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Bridging dichotomies between children, nature, and digital technologies

Kristiina Kumpulainen

Introduction

Educating children to appreciate and care for the environment has been a long-standing cultural value and priority in the Nordic countries. This priority is reflected in the richness of outdoor education programs, such as Forest Schools (Williams-Siegfredsen, 2017), and efforts to promote environmental education in schools as a cross-cutting curriculum theme (Wong & Kumpulainen, 2019). In Finland, the national curriculum emphasises the need to develop children's knowledge, critical skills, and identities in line with their interest and participation in environmental advocacy (Furu, 2019; Tolppanen, et al., 2017). In parallel, the everyday lives of many children in the Nordic countries have been characterised by opportunities to roam 'freely' in nature contributing to its enhanced appreciation and care (Mjaavatn, 2016).

At the same time, the rapid pace of digitalisation together with urbanisation and changing lifestyles are leading some people to argue that our relationship with nature is fundamentally changing, and that digital technologies are distancing children from experiencing nature itself, the Nordic countries being no exception (Clayton et al., 2017; Edwards & Larson, 2020; Mjaavatn, 2016). Of course, there is a nuanced feel to these claims – from concerns about 'indoor children' or 'couch potatoes' whose lived experiences are becoming more distant from nature due to the pervasiveness of digital technologies in their lives (Soga & Gaston, 2016), the increasing 'nature deficit disorder' in children (Louv, 2005, 2012), and overall environmental 'illiteracy' (Payne, 2006). But fundamentally they highlight deeply rooted imaginaries about childhood in which children play and roam outdoors, relating to plants, animals, and the wildness, which puts it at odds with their digital engagement. These imaginaries are also reflected in environmental education approaches that challenge the value of digital technologies in contributing to children's environmental appreciation and care (Payne, 2010).

In this chapter I argue that these imaginaries about childhood and their relationship to nature and digital technologies are both outdated and unhelpful. In particular, I suggest that in the age of rapid technological and environmental change, there is a need to challenge unnecessary binaries that limit the pedagogical renewal of environmental education responsive to our current troubled times. These

binaries apply to discussions about nature and culture, traditional and digital literacies, outdoors and indoors, science and art, realism and fantasy, cognition and affect, and mind and body. Moreover, I posit that environmental education in the Nordic countries and beyond must recognise children's rights to multimodal communication, participation, and meaning making in the digital age and, importantly, ensure that children can develop a critical and transformative stance towards the relationship between people, technologies, and nature (Greenwood & Hougham, 2015). Here it is important to ensure that environmental education 'stays with the trouble' in the contact zones of human and nonhuman relations, and where digital technologies may play a part in bringing these relations closer to human attention (Facer, 2019).

In my chapter, I use relational ontology and Donna Haraway's (2008, 2016) worldling concept to revisit some of the imaginaries about childhood and their relationship to nature and digital technologies. I use them to understand and promote environmental education with digital technologies that have the potential to immerse children in nature. From the relational perspective (Barad, 2003, 2007), digital technologies are not just tools or objects that are used for predefined ends but agentic participants in the unfolding of activities that together with other actors including children, other humans, and nonhuman entities (i.e. animals, trees, waterways, rocks, materials, and tools) create a 'space' for worldling. Worldling accounts here for children's immersive engagement and relating in nature, including their attentiveness to complex relations between human and more-than-human worlds.

I start by identifying and assessing the persistent strands, binaries, and limitations of research on the integration of digital technologies in environmental education, with a specific interest on the uptake and use of augmented reality technology. Building on this review, I introduce a novel pedagogical approach to environmental education that moves beyond seemingly dichotomous thinking about children, nature, and digital technologies. To explain this approach, I draw on some empirical findings of the studies in the Enriching Children's Ecological Imagination (ECHOING) research group in which primary school children in Finland engaged in storying activities with augmented reality technology during their outdoor exploration and crafting and communicating of their stories (Kumpulainen, et al., 2020; Kumpulainen, et al., 2021). Using the notion of worldling, I illustrate the serendipitous unfolding of opportunities (worldling pathways) that children's storying activities with augmented reality technology generated. I end by considering the value of relational ontology to generate novel understandings of the co-emergent role of digital technologies in environmental education that can enhance our understanding and pedagogic practice of the relationships between children, nature, and digital technologies.

Digital technologies in environmental education

Digital technologies are becoming increasingly mobile, small sized, geo-locative, powerful, and low cost, contributing to modes of communication, engagement,

and representations of the natural world, holding novel, yet largely unexplored opportunities for environmental education and learning. To date, digital technologies have been used to connect learners to various local and distant environments that may otherwise be difficult or even dangerous to visit (Jacobson, Militello, & Baveye, 2009; Wrzesien & Alcañiz Raya, 2010). Similarly, technologies have been employed to provide learners with information about the environment and to contribute to environmental monitoring projects and data generation, sharing observations and findings with different communities (Fauville, et al., 2016; Fauville, 2017), as well as for taking civic action (see Mäkitalo in this volume). Digital games and play have also been integrated into environmental education to enhance motivation and nature exploration (Fjællingsdal & Klöckner, 2019; Schneider & Schaal, 2018). In the research literature (for reviews see Buchanan, Pressivk-Kilborn, & Maher, 2018; Fauville, Lantz-Andersson, & Säljö, 2014), the integration of digital technologies in environmental education has ranged from the use of digital cameras (Änggård, 2015), all the way to tracking digital trails and engaging in augmented reality that entails visualisation of virtual objects or multi-modal information in a real world (Buchanan, Pressivk-Kilborn, & Maher, 2018; Schneider & Schaal, 2018).

Despite the paucity of research, there is some evidence to suggest that augmented reality technology can support environmental education and learning, enhancing students' interest in learning about the environment and developing positive relations with nature (Huang, Chen, & Chou, 2016). Importantly, augmented reality can provide access to nature, but also to render a perception that we are within nature. In this case, the educational potential of augmented reality is based on its ability to create learning experiences that combine digital and physical objects and spaces supporting students' critical thinking, problem-solving and communicating, and enhanced motivation and knowledge building (Chang, Hou, Pan, Sung, & Chang, 2015; Lu & Liu, 2015). For instance, in their study with sixth graders Kämäräinen, et al. (2013) investigated how augmented reality technology, paired with handheld environmental probes during a field trip to a local pond, was able to address ecosystem science learning goals and enhance students' sense making of water quality measurements. The study showed how augmented technology supported students' interactions with the pond and engagement in scientific practices with gains in attitudes and learning. The study by Lu and Liu (2015) investigated how augmented reality technology embedded in a digital game-based interactive learning environment supported elementary school students' learning about marine ecology and water resources. The technology was incorporated in the learning activity through digital storytelling with 3D visual images and game-based tests. Usefully, the study reported positive gains in the students' learning, confidence, and satisfaction. In their study, Eney et al. (2012) used augmented reality to help children aged 6 to 8 years old learn the concept of Newtonian force and motion, concluding that using augmented reality embodied play enhanced children's learning in physics.

The promising pedagogical applications of augmented reality technologies in environmental education described above are not without their critics and are not

unchallenged. In parallel, there are discussions about how nature is represented in and through digital technologies, and whether this representation entangles children in nature (Kahn et al., 2009; Scott-Stevenson, 2020; Greenwood & Hougham, 2015). Some people also argue that digital technologies in general are related to neoliberal globalisation and a culture of fast speed that has little to do with the values and goals of environmental education that stress slow and deep immersive nature experiences in local natural environments and humans' relations and connectedness to nature (Payne, 2006). At its most extreme, instead of children touching nature, they touch screens that displace their immersive experiences with actual environments (Louv, 2012). It has been argued that the social and environmental costs of technological production have gone largely unexamined and taken for granted (Greenwood & Hougham, 2015). At the level of educational practice, the integration of digital technologies requires professional competence and creativity from teachers, and often they feel ill-equipped to deliver multidimensional and transdisciplinary goals (Wong & Kumpulainen, 2019). In addition, teachers find it difficult to employ digital technologies in environmental education as there are less available applications or pedagogical models on how digital technologies can be used outdoors during children's mobile and embodied learning activities in nature.

At the same time, systematic research knowledge about the possibilities of digital technologies in environmental education is limited, particularly as it relates to pedagogical efforts to immerse children in nature. It appears that research efforts around digital technologies in environmental education have focused on conceptual learning and motivation with predetermined plans, whereas holistic and open-ended approaches that acknowledge the affective, ethical, imaginative, and even mystical side of humans' engagement in and relations with nature are rare. This is a serious limitation as we know from research that increasing environmental knowledge is not the sole factor that connects people with nature or advances their valuing and caring for nature (Renshaw, et al., 2021). Instead, an affective connection is needed. It is holistic and immersive encounters with nature that support children developing appreciation, care, and advocacy for nature (Giusti, 2019). Therefore, there is a need to generate more research knowledge on how digital technologies enter into the relationship with human and nonhuman entities and how this potentially produces a space for children's immersive engagement in nature.

A relational approach to environmental education with digital technologies

In response to the need to develop environmental education relevant today, one of the studies in our ECHOING research group has investigated how cultural nature stories based on Finnish mythology, with augmented reality technology and children's own mobile storying activities, create potential animated spaces for children to be immersed in nature (Kumpulainen, et al., 2020; Kumpulainen, et al., 2021, see also Renlund, et al., in this volume). Our pedagogical approach – based on

relational ontology that views human, nonhuman and other matter as ‘one plane of being’, as entangled reality – recognises the mutually supportive narratives of literacy, art, science, and technology that can potentiate spaces for children’s storying, and support children’s immersive intra-actions in nature. Importantly, our pedagogical motivation aims to foster children’s relational attentiveness to the complexities of the human and more-than-human worlds. In this case, Haraway (2016) helps us support children’s understanding of humans as part of the web of life that transcends disciplinary boundaries and disrupts binaries between human and nonhuman, the natural and cultural, and the material and the discursive. Put differently, the opportunity to immerse in nature and to consider, form, and maintain a relationship with the natural world should be at the heart of environmental education.

Our interdisciplinary team has used Finnish mythology that invites children to address situations from several angles, offering alternative visions of the world and provoking fundamental questions that can in turn prompt change. An augmented reality application, MyAR Julle (www.myar.community/julle/index-en.htm) was created, framed by a short orienting story about a forest elf (Julle). Julle features elves, known as modest drillers, as caring supernatural characters who respect nature and its habitats but who also expected reciprocity from humans (Saure, 2019). The app allows children to project an immersive rendering of the Julle character in the physical environment and invites them to ‘capture’ it by taking a photo of it in nature and creating a short narrative around the character. Afterwards, teachers allocate time for children to communicate and reflect on their stories, and to share what they have experienced and/or learnt. Children’s storying creates a space for collective discussions and reflections, and potential mobilisation of the children’s stories (Kumpulainen et al., 2020).

Children ‘worldling’ with augmented reality technology

Building on relational ontology and using the lens of Haraway (2016) our research findings revealed ‘worldling pathways’, namely, playing and imagining, feeling and sensing, being and becoming, and critical thinking and future making that illuminate the ways in which the children immersed in nature and attended to complex relations between the human and more-than-human worlds. Following relational ontology, I understand worldling as a creative and performative practice that emerges in the entangled practices of the liminal in between (Irwin, 2013).

Playing and imagining

The augmented fictitious character Julle created a playful and imaginative layer to the children’s storying in nature, enriching and expanding their worldling. The fictitious mode also brought forward incompleteness and open-endedness in the activity that further immersed children in nature. Many of the children imagined and played with the augmented reality character situating Julle in, on, or beside different plants and built constructions or abandoned objects, such as a

bicycle. The Julle character was placed peeking behind the trees, sometimes hiding from adults or children or secretly observing them. Some of the children also pictured themselves, their peers, or the researchers in their stories, illustrating how they or other humans were interacting with Julle and nature. The children also played with the technology, making the Julle character larger or smaller or turning the character upside down. This technological feature invited the children to experiment with proportions and composition. The different versions of the Julle character that the children could choose from in the app similarly invited playful experimentation and the making of stories. Altogether, the children's storying in nature with the augmented reality technology demonstrated their playful and imaginative immersion into the human and more-than-human worlds.

Feeling and sensing

Children's storying in nature with our augmented reality technology was rich in affect and senses. The children enjoyed creating augmented stories that reflected their sensed reality and fantasy in various ways (see also Wohlwend, Buchholz, & Medina, 2018). The children's stories were typically connected to specific places or things in nature, for instance, rocks or trees the children felt attached to. Some of the children emphasised the beauty of nature in their stories as they imagined the positive sensations these aroused in the Julle character and the children themselves. Meanwhile, some children imagined Julle to feel uncomfortable or unhappy in nature. For example, in some of the children's augmented stories, Julle was depicted as feeling scared of falling from a high place or being afraid of humans and hiding from them. Some seasonal changes were also in the children's storying – for example, in some Julle was feeling cold due to the snow. In summary, the children's storying with augmented reality technology evidenced the children's attentiveness to nature, as they lived through their emotions and senses with and through the augmented character Julle and nature.

Being and becoming

The open-endedness of the storying activity in our work allowed children to immerse themselves in nature, bringing to the fore different ways of being and becoming in nature. Moreover, storying with Julle brought forward the children's diverse experiences, identities, and cultural knowledge in relation to nature, evidencing how every place is about multiple stories that are also interconnected to other places and time (Massey, 2005). The children's storying communicated their experiences and understandings of local environments and places as well as people and other objects, both imagined and real. The children's storying with the augmented character Julle appeared to act as an encounter through which they could find and re-define themselves, their knowledge, and experiences as well as other people and nature, opening up opportunities for personal and collective dialogue and reflection.

Critical thinking and future making

Children's critical considerations of human and nonhuman relations were clearly shown in our research, addressing issues of power and ethics. This often happened when the children positioned themselves into the role of the augmented character Julle or they viewed the world in the role of animals, insects, or plants and made observations about humans' carelessness behaviour in nature. For example, the children storied how humans are destroying nature by littering and proposed that nature would be better off without humans. The children's storying also immersed children into considering their own values and pro-environmental actions to protect nature, such as picking up rubbish to protect nature when storying about collective efforts with other children. These findings are evidence of the children attending to the rich complexities of the present and imagining and acting on towards alternative futures. At a broader sense, the children's storying can be interpreted as a utopian practice that uncovers the richness and tensions of the meanwhile, and explores avenues for hopeful futures (Facer, 2019).

Discussion

In this chapter I have called for the need to challenge unnecessary binaries that limit and narrow research and pedagogical renewal of environmental education in the Nordic countries and beyond. Here I have discussed how relational ontology can offer a means to bridge these binaries between children, nature, and digital technologies. From the relational perspective, the meaning of digital technologies is not predetermined but instead it is emergent, temporally contingent, and socio-materially entangled (Barad, 2003, 2007).

Drawing on our research on children's storying in nature with augmented reality technology, I have shown how technologies can be conceptualised as agentic participants in the unfolding of activities that together with other actors including children, other humans, and nonhuman entities create an improvisational space for worlding – that entails attending to the complex relations of the human and more-than-human worlds (Haraway, 2016). It is these shifting relational entanglements that researchers and educators need to sensitise to understand the potentialities and challenges that emerge (Burnett, et al., 2020).

Furthermore, the worlding pathways illuminated by our research demonstrate how the children immersed in living and imaginative inquiries about the relation between themselves and other human beings, materials, technology, and nature. Storying with augmented technology invited the children to explore nature and its various elements – immaterial and material – from a range of perspectives and positions. Here, nature became alive and entangled with the children's engagement in nature as they explored and attended to environmental details, such as place, seasonal changes, temperature, and aesthetic details. The children's immersive investigation appeared to awaken their awareness of nature, themselves, and other humans. The children's living inquiry, playfulness, and imagination not only retold

a story and document sensed reality, but also invited the children to engage in imagining the future and how they can contribute to it.

The importance of critical thought in relation to integrating digital technologies in environmental education needs to be highlighted. In particular, pedagogical approaches covering the integration of digital technologies in environmental education draw largely on human-centric values with a focus on increasing children's environmental knowledge. Holistic and open-ended approaches that take account of the affective, ethical, imaginative, and even mystical side of humans' engagement in and relations with nature are rare. This is a serious limitation. Increasing environmental knowledge is not the sole factor that connects people with nature or advances their valuing, caring and advocacy for nature (Giusti, 2019). And, therefore, it is important to further understand how digital technologies can enter children's immersive and enchanted engagement in nature, recognising the affective, embodied, sensuous and moral dimensions of our being, learning and becoming in nature, in addition to knowledge enhancement. Similarly, we need to direct attention to the curriculum frameworks, and how they afford room for teachers to implement creative and holistic approaches in environmental education with digital technologies.

Above all, it is clear that more research and development work is needed to guide environmental education policy and practice towards a relational approach with (or without) digital technologies. Attention needs to be directed to the educational programs and approaches and the moment-to-moment emergence of sociomaterial entanglements that give rise to opportunities, tensions, and limitations. There is also a clear need to revisit the Nordic imaginary of an autonomous and independent child and to consider whether this imaginary ought to be revised into the notion of a relational child that positions the child as part of a network of social, cultural, technological, and environmental relations.

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