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Digital Technology in Outdoor and Environmental Education: Affects, Assemblages and Curriculum-Making

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Abstract

Researchers across outdoor and environmental education (OEE) are drawing on relational ontologies to break down dualisms, human-centric thinking and challenge neoliberal education that focusses on outcomes and achievements. Digital technology has been seen as problematic in OEE because of its distracting qualities within notions of authentic outdoor experiences. Re-conceptualising digital technology as something learners are entangled with — rejecting a dualistic position — offers a nuanced way of understanding how digital technology could be harnessed for OEE. This research presents speculative findings from a new materialist inspired project on how teachers considered video-making and the more-than-human in OEE. Working with assemblage theory and attention to affect, we portray ways assemblages of video-making and the more-than-human can shape OEE in new ways. Implications for educators in how they might assemble OEE with technology are suggested.

Keywords: Outdoor and environmental education; assemblages; digital technology; affect; video-making

Introduction

The inclusion of digital technology in formal education has been approaching mainstream adoption across the world with national frameworks in most developed countries (for example, European Commission, 2017; Ministry of Education, 2017). In outdoor and environmental education (OEE) research however, technology has been less broadly welcomed because it can present a potential barrier to direct experience with the natural world (Cuthbertson et al., 2004; Greenwood & Hougham 2015). Other research is challenging this binary position of technology vrs nature drawing on poststructuralist inspired thought such as new materialism (Jukes et al., 2023; Reed, 2022). New materialist thought (Coole & Frost, 2010) understands ontology as non-dualistic and where matter and discourse both shape how we understand reality. It is being used by researchers to move beyond human exceptionalism and to find ways to reconsider human–environment relations (Ruck & Mannion, 2020; Jukes, 2023).

Theorising around formal education and technology is also looking to new materialism and posthumanist theory to re-conceptualise curriculum theory (Snaza et al, 2016) and epistemological relationships with technology as entanglements (Fawns, 2019; 2022). In this research, we are inspired by new materialist thought to resist understanding the (human) teachers as the sole and dominant curriculum planner in OEE. Drawing on assemblage theory (Deleuze & Guattari, 2004) and affect (Deleuze & Guattari, 2004; Dernikos et al, 2020), we undertook research with OEE educators as they sought to include video-making with digital Smartphones in the planning phase of their educational work. For Deleuze and Guattari (2004), the notion of affect is based on

Spinozian philosophy where an affect is thought of as a “becoming” that represents a change of state or capacities of an entity; it may be physical, psychological, emotional or social. In this article, we present findings from a unique research project with educators in an outdoor school in Aotearoa New Zealand who explore ways they might work with digital technology within OEE practice.

Digital technologies in OEE

Research on digital technologies in OEE is not extensive, but some researchers are exploring their potential for place pedagogy and enhanced teaching and learning (Greenwood et al., 2015). For example, using geospatial technologies (Barnett et al., 2013), Smartphone and location-based applications that foster a connection to place in Education for Sustainable Development (Schneider & Schaal, 2018) and Information and Communication Technology (ICT) use to support critical skills and action oriented problem solving (Fauville et al., 2014). Researchers have also explored using emerging gamified strategies with mobile learning applications (Leitão et al., 2021), and those working with creative video-walks found they helped engage learners and increased their scientific observation and knowledge of local places (Renshaw et al., 2023). Working more explicitly with relational ontologies, Land et al. (2020), used the Facetime application with early years learners to explore ways of relating to place and the more-than-human through digital place stories. Whilst digital technology use in OEE is increasing, there is a need for more consideration and understanding of what it critically offers practice and research (Lowan-Trudeau, 2023).

Concerned with binary views on technology and society, research on digital technologies in OEE is being influenced by a postdigital perspective (Reed, 2022). Informed by relational approaches to understanding pedagogy and technology (e.g. sociomaterial and posthumanist), the postdigital position is a commitment to understanding objects, individuals and technology as not discrete elements but entangled (after Barad, 2007). As a result, the postdigital position views all digital activity as social, material and embedded in rich and diverse contexts (Fawns, 2019; Jandrić et al., 2019). Fawns et al., (2023, p. 624) note “Digital activity is always realised through material means and is always embedded in the world.” For this research we see the postdigital position is well aligned to that of new materialism in OEE (e.g. Reed, 2022). A postdigital position provides a conceptual pathway for us to link our thinking around technology and society as relational and embedded in curriculum-making for OEE.

Curriculum-making for OEE with new materialism

When educators go outside, its often with some educational intentions derived from, or in response to, a national curriculum. Whilst we might initially think of a curriculum as something “prescribed” (Miller et al., 2010) we can appreciate that it’s a multifaceted concept “constructed, negotiated and re-negotiated at a variety of levels and in a variety of arenas” (Goodson, 2005; p. 229). In this research, we see the way educators work with curricula outdoors as a process of curriculum-making that includes the environment and a multitude of actors both human and more-than-human (Mannion et al., 2012).

Curriculum theorising in OEE is being informed by new materialist approaches to help conceptualise a way of rejecting human exceptionalism (for example: Jukes, 2023; Mannion, 2020; Snaza & Weaver, 2015; Stewart, 2020). New materialism offers a powerful collection of ideas for OEE, given its conceptual toolbox that positions the human as always part of a more-than-human world (Jukes, 2023). These approaches to curricula reject a linear-rational approach built on dominant learning intentions and notions of sovereign agency held by humans. Theorists seeking to return the more-than-human material world into the conceptualising of curriculum are

rejecting humanist and instrumental views of nature (Magrini, 2015; Jardine et al., 1997; Jardine, 1998; Taylor & Pacini-Ketchabaw, 2015). Drawing on material feminist writing, new materialist researchers argue that we are not separate from nature and that to respond to the challenges of the Anthropocene (Crutzen, 2002), we need to focus on relational ways of thinking and acting (Duhn et al., 2017; Riley, 2023; Brown et al., 2020).

Whilst there are scholars working with new materialist thought in OEE, the empirical research is less common. Some examples include Persson et al. (2022), who are concerned with developing ecological literacy in high school students. Using Latour's materialist ideas of understanding non-human relations as intertwined entanglements, their research found that human–non-human relations became entangled with ecological facts and emotions in the field. Tseveni (2021) found that nature journaling empowered learners to become aware of some humanist privileging in their relations with the more-than-human world. Ruck and Mannion (2021), used new materialism to inform their research on using conservation activities in the school grounds. They found that conservation activities can facilitate collective thinking; an embodied way of coming to know other species and ourselves in relation to them. Jukes (2020) used remaking activities and new materialism in outdoor education. He presents diffractive readings on making paddles from discarded wood as an ethical praxis with pedagogical potential for human–environment relations. These research projects show the potential of new materialism in OEE when we de-centre the human. In the emerging empirical research, there is less attention to digital technology and new materialism in OEE. Our research contributes to this nascent area of the field.

Research context

This research was a collaboration between a research team interested in technology use in OEE and the co-founders and teaching staff of an outdoor school in Dunedin (The Dunedin Nature School), Aotearoa New Zealand. Dunedin Nature School operates a full day outdoor learning school using local outdoor spaces. The school takes pupils that are released from school one-day a week. Under the 2020 NZ Education and Training Act (New Zealand Education and Training Act, 2020, s.52a), pupils can be under other educational direction one day a week if approved by the school principal and parents. Both founders of the school¹, Geoff Markby and Lizzie Potter are fully registered and experienced teachers with much passion and knowledge of outdoor learning and Mātaunaga Māori (Māori knowledge and epistemology). The Dunedin Nature school is a strengths-based outdoor learning provider that is concerned with place-based and environmental practice. They work to the NZ national curriculum but do so in ways that are child-led and place-responsive. One of the research team had met the teachers at an OEE and volunteered at the school. It was during the volunteer work that a mutual idea to support the teachers to explore how they might utilise digital technology came about.

At the start of the project, both teachers expressed interest in how to develop the use of digital technology in their practice. Of all the technologies available to the teachers, it was decided that video-making with Smartphones or tablets would be a useful choice as they offer learners opportunities to lead any technology use and be creative. Video-making was also seen as a low technology option that did not require Wi-Fi or access to the internet for it to work in real time. The Dunedin Nature school uses different local environments around Dunedin but also have a base they use regularly at one of the teacher's homes. The regular site has extensive native bush and some established resources such as a firepit, areas for crafting and access to toilets. The research was conducted at this private site that is used regularly.

¹The teachers' names, and the name of the school, are deliberately included as the researchers and educators expressed a desire for these to be included in the research. This research was approved by the Academy EX Ethics committee — Ethics approval Number: Staff.2021.0003.

There were three site visits in the research, the first was used to discuss ways that technology could be integrated into planning OEE. The teachers were then left to consider how they would plan to use video-making in their practice and data collection was undertaken with each teacher on the two remaining site visits via a place-responsive walking interview method (Lynch & Mannion, 2016).

Methodology and conceptual framework

The methodology we employed for this research was a multi-case study (Stake, 2006), inspired by new materialism. Stake's (2006) approach to case study rejects positivistic orientations and instead argues that a multi-case study is about deepening our understanding of a phenomenon not working to generalisability from a representative sample. This approach has been used by one of the authors successfully (Lynch & Mannion, 2021; Lynch, 2018). Other researchers who take a new materialist inspired approach to case study (or case assemblage) research draw on similar features we used. For example, our case boundaries were not discrete people or bodies but seen as relational (Andersson et al., 2020; Riley et al., 2023). Similarly, our research process of case selection, data collection and knowledge creation were also understood as relational; where affective flows could shape all aspects of the research process. Strongly informed by Fox & Alldred (2015, p. 405) our approach to case study was rhizomatic. Using Fox and Alldred's work (*Ibid.*), Figure 1 (Lynch, 2018, p. 100) denotes how we understood the mutually affecting/affected relationships in the assemblage of the event (OEE and digital technology), the research assemblage (case study research components) and the hybrid research assemblage. This latter assemblage portrays the outcomes of the research (the vignettes and new possibilities for OEE and digital technologies):

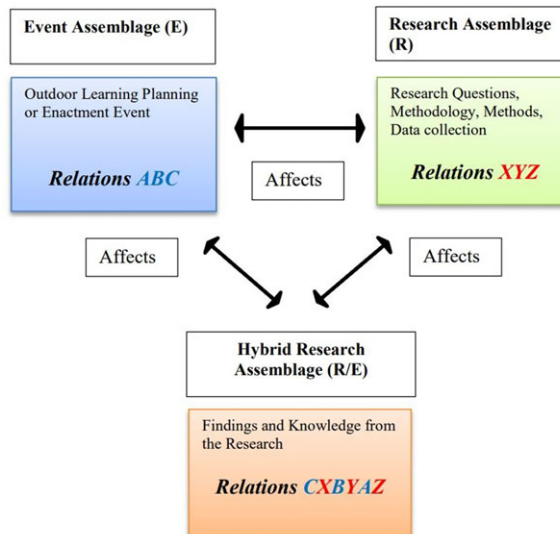


Figure 1. (Lynch, 2018, p.100).

This approach to case study research supported our post-anthropocentric and relational understandings of place. Coole & Frost (2010, p. 8) write on the development of new materialist thought as that which: “avoids dualism or dialectical reconciliation by espousing a monological account of emergent, generative material being.” This quote is useful in framing our explanation of

the methodological approach we used in this research because it highlights how we are always part of ongoing relations, never separated from the world.

Informed by new materialist thought, each case in the study was understood as an assemblage and not discrete human subjects. As a result, the case definition (or boundary) was relational and understood to be: **the teacher and any planning practices of video-making with the more-than-human in environmental education.**

Deleuze and Guattari's concept of an assemblage (2004) is central to this research. The term assemblage denotes a grouping or coalescing of things, concepts, matter and bodies that hold together temporarily at the ontological level. Assemblages have capacities to produce other assemblages as well as break them down. With the term assemblage, Deleuze and Guattari (2004) create an explanation for how a new grouping of things can exist, without requiring pre-existing conditions (a priori) of any of its components. For this study, this concept of the assemblage allowed us to take an intertwined view on the social and material relations that were at play in the teachers' ideas on curriculum-making. Assemblages are constituted by relations and affects. Working with assemblage theory in sociological inquiry, Fox & Alldred (2015, p. 404) state that "Assemblages are territories produced and disputed by the affects between relations." In this research, we had a particular attention to affects as we see these are important forces in the formation and capacities of assemblages. In this research, we focused on affects to understand how assemblages might be enabling or constraining for environmental education and digital technology. Next, we explain how we understand affect and how we used it in this research.

Assemblage theory and affect

The Deleuze and Guattari notion of affect is based on Spinozian Philosophy where an affect is thought of as a "becoming" that represents a change of state or capacities of an entity (see Fox and Alldred (2015) who apply Deleuze and Guattari philosophy to sociological inquiry). Affects are more about the flows and energies of relations than about human ideas or emotion. Hickey-Moody (2014, p. 174) describes Deleuze's Spinozist affect as the change that bodies undergo because of an encounter, "it's a margin of change." More so, affects are not what you feel but can be thought of as "an event that forces you *to be(come) affected, to feel something* [original italics]" (Dernikos et al., 2020, p. 5). Affects produce capacities within assemblages through the relations they change; one affect can produce more than one capacity, as a result, life is rhizomic, not linear (Fox & Alldred, 2015).

By taking a focus on affects in this research we sought to understand how digital-environmental assemblages might have educational capacities. In other words, how more-than-human video-making might affect, shape and create new ways of thinking and doing OEE in the 21st century. We see that affect theory is central to new materialist thought and very relevant to education, for example, Seigworth (2020, p. 87). notes: "I think pedagogy is affect's first lesson, or maybe affect is pedagogies first lesson. . . . Affect and pedagogy are inextricably inseparable." In this research, we used affect theory to speculate on the capacities of technology-environmental education assemblages and how they could shape teachers' curriculum-making in OEE.

Methods

Place-responsive methods were employed through the use of walking interviews. The walking interviews allowed for insights into the educators' ideas about curriculum-making, the capacities of more-than-human actants and potentialities of video-making as we walked the site they regularly used. The walking interview as a method has been used in human and cultural geography research that identifies the importance of doing more than a static interview to apprehend the world (Kuntz & Presnall, 2012). Walking interviews have been used in researching everyday life

through the visual ethnographic work of Pink (2007); by Edensor's (2010) work on walking with place being stretched out along linear routes; Ingold and Vergunst's (2008) work that sees walking as creating the world in formation; and Evans and Jones (2011) walking interviews on town planning that found the walking aspect stimulated the interview process in nuanced ways. The first author provides more details on their take on the walking interview in Lynch (2018, 2020), but it can be summarised as where interviews are seen as material and discursive; where the social fabric of life is not static (Lorimer, 2008) and neither are the practices within it (Pink, 2007, 2012). As a result, doing a walking interview made it possible to collect data on the ways more-than-human relations and video-making might be assembled in curriculum-making in environmental education.

During the walking interviews, audio data was collected as well as photographs taken. The process involved the researcher walking the site with the educator deciding on the route. The interview was semi-structured with the educator being asked to lead the walk around the site explaining how they currently used it for OEE. We would regularly stop and discuss how the educators might use video-making in their curriculum-making at a particular place and accompanying photographs were taken of place-specific features. After each walking interview, researcher field notes were also recorded.

Analysis: Considering an "affective scratch"

Because we wanted to focus on affect within more-than-human assemblages of place-educator and digital technology, we were guided by Denikos et al.'s (2020) concept of an affective "scratch." Denikos et al note:

We offer affective scratching's as a figure of thought to help us feel out what affect does over what it is. The scratch is a frequency: a cut or vibration that momentarily slips out of groove and exceeds capture in language. It guides, dis/connects, excites, startles, interrupts, diverts, and reorients . . . it also tunes us into the vibrations and capacities of nonhuman bodies (e.g. chalk, needle, sound, board, vinyl, and space). (2020, p. 4).

For us, affective scratching involved remaining open to creative ruptures in thought.

We use the term "scratch" in this research, to denote the potential of affect to open up the world and help us see new possibilities for OEE that are both enabling and constraining. Denikos et al (*ibid.*, p. 10) write " . . . (W)e use the term *scratch* [original italics] to help us remember affect's promising possibilities – its capacity to tear open new worlds in stuck moments – but also to remind up of its threats, mobilities and fizzles." We used this enabling and constraining potential in our reading of the affects in the data as we sought to understand what new ways of understanding they could produce. The 13 vignettes were produced from the empirical materials as we sought to understand how "nonhuman bodies" (the more-than-human and the digital technology) had capacities to "excite," "interrupt" or "scratch" our current thinking of OEE practice.

These inspirations helped us create a process that produced the vignettes and new thinking around digital technology in OEE curriculum-making:

In the production of each vignette, we sought to:

1. Identify the affects at play in the assemblage.
2. Consider what increases or decreases in capacities to act they produce.
3. Speculate on what new practices or possibilities (a "scratch") for curriculum-making with technology in OEE might occur.

Speculative vignettes

We present four vignettes (hybrid research assemblages, see Figure 1) that portray some exit points from current thinking, and some new possibilities, for teacher's practices of OEE curriculum-making with digital technology. The first vignette (A) portrays the OEE work these educators do and provides details on the ways they work with more-than-human relations. Vignettes B, C and D are examples of the data that produced ruptures and new understandings of OEE with digital technology. Combining data from both walking interviews, this first vignette discloses the ways the educators seek to attune the learners to place and develop a sense of care in them for the environment.

Vignette A — The educators environmental education practice

This vignette portrays the OEE work the educators do and how they are driven to attune the learners to place and nature over time; to get their “nature eyes.” It is within this practice that we set out to explore how video-making might be part of the environmental work they do.

The educators OEE practice

Interviewer: “What elements of what you do is based around being environmental, do you think?”

Lizzie: “Like, we I think there's, there's just what we're constantly aware of that is **teaching kids the values of how you look after the planet**. Yeah. And then into weaving how Tāne Mahuta [Māori lend] got to the forest, we don't go down the whole, you know, religious thing that people might expect that to get slightly confused with. Yeah. But you know, we do talk constantly about even on the beach with our Karakia. And here that **we are guardians**, that we're here for a limited time . . . But, you know, **our job is keepers of the forest, or keepers of the beach**.” (Figure 2)



Figure 2. Part of the site they use regularly with a predator trap (placed by a local charity to catch invasive mammals).

Interviewer: “So what would you say was the general philosophy of the work you’re doing here?”

Geoff: “Well, I guess first and foremost, is **to use nature as a classroom**, get them outdoors, because there’s so many directions, you can go with the learning. Yep. And like all curriculum areas, you know, within a school setting, with opportunities to teach them new things. The exploratory aspect of nature, so beneficial for children . . . **it takes a few weeks for their eyes to be opened**. Yes, they’re not necessarily, when they first start, attuned to what’s on offer, or what opportunities they could enjoy. But we’ve just noticed that with the group, six weeks, seven, suddenly their eyes are open, and they don’t need any prompting, they’re all there. And this happens on a social level, too, they start to gel more as a group and work together. And also, **they find things quickly . . . what they’re like, and they notice things more. So it’s like getting their nature eyes**. And that’s, that’s really special for us, because it’s gifts, we want to get them to get - brilliant.”

Vignette B — Difficulties in video-making with OEE

In this vignette, we combine data from two different walking interviews at the same fire-pit location, and researcher field notes to portray how the educators described how they might harness video-making in their work. The ways the educators work with the many more-than-human relations seems something they already do well. This vignette portrays the ways the teachers are wrestling with the idea of video-making in their work even though they are keen to use it.

Research field notes

“After the walking interviews, it struck me how challenging it is to work out ways to harness the technology as part of any OEE . . . A lot of the ideas around video making seem to be to do with videoing as a tool to celebrate what learners are doing . . . **what does strike me is that the site is really rich, and more than human relations that they’re working with all the time. So, getting the technology to be part of that is challenging**, and it feels like **the teachers have to be attuned to the technology.**” (field note excerpt from 1st walking interview)

Walking interview data (Geoff)

Geoff: “Yesterday we cooked cockles from Blueskin Bay, right. And we learned about the correct size and how many you can take, and the lifecycle of a cockle and we brought them back and we had cockles. Steamed on the fire. We had baked potatoes we had wild spinach, which we collected it from the beach, which we cooked up we tried some seaweed . . . it’s interesting some children in a group of maybe three or four start to eat the rest will have a go you know because they don’t want to be left out . . . there’s always three or four children who really loved the food preparation, the gathering and the preparing side of things. And **it would be cool to maybe showcase them carrying out a particular cooking activity.**” (Figure 3)



Figure 3. Image of the fire-pit area.

Walking interview data (Lizzie)

Lizzie: “I mean, like, you know, **you’ve got me thinking about the kids doing it more**, which we talked about before, but it would be, you know, video or taking photographs of them making something. Yeah. You know, even simple as how do I put flour for damper on a stick? Or, you know, a simple process of making chickweed pesto, something like that?”

Interviewer: “And I’m wondering is any way you see technology and using technology as being able to further your environmental educational aims? Or the environmental educational dimension to what you do?”

Lizzie: “I think again, **that’s the video. Right? Isn’t it? It’s kind of like, you know, what, can you tell me about that bird? What can you tell me about this plant?**”

In this vignette, there are affects that are increasing and decreasing capacities for change. The more-than-human relations these educators are harnessing are linked to concerns for the environment. The identification and collection of cockles to eat and as discussion points about life cycles and the importance of sustainable harvesting are rich OEE practices. Reading this vignette, we sense the enabling affects of the video-making here to share this practice with others, for example, family, social media, local communities etc. There are also constraining affects where the educators seem to struggle in how to use video-making in their OEE work at this early stage of considering how to use technology. The technology and the ways it could be pedagogical are something they seem unsure about; they’re still feeling their way here it seems.

We see a scratch here of an affective rupture in how curriculum-making with video-making/technology is new, uncomfortable and challenging. Speculating for OEE and technology use — how do we help educators to develop their pedagogy to include the relational possibilities of technology in OEE?

Vignette C - NOT taking pictures and thinking about privacy

Walking interview data (Lizzie)

Lizzie: “I am really mindful when I take the camera out and I take a photograph on purpose of a child. I do say to them, can I take your photograph? Because I want to be able to show the grown-ups what we’re doing, what you’re doing ... **we really struggled to get photographs of their portfolios, because ... it’s intrusive** ... They don’t like it. You know? And I can see that it’s uncomfortable. Yeah. Even if they said, Yeah, but I can tell it’s really ‘I’m only saying that because you’re an adult, and you’ve got a bit of authority over me, perhaps, then I won’t do it. You know ...

I would say this wouldn’t be a digital place. Because this is a this is a special hidey hole. Do you know what I mean?

And there are sometimes when you really want to take a photograph, but you just don’t, because you just you just know that **it’s not the right time. Place.**” (Figure 4)



Figure 4. Image of the games the children were playing in the private space.

The affecting power of making videos or taking photographs as something that can be intrusive or inappropriate is palpable in this vignette. The image portrays a secret game the children made, and the sense of it being in a “hidey hole” are perhaps only possible because this is a secluded part of the bush where the children can mostly play away from the educators. We see there are affects here increasing the capacity to act (play) with the leaves (the more-than-human). Yet as soon as we consider the use of technology here, this vignette portrays the constraining affects of technology that diminish the capacity of the children to act (play) with the more-than-human. There is educational value in this assemblage that gets disrupted via the relations of digital technology.

Speculating about these points for curriculum-making with technology in OEE, we sense a scratch where technology is impacting on the ways a place might be powerful for learning with the more-than-human. This vignette portrays how the educator is attuned to something around the constraining affects of technology. These affects have significant potential to shape OEE curriculum-making — not in a necessarily positive way. This vignette signals the affecting relations of technology that produce tensions and ruptures in the educator’s practice. If the postdigital position suggests digital activity is always embedded in the world, how do educators work with it in OEE when it disrupts the relations of the more-than-human we go outdoors to encounter?

Vignette D - Videos as new ways of interacting with the internet for young people and the links to sharing and caring

Researcher field notes

“So, the educator is poised really to see where the learner wants to take things. The learners noticed the more than human, which drives the learning, and so do the educators. But technology feels like it has **an agency to do the work - to extend the work - they’re doing beyond the educational encounters** back into the families . . . back into the communities. So there’s an agency, a capacity there, for the technology to do that. There’s also capacity for the **technology in these assemblages, to increase the children’s knowledge** about a topic,” (field note excerpt from 2nd walking interview).

Walking interview Lizzie

Interviewer — “Excellent. Can you think of any way that you might use technology here or video making here?”
Lizzie — “Well, **I guess again, it’s activity based**, isn’t it? Yeah. So, anything like weaving is always amazing. We’ve got a girl who comes in Friday. She just loves it. And she just picks it up so fast. I mean, I’m not a great weaver, but I can make a few things (Figure 5).



Figure 5. Lizzie weaving with Ti kōuka (Cabbage Tree) leaves

This week, I'm gonna get the Nature School phone, . . . and say **"I'm gonna give you this** for however long an hour or so. And I want you to go away. And **I want you to take four or five pictures of what is special about nature school,**" and then I can I post that on Instagram, it's a great idea. . . . I'm gonna take some photographs, I want to put it on Instagram. **So other parents and grownups can see what you're doing."**

In this vignette, there are affects around the use of the Nature School phone as a camera as well as a video-making tool. There are enabling affects around the way the technology can be given to the learners and any photos or videos could be shared with others beyond the site. This has the capacity to share this educational work and link learners with their families and communities. The constraining affects are palpable too. The educator in this vignette is exploring opportunities for the technology and how she can encourage the learners to lead with it — something she is experimenting with in her planning and thinking. The vignette portrays the way the educator is searching, working out, imaging how she might use the phone in useful ways.

We see a scratch here where there is an affective rupture in how we understand curriculum-making with technology. This vignette discloses how the relations of digital technology provide an opportunity for the teacher to experiment pedagogically. Her response to the difficulty in working out how the technology might be used pedagogically is to let the learner take control.

Thinking speculatively, we see there is value in encouraging environmental educators to work with technology in ways that are not instrumental. Giving learners the freedom to use the phone is a great start, and how might this deepen the OEE work we do? Video-making has educational potential in how learners, educators and more-than-human are entangled. One pedagogical challenge is how we might encourage learners to create videos or photographs that are pedagogical in the connection they might create with others online? How might we help children be able to connect with other communities of children online and how do we navigate this educational potential as teachers and adults?

Scratching new Affective Pedagogies for OEE

Affective pedagogies happen outside of teachers' conscious intentions with learning sparking in the becoming's encountered when bodies (human and non-human) meet. (Dernikos et al., 2020, p.15).

Our vignettes show that for these educators, curriculum-making with digital technology is challenging. As place-responsive practitioners, they seem very attuned to working with more-than-human relations in their curriculum-making. However, when the relations of technology are considered, they make new demands on their practice that seem to resist easy pedagogical responses. In this research, using affect theory helped us resist human exceptionalism and understand technology, humans and more-than-human as assemblages. Paying attention to affect, enabled us to consider the relations and agencies within assemblages that might constrain and enable curriculum-making in OEE.

Le Grange (2017) draws on posthumanist and rhizomatic thought to explore what environmental education might look like within a relational ontological position. He argues that "The earth is not a stage on which pedagogy is performed but the performance of pedagogy is bent by the earth." (p. 102). In this research, the vignettes provide ways to re-think and re-imagine ways pedagogy gets bent by the relations of digital technology and the more-than-human in OEE. We share two statements that portray both the difficulties presented when working with affects in digital technology in OEE and some glimpses of what new possibilities emerge. These are:

1. Harnessing digital technologies in curriculum-making for OEE with the more-than-human is challenging and can disrupt educators established practice.
2. Video-making has educational potential for learners to create, consume and share their knowledge and expertise about OEE with others beyond the physical place.

These points offer important implications for OEE. Firstly, using technology in OEE could be hard for educators to do well, especially those who have not done so before. For some time, outdoor and OEE researchers have been open to, and directed to, understanding place and the more-than-human as co-composers. What our research has shown is that these two teachers, who regularly work with more-than-human relations, are not *yet* seeing technology as co-composer. This first point seems obvious - that working with something new in pedagogy is hard - but is one we feel is important for OEE because if we are living in a postdigital world where we are entangled with technology, what might be making it hard to harness in practice?

There are existing models in the literature that educators can use to help them consider technology use, technology integration (Puentadura, 2006) and alignment with pedagogical aims, including ones specific to outdoor learning (Hills & Thomas, 2020). There are few resources, if any, for in-service educators already working relationally with the more-than-human to consider if they want to include digital technology in OEE. This is an area for further research. We suggest that future research seeks to further understand the disruptive and challenging nature of digital technology as environmental educators try and harness it into their curriculum-making.

Our second point shows there is potential for learning, and sharing, about local environmental matters and the more-than-human with video-making that portray ways knowledge is affective beyond a physical outdoor place. Whilst this might be understood as counter to the embodied nature of place and place-responsive practice in OEE, we think it is more nuanced than that. In this new materialist research, we see technology as a field of relations that are intertwined with the more-than-human. Within this perspective, there is no hierarchy but a reciprocal affecting/affected relationship. As a result, this second point shows the potential for video-making to affect (other people, communities etc) and be affected (data storage on servers etc). In other words, video-making could have capacities to affect others in ways that are not limited to embodied place experiences in situ. This resonates with some current thinking around how the internet can facilitate a networked understanding of learning where technology links educators, learners and communities. Current thinking in Networked learning is drawing on posthumanist thought and assemblage theory (Networked Learning Editorial Collective, 2021) but is yet to fully embrace the ecological dimension. There is potential for OEE to contribute to this ecological dimension of networked learning in how digital technology can be environmental, ecological and pedagogical via the network of the internet. Our research shows there is potential for the field of OEE to contribute to theories of network learning.

We also see how relations around video-making might rupture current understanding of place-responsive practice in OEE as needing to be grounded in a physical place. Working with Barad's (2007) understanding of time and space not being "containers" per se but as produced through the entanglements of matter and discourse (through the intra-action of relations) provide some support in understanding this. In her chapter on visual redress (acknowledging injustices of the past and marking them in a visual way) and new materialism, Bozalek uses Barad's (2007) ideas on time and space to discuss how affect can tune into forces from the past and present "... activating and transforming the different ecologies of the event." (Bolzack, 2023, p.29). These ideas are productive as we look to find new ways of understanding digital technology and OEE curriculum-making. The videos have potential to be educative beyond the space and time configuration of the site because the affects can tune into the past and the present transforming the digital ecologies being produced. As Bozalek notes about Augmented Reality and visual redress, technology can

give access to ways of reconfiguring or creating new practices of material-discursive entanglements. For this research, we see that the videos once made are not static. Whilst they may denote an event made at a certain time and place, any potential for learning with them is not so limited. It's potentially always ongoing in the production of new digital-OEE ecologies.

Both these points also continue to trouble the concept of the educator as sole planner of curricula in OEE. The idea of the more-than-human as co-implicated in curriculum planning is not new, but what our research does suggest relates to posthumanist ways of teaching that Braidotti acknowledges as a collaborative process. She argues that collaborative and non-hierarchical, teaching allows other entities (human, non-human, technological etc) to “intervene as heterogeneous forces that connect the educational practice to the wider world” (2019, p. 142). This is potentially how we see this research as being useful – they help us understand how the more-than-human relations connect to the wider world through our co-composing with them. New materialist research, resists interpretations and judgements, it is performative and produces new “lines of flight that carry us into new possibilities of being-thinking . . .” (Snaza et al., 2016, p.xv). In this research, we argue that digital technology has potential to do work for us to link our practice to the wider world, but it is a complex web of relations that can be enabling and constraining. We suggest educators pay attention to these two forces as they seek out new and invigorating collaborations with the more than-human and digital technology in OEE.

Ongoing ruptures and possibilities

The idea of a conclusion, where summaries and endings are performed, are counter to the project of post-qualitative research. Higgins (2017) argues that instead of a conclusion (that resonates with connotations of closure) we should see this stage of postqualitative research as an iterative opening up of possibilities with the relations of the research and the world. As a result, we are framing our final remarks here as open possibilities that have been produced from the scratches we have discussed. Much like how a scratch in the sand with a stick leaves a mark, this section also provides something for others to notice and respond to.

In this research, we have presented emerging views on digital technology and OEE as relational and entangled that resist hierarchies and human-centric thinking. We have shown how assembling more-than-human and technology relations could positively shape human–environmental relations but also present a challenge to educators. By paying attention to the multiple:

- affects at play in assemblages of technology;
- the more-than-human;
- learners and educators’ intentions;

new considerations of curriculum-making for OEE appear. Within an entangled view of technology and the more-than-human, we are always working with reciprocal affecting relationships.

A postdigital position argues for an entangled view of technology, matter and social relations. If this is how our young people are experiencing the world then we should include these considerations in our pedagogical work in OEE. What our research has produced are two ideas around how nuanced this work needs to be and that dichotomies of technology vrs the outdoors are no longer useful. The discussed affects have potential to educate in ways we have not yet imagined but there are also negative aspects we should pay attention to. Improving human–environment relations can be something we do with the more-than-human in places and across networked spaces. The potential lies in how well we navigate these tensions.

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References

- Andersson, Å., Korp, P., & Reinertsen, A.B. (2020). Thinking with new materialism in qualitative case studies. *International Journal of Qualitative Methods*, 19, 1–6. DOI: [10.1177/1609406920976437](https://doi.org/10.1177/1609406920976437).
- Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.
- Barnett, M., Makinster, J.G., Trautmann, N.M., Vaughn, M.H.O., & Mark, S. (2013). Geospatial technologies. In R. Stevenson, M. Brody & J. Dillon (Eds.), *International handbook of environmental education* (pp. 331–348). Routledge.
- Bozalek, V. (2023). Feminist new materialism and visual redress. In E. Costandius & G. de Villiers (Eds.), *Visual redress in Africa from indigenous and new materialist perspectives* (pp. 25–36). Routledge.
- Braidotti, R. (2019). *Posthuman knowledge*. Polity Books.
- Brown, S., Siegel, L., & Blom, S. (2020). Entanglements of matter and meaning: The importance of the philosophy of Karen Barad for environmental education. *Australian Journal of Environmental Education*, 36(3), 219–233. <https://doi.org/10.1017/ae.2019.29>
- Coole, D.H., & Frost, S. (2010). *New materialisms: Ontology, agency, and politics*. Duke University Press.
- Crutzen, P.J. (2002). Geology of mankind. *Nature*, 415(6867), 23.
- Cuthbertson, B., Socha, T.L., & Potter, T.G. (2004). The double-edged sword: Critical reflections on traditional and modern technology in outdoor education. *Journal of Adventure Education & Outdoor Learning*, 4(2), 133–144.
- Deleuze, G., & Guattari, F. (2004). *A thousand plateaus: Capitalism and Schizophrenia*. Continuum.
- Dernikos, B.P., Lesko, N., McCall, S., & Niccolini, A.D. (2020). *Mapping the affective turn in education: Theory, research and pedagogies*. Routledge.
- Duhn, I., Malone, K., & Tesar, M. (2017). Troubling the intersections of urban/nature/childhood in environmental education. *Environmental Education Research*, 23(10), 1357–1368. DOI: [10.1080/13504622.2017.1390884](https://doi.org/10.1080/13504622.2017.1390884).
- Edensor, T. (2010). Walking in rhythms: Place, regulation, style and the flow of experience. *Visual Studies*, 25(1), 69–79. DOI: [10.1080/14725861003606902](https://doi.org/10.1080/14725861003606902).
- European Commission, Joint Research Centre, Redecker, C. (2017). *European framework for the digital competence of educators*. DigCompEdu (Y,Punie, editor) Publications Office. <https://data.europa.eu/doi/10.2760/159770>.
- Evans, J., & Jones, P. (2011). The walking interview: Methodology, mobility and place. *Applied Geography*, 31(2), 849–858. DOI: [10.1016/j.apgeog.2010.09.005](https://doi.org/10.1016/j.apgeog.2010.09.005).
- Fauville, G., Lantz-Andersson, A., & Säljö, R. (2014). ICT tools in environmental education: Reviewing two newcomers to schools. *Environmental Education Research*, 20(2), 248–283.
- Fawns, T. (2019). Postdigital education in design and practice. *Postdigital Science and Education*, 1(1), 132–145. DOI: [10.1007/s42438-018-0021-8](https://doi.org/10.1007/s42438-018-0021-8).
- Fawns, T. (2022). An entangled pedagogy: Looking beyond the pedagogy—technology dichotomy. *Postdigital Science Education*, 4(3), 711–728. DOI: [10.1007/s42438-022-00302-7](https://doi.org/10.1007/s42438-022-00302-7).
- Fawns, T., Ross, J., Carbonel, H., Noteboom, J., Finnegan-Dehn, S., & Raver, M. (2023). Mapping and tracing the postdigital: Approaches and parameters of postdigital research. *Postdigital Science Education*, 5(3), 623–642. DOI: [10.1007/s42438-023-00391-y](https://doi.org/10.1007/s42438-023-00391-y).
- Fox, N.J., & Alldred, P. (2015). New materialist social inquiry: Designs, methods and the research-assemblage. *International Journal of Social Research Methodology*, 18(4), 399–414. DOI: [10.1080/13645579.2014.921458](https://doi.org/10.1080/13645579.2014.921458).
- Goodson, I. (2005). *Learning, curriculum and life politics: The selected works of Ivor Goodson*. Routledge.
- Greenwood, D.A., & Hougham, R.J. (2015). Mitigation and adaptation: Critical perspectives toward digital technologies in place-conscious environmental education. *Policy Futures in Education*, 13(1), 97–116.
- Hicky-Moody, A. (2014). Affect as method: Feelings, aesthetics and affective pedagogy. In R. Coleman. & J. Ringrose (Eds.), *Deleuze and research methodologies* (pp. 79–96). Edinburgh University Press.
- Higgins, M. (2017). Post-qualitative mo(ve)ments: Concluding remarks on methodological response-abilities and being wounded by thought. *Reconceptualizing Educational Research Methodology*, 8(3), 89–101.
- Hills, D., & Thomas, G. (2020). Digital technology and outdoor experiential learning. *Journal of Adventure Education and Outdoor Learning*, 20(2), 155–169. DOI: [10.1080/14729679.2019.1604244](https://doi.org/10.1080/14729679.2019.1604244).
- Ingold, T. & Vergunst, J. (Eds.) (2008). *Ways of walking: Ethnography and practice on foot*. Ashgate.
- Jandrić, P., Ryberg, T., Knox, J., Lacković, Nša, Hayes, S., Suoranta, J., Smith, M., Steketee, A., Peters, M., McLaren, P., Ford, D.R., Asher, G., McGregor, C., Stewart, G., Williamson, B., Gibbons, A. (2019). Postdigital dialogue. *Postdigital Science and Education*, 1(1), 163–189. DOI: [10.1007/s42438-018-0011-x](https://doi.org/10.1007/s42438-018-0011-x).
- Jardine, D. (1998). *To dwell with a boundless heart: Essays in curriculum theory, hermeneutics, and the ecological imagination*. Peter Lang.

- Jardine, D., Friesen, S., & Clifford, P. (1997). *Curriculum in abundance*. Routledge.
- Jukes, S. (2020). Thinking through making: Junk paddles, distant forests and pedagogical possibilities. *Environmental Education Research*, 26(12), 1746–1763.
- Jukes, S. (2023). Introduction: Provocations and intent. In *Learning to confront ecological precarity: Engaging with more-than-human worlds* (pp. 1–20). Springer Nature.
- Jukes, S., Stewart, A., & Morse, M. (2023). Learning landscapes through technology and movement: Blurring boundaries for a more-than-human pedagogy. *Journal of Adventure Education and Outdoor Learning*. 1–8. <https://10.1080/14729679.2023.2166543>
- Kuntz, A.M., & Presnall, M.M. (2012). Wandering the tactical: From interview to intraview. *Qualitative Inquiry*, 18(9), 732–744. DOI: [10.1177/1077800412453016](https://doi.org/10.1177/1077800412453016).
- Land, N., Hamm, C., Yazbeck, S.L., Danis, I., Brown, M., & Nelson, N. (2019). Facetiming common worlds: Exchanging digital place stories and crafting pedagogical contact zones. *Children's Geographies*, 18(1), 30–43. DOI: [10.1080/14733285.2019.1574339](https://doi.org/10.1080/14733285.2019.1574339).
- Le Grange, L. (2017). Environmental education after sustainability. In B. Jickling & S. Sterling (Eds.), *Post-sustainability and environmental education: Remaking education for the future* (pp. 93–107). Palgrave Macmillan.
- Leitão, R., Maguire, M., Turner, S., Arenas, F., & Guimarães, L. (2021). Ocean literacy gamified: A systematic evaluation of the effect of game elements on students' learning experience. *Environmental Education Research*, 28(2), 1–19. DOI: [10.1080/13504622.2021.1986469](https://doi.org/10.1080/13504622.2021.1986469).
- Lorimer, H. (2008). Cultural geography: Non-representational conditions and concerns. *Progress in Human Geography*, 32(4), 551–559. DOI: [10.1177/0309132507086882](https://doi.org/10.1177/0309132507086882).
- Lowan-Trudeau, G. (2023). Digital technologies and environmental education. *The Journal of Environmental Education* 54: 1–7. <https://doi.org/10.1080/00958964.2022.2152413>.
- Lynch, J. (2018). Education in outdoor settings: The teacher's role in more-than-human curriculum making. (PhD thesis. University of Stirling. <http://hdl.handle.net/1893/28624>
- Lynch, J. (2020). Mobile methods in outdoor studies: Walking interviews with educators. In B. Humberstone & H. Prince (Eds.), *Research methods in outdoor studies* (pp. 207–218). Routledge.
- Lynch, J., & Mannion, G. (2016). Enacting a place-responsive research methodology: Walking interviews with educators. *Journal of Adventure Education and Outdoor Learning*, 16(4), 330–345.
- Lynch, J., & Mannion, G. (2021). Place-responsive Pedagogies in the Anthropocene: Attuning with the more-than-human. *Environmental Education Research*, 27(6), 864–878. DOI: [10.1080/13504622.2020.1867710](https://doi.org/10.1080/13504622.2020.1867710).
- Magrini, J. (2015). *New approaches to curriculum as phenomenological text: Continental philosophy and ontological inquiry*. Palgrave MacMillan.
- Mannion, G. (2020). Re-assembling environmental and sustainability education: Orientations from new materialism. *Environmental Education Research*, 26(9-10), 1353–1372.
- Mannion, G., Fenwick, A., & Lynch, J. (2012). Place-responsive pedagogy: Learning from teachers' experiences of excursions in nature. *Environmental Education Research*, 19(6), 792–809. DOI: [10.1080/13504622.2012.749980](https://doi.org/10.1080/13504622.2012.749980).
- Miller, K.H., Edwards, R., & Priestley, M. (2010). Levels and equivalence in credit and qualifications frameworks: Contrasting the prescribed and enacted curriculum in school and college. *Research Papers in Education*, 25(2), 225–243.
- Ministry of Education (MoE). (2017). Digital technologies: Hangarau Matihiki. Wellington, New Zealand. <https://education.govt.nz/assets/Documents/Ministry/consultations/DTconsultation/DTCP1701-Digital-Technologies-Hangarau-Matihiko-ENG.pdf>.
- Networked Learning Editorial Collective (NLEC), Gourlay, L., Rodríguez-Illera, Jé L., Barberà, E., Bali, M., Gachago, D., Pallitt, N., Jones, C., Bayne, S., Hansen, S.B., Ørsen, H., Hrastinski, S., Jaldemark, J., Themelis, C., Pischetola, M., Dirckinck-Holmfeld, L., Matthews, A., Gulson, K.N., Lee, K., Bligh, B., Thibaut, P., Vermeulen, M., Nijland, F., Vrieling-Teunter, E., Scott, H., Thestrup, K., Gislev, T., Koole, M., Cutajar, M., Tickner, S., Rothmüller, N., Bozkurt, A., Fawns, T., Ross, J., Schnaider, K., Carvalho, L., Green, J.K., Hadžijusufović, M., Hayes, S., Czerniewicz, L., J., Knox (2021). Networked learning in 2021: A community definition. *Postdigital Science Education*, 3(2), 326–369. DOI: [10.1007/s42438-021-00222-y](https://doi.org/10.1007/s42438-021-00222-y).
- New Zealand Education and Training Act (2020). <https://www.legislation.govt.nz/act/public/2020/0038/latest/LMS177679.html>.
- Persson, K., Andrée, M., & Caiman, C. (2022). Down-to-earth ecological literacy through human and nonhuman encounters in fieldwork. *The Journal of Environmental Education*, 53(2), 99–116. DOI: [10.1080/00958964.2022.2046534](https://doi.org/10.1080/00958964.2022.2046534).
- Pink, S. (2007). Walking with video. *Visual Studies*, 22(3), 240–252. DOI: [10.1080/14725860701657142](https://doi.org/10.1080/14725860701657142).
- Pink, S. (2012). *Situating everyday life: Practices and places*. Sage.
- Puentedura, R.R. (2006). Transformation, technology, and education. <http://hipposus.com/resources/tte/>.
- Reed, J. (2022). Postdigital outdoor and environmental education. *Postdigital Science and Education*, 6(2), 1–9. DOI: [10.1007/s42438-022-00323-2](https://doi.org/10.1007/s42438-022-00323-2).

- Renshaw, P., Jackson, K., Mortlock, H., Tooth, R.** (2023). Enchantment and digital technologies: Cultivating children's enchantment with the more-than human through video-walks in local places. *The Journal of Environmental Education*, 54(1), 20–32. DOI: [10.1080/00958964.2022.2152408](https://doi.org/10.1080/00958964.2022.2152408).
- Riley, K.** (2023). *(Re) Storying human/earth relationships in environmental education: Becoming (partially) posthumanist*. Springer Nature.
- Riley, K., Froehlich Chow, A., Wahpepah, K., Houser, N., Brussoni, M., Stevenson, E., & Humbert, M.L.** (2023). A nature's way—Our way pilot project case assemblage: (Re) Storying child/physical literacy/land relationships for indigenous preschool-aged children's wholistic wellness. *Children*, 10(3), 497.
- Ruck, A., & Mannion, G.** (2020). Fieldnotes and situational analysis in environmental education research: Experiments in new materialism. *Environmental Education Research*, 26(9–10), 1373–1390.
- Ruck, A., & Mannion, G.** (2021). Stewardship and beyond? Young people's lived experience of conservation activities in school grounds. *Environmental Education Research*, 27(10), 1502–1516. DOI: [10.1080/13504622.2021.1964439](https://doi.org/10.1080/13504622.2021.1964439).
- Schneider, J., & Schaal, S.** (2018). Location-based smartphone games in the context of environmental education and education for sustainable development: Fostering connectedness to nature with Geogames. *Environmental Education Research*, 24(11), 1597–1610.
- Seigworth, L.** (2020). Affect's first lesson: An interview with Gregory Seigworth. In I. B.P. Dernikos, N. Lesko, S. McCall & A.D. Niccolini (Eds.), *Mapping the affective turn in education: Theory, research and pedagogies* (pp. 87–93). Routledge.
- Snaza, N., Sonu, D., Truman, S.E., & Zaliwska, Z.** (2016). *Pedagogical matters: New materialisms and curriculum studies*. Peter Lang Publishing, Inc.
- Snaza, N., & Weaver, J.** (2015). *Posthumanism and educational research*. Routledge.
- Stake, R.** (2006). *Multiple case study analysis*. The Guildford Press.
- Stewart, A.** (2020). *Developing place-responsive pedagogy in outdoor environmental education: A rhizomatic curriculum autobiography*. Springer Nature.
- Taylor, A., & Pacini-Ketchabaw, V.** (2015). Learning with children, ants, and worms in the anthropocene: Towards a common world pedagogy of multispecies vulnerability. *Pedagogy Culture and Society*, 23(4), 507–529. DOI: [10.1080/14681366.2015.1039050](https://doi.org/10.1080/14681366.2015.1039050).
- Tsevreini, I.** (2021). Nature journaling as a holistic pedagogical experience with the more-than-human world. *The Journal of Environmental Education*, 52(1), 14–24. DOI: [10.1080/00958964.2020.1724854](https://doi.org/10.1080/00958964.2020.1724854).

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