ digital health assemblages in order to support alternative ways of *being* and *doing* critical. Future research should explore how those supporting teacher learning – whether that be as part of Initial Teacher Education or career-long professional learning – might enter into teachers’ assemblages so as to disrupt the discursive-material conditions that shape normative understandings about digital health (Camacho-Miñano et al., 2024). This could involve encouraging reflection among teachers so that they recognise the ways in which they are experiencing negative affect and explore how their learners might be entwined within their digital health assemblages. However, future research should also explore how embodied, critical, affective pedagogies might enable both teachers and pupils to engage in more positive affective experiences that can also lead to action (Lambert et al., 2022).

Our findings suggest there is merit in drawing upon creative methods when working with teachers and in encouraging teachers to challenge not only how they *think* about digital technology, but how and who they *are* with digital technology. Previous literature has provided key insights into how teachers can reflect upon their own identities and discursive contexts and how these relate to pedagogical practices (Wrench and Garrett, 2012). However, there is a need to shift the focus away from the individual and discourse towards how individuals intra-act with material-discursive assemblages. Importantly, there is not necessarily a right or wrong way of engaging with digital technology – we can support teachers and their learners in finding opportunities within their own unique contexts to (critically) explore the infinite range of opportunities that digital technologies for health afford. The teachers in our study are, to varying extents, already on a critical journey – they desire to think and do critically and positively impact their pupils, they are inquisitive and they are open to new possibilities, all of which offers us an exciting starting point for further critical work.

## Acknowledgements

The authors would like to thank the participating teachers.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

## Funding

The author(s) disclosed receipt of the following financial support for the research, authorship and/or publication of this article: this work was supported by Una Europa (Seed Funding Project Reference: SF2019002).

## ORCID iDs

Sarah MacIsaac  <https://orcid.org/0000-0002-3494-0987>

Maria José Camacho-Miñano  <https://orcid.org/0000-0001-6910-3006>

## Data availability

Expanded narratives and original mind maps may be accessed via the following link: <https://doi.org/10.7488/ds/7726> (Gray, Shirley; MacIsaac, Sarah; Camacho-Minano, Maria Jose. [2024]. A socio-material analysis of Physical Education teachers’ digital health mind maps: full narratives [dataset]. University of Edinburgh. Moray House School of Education and Sport).

## References

- Alfrey L and O'Connor J (2020) Critical pedagogy and curriculum transformation in Secondary Health and Physical Education. *Physical Education and Sport Pedagogy* 25(3): 288–302.
- Azzarito L, Simon M and Marttinen R (2016) 'Stop photoshopping!' A visual participatory inquiry into students' responses to a body curriculum. *Journal of Teaching in Physical Education* 35(1): 54–69.
- Azzarito L, Simon M and Marttinen R (2017) 'Up against Whiteness': Rethinking race and the body in a global era. *Sport, Education and Society* 22(5): 635–657.
- Barad K (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke university Press.
- Barker D, Quennerstedt M, Johansson A, et al. (2021) Fit for the job? How corporeal expectations shape physical education teachers' understandings of content, pedagogy, and the purposes of physical education. *Physical Education and Sport Pedagogy* 28(1): 29–42.
- Bruns A (2008) The future is user-led: The path towards widespread produsage. *The Fibreculture Journal* 11. Available at: <https://eprints.qut.edu.au/12902/1/12902.pdf>
- Camacho-Miñano MJ, MacIsaac S and Rich E (2019) Postfeminist biopedagogies of Instagram: Young women learning about bodies, health and fitness. *Sport, Education and Society* 24(6): 651–664.
- Camacho-Miñano MJ, Rich E, Gray S, et al. (2024) From critical thinking to critical doing: Pedagogical principles of critical digital health pedagogy in physical education? In: *2024 AIESEP International Conference*, Helsinki, Finland, 13–17 May.
- Clark MI and Thorpe H (2020) Towards diffractive ways of knowing women's moving bodies: A Baradian experiment with the fitbit–motherhood entanglement. *Sociology of Sport Journal* 37(1): 12–26.
- Coole D, Frost S, Bennett J, et al. (2010) *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.
- Cooper J and Sandlin JA (2020) Intra-active pedagogies of publicness: Exploring street art in Melbourne, Australia. *Pedagogy, Culture & Society* 28(3): 421–443.
- Fitzpatrick K (2019) What happened to critical pedagogy in physical education? An analysis of key critical work in the field. *European Physical Education Review* 25(4): 1128–1145.
- Fitzpatrick K and Russell D (2015) On being critical in health and physical education. *Physical Education and Sport Pedagogy* 20(2): 159–173.
- Flore J (2022) (Dis)assembling mental health through apps: The sociomaterialities of young adults' experiences. *Media International Australia*. Epub ahead of print 25 July. DOI: 10.1177/1329878X221114486.
- Fotopoulou A and O'Riordan K (2017) Training to self-care: Fitness tracking, biopedagogy and the healthy consumer. *Health Sociology Review* 26(1): 54–68.
- Fox NJ and Alldred P (2017) *Sociology and the New Materialism: Theory, Research, Action*. London: SAGE.
- Freire P (1970) *Pedagogy of the Oppressed*. New York: Continuum.
- Fullagar S and Pavlidis A (2021) Thinking through the disruptive effects and affects of the coronavirus with feminist new materialism. *Leisure Sciences* 43(1–2): 152–159.
- Gerdin G, Philpot R and Smith W (2018) It is only an intervention, but it can sow very fertile seeds: Graduate physical education teachers' interpretations of critical pedagogy. *Sport, Education and Society* 23(3): 203–215.
- Goodyear VA, Kerner C and Quennerstedt M (2019) Young people's uses of wearable healthy lifestyle technologies; surveillance, self-surveillance and resistance. *Sport, Education and Society* 24(3): 212–225.
- Henriksen D, Gretter S and Richardson C (2020) Design thinking and the practicing teacher: Addressing problems of practice in teacher education. *Teaching Education* 31(2): 209–229.
- Jusslin S and Østern TP (2020) Entanglements of teachers, artists, and researchers in pedagogical environments: A new materialist and arts-based approach to an educational design research team. *International Journal of Education and the Arts* 21(26): 1–28.
- Kaufmann K and Peil C (2020) The mobile instant messaging interview (MIMI): Using WhatsApp to enhance self-reporting and explore media usage in situ. *Mobile Media & Communication* 8(2): 229–246.
- Lambert K, Gray S, O'Connor J, et al. (2022) How is embodiment in physical education theoretically conceptualised? A concept analysis. *Physical Education and Sport Pedagogy*. Epub ahead of print 16 December. DOI: 10.1080/17408989.2022.2153819.

- Lupton D (2015) Data assemblages, sentient schools and digitised health and physical education (response to Gard). *Sport, Education and Society* 20(1): 122–132.
- Lupton D (2019a) The thing-power of the human-app health assemblage: Thinking with vital materialism. *Social Theory & Health* 17: 125–139.
- Lupton D (2019b) Toward a more-than-human analysis of digital health: Inspirations from feminist new materialism. *Qualitative Health Research* 29(14): 1998–2009.
- Lupton D (2022) ‘Next generation PE’? A sociomaterial approach to digitised health and physical education. *Sport, Education and Society* 27(5): 516–528.
- Maclsaac S, Kelly J and Gray S (2018) ‘She has like 4000 followers!’ The celebrification of self within school social networks. *Journal of Youth Studies* 21(6): 816–835.
- MacLure M (2013) Researching without representation? Language and materiality in post-qualitative methodology. *International Journal of Qualitative Studies in Education* 26(6): 658–667.
- Quennerstedt M, Barker D, Johansson A, et al. (2021) The relation between teaching physical education and discourses on body weight – an integrative review of research. *Curriculum Studies in Health and Physical Education* 12(3): 287–305.
- Rich E and Miah A (2017) Mobile, wearable and ingestible health technologies: Towards a critical research agenda. *Health Sociology Review* 26(1): 84–97.
- Rich E, Lewis S, Lupton D, et al. (2020) *Digital Health Generation? Young People’s Use of ‘Healthy Lifestyle’ Technologies*. Bath: University of Bath.
- Rodríguez-Dorans E and Jacobs P (2020) Making narrative portraits: A methodological approach to analysing qualitative data. *International Journal of Social Research Methodology* 23(6): 611–623.
- Stolz SA (2015) Embodied learning. *Educational Philosophy and Theory* 47(5): 474–487.
- Sykes H and McPhail D (2008) Unbearable lessons: Contesting fat phobia in Physical Education. *Sociology of Sport Journal* 25(1): 66–96.
- Thorpe H, Brice J and Clark M (2020) *Feminist New Materialisms, Sport and Fitness: A Lively Entanglement*. Cham: Palgrave Macmillan.
- Vandenbosch L, Fardouly J and Tiggemann M (2022) Social media and body image: Recent trends and future directions. *Current Opinion in Psychology* 45: 101289. DOI: 10.1016/j.copsyc.2021.12.002.
- Wrench A and Garrett R (2012) Identity work: Stories told in learning to teach physical education. *Sport, Education and Society* 17(1): 1–19.