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Watery Webs of Interconnectedness: Waterways as Pedagogical Sites

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Abstract

Despite the ever-growing body of knowledge about human impacts on river and coastal ecosystems, and the need to work towards sustainable futures, young children's participation in environmental action initiatives in aquatic habitats remains low. This signifies an urgency for educators to support young children's relationship with freshwater and marine environments so they can acquire the skills and dispositions to become 'agents for change' for the environment. Guided by Deleuzian ideas of being and becoming, and ecologies of knowledges, this paper considers three exploratory case studies from England, the United States and Australia that investigated early childhood teachers' practices of using waterways as pedagogical sites.

Data were collected through ethnographic methods of observations and interviews. Findings revealed that early childhood teachers viewed such habitats as spaces where action initiatives for sustainability can be conceived and incorporated as "webs of interconnectedness" into the curriculum. We conclude this study has the potential to expand understandings of under-utilized pedagogical spaces, such as natural water and marine habitats, where adults and children have permission to learn together to cultivate a more intimate relationship with the earth.

Key Words

Early Childhood Education for Sustainability; Epistemology; Being and becoming; Waterways; Pedagogies

Introduction

In September 2015, the United Nations adopted the resolution to address growing sustainability challenges through international collaborative partnership. This collaboration detailed a 'plan of action for people, planet and prosperity,' (United Nations General Assembly, 2015) comprising 17 Sustainable Development Goals and 169 targets. Key to their successful implementation is the recognition and understanding that these goals 'are integrated and indivisible' which resonates with the idea of interconnectedness. Whilst there is a swathe of research related to environmental/outdoor learning, including widespread international adoption of the Forest school philosophy, (Constable, 2014; Knight, 2013) the authors of this paper note the limited research related directly to natural water environments, coastlines and beaches as physical and emotional places for learning about environmental issues. Horvath (2016) conducted a small-scale research project with parents and community members in the context of her unique 'Water school' initiative in England and the value attributed to 'preserving nature's treasures' (2016, p. 11), offers tacit reference to ecological sustainability. As an Early Childhood educator, Horvath's research sought to explore views, attitudes and personal epistemological beliefs related to natural water environments, including emotional, sensory and physical responses.

The idea of ocean *literacy* is gaining momentum and the need to understand the ocean's influence on inhabitants, and human impacts on the ocean is captured within Ocean Literacy frameworks (see for example USA 2002-2010; Europe & UK, Savage, 2014). The seven principles of Ocean Literacy postulate the validity of scientific inquiry with the ocean noted as the last and largest unexplored place on earth (less than 5% of it has been explored). The framework is also a stark reminder that the ocean *sustains* life on earth, and humans must live in ways that sustain the ocean.

Ocean literacy frameworks can be considered in conjunction with national curricular frameworks to develop a useful pedagogic lens to build coherent and conceptually sound learning experiences for young children. Whilst this framework is noted as an instructional tool, the authors suggest it can be *read* with flexibility of thought and show how educators, (who we view as learners themselves), can build their understanding of the seven Ocean Literacy principles. The interdependency of an ethical foundation recognised in the Earth Charter Initiative (2012) is mirrored in the principles of the Ocean Literacy framework, promoting the four dimensions of respect and care for the community of life; ecological integrity; social and economic justice; and

democracy, nonviolence and peace. These dimensions reflect the pillars of sustainability (Brundtland, 1987) and human values that Early Childhood Education (ECE) encompasses.

Research related to Early Childhood Education (ECE), highlights the influence of romantic legacies, where educators often avoid 'critical engagement with the child/nature intersection and its implications for education for sustainability' (Duhn, 2012, p. 19). Limitations are also noted in relation to educators' perceptions of the cognitive benefits of alternative pedagogies, and Elliott and McCrea (2016) state that many early childhood educators were astounded by the complex knowledges that young children often demonstrate, and concluded, 'the romanticised notions of children in nature may be thwarting more challenging and deliberate pedagogical discussions' (p. 21). Duhn (2012) considers how 'lingering discourses' (p. 20) of childhood as a natural time of innocence, that should be '*kept free of complex knowledges*' (Lesnik-Oberstein, 1994 cited in Duhn, 2012, p.20), continues the view of children as needing to be protected from risky environments. This reinforces the dominance of 'safe places' (both physical and emotional) for pedagogic interactions. New, Mardell & Robinson (2005), examine early childhood education and offer alternative narratives to support educators to move beyond 'safe' spaces to 'discover what's possible'. They advocate a risk rich curriculum where adults and children explore 'unfamiliar terrains' (p. 1), thus resonating with Seller's (2013) invitation for educators to 'receive children in curriculum' (p. 174) whilst learning *with* adults.

The notion of engaging young children in aquatic habitats is part of a broader international movement arguing the need to re-engage young children in experiences of the natural world (Louv, 2010), thus, with the inextricable connections between the ocean and humans, we argue the need for adults to engage *with* young children in experiences of environmental issues which are part of children's worlds. This includes an authentic recognition of what De Sousa Santos (2007) refers to as 'the ecology of knowledges' (p. 45). De Sousa Santos recognises the complexity of acknowledging alternative epistemological beliefs but, he argues, this requires 'a gigantic decentring effort' (p. 55). Lang (2007) suggests that education for sustainability is about 'interactions between people, and how these interrelationships affect the integrity of the environment and its functioning' (p. 28) and Woolfolk (2013) argues that these different contexts or interactions influence the development of 'behaviours, beliefs and knowledge' (p.75) and therefore shape children's views on their world, thus, Brownlee and Berthelsen (2006), argue for an exploration of personal epistemology and relational pedagogy. This research is also cognisant of Bronfenbrenner's bioecological model of human development (1979) in which children's natural environments are viewed as 'a dynamic entity which is constantly changing' (Keenan and Evans, 2010, p.35). Bronfenbrenner also recognised that children grow up in families and communities which reflect a wide ranging and diverse world of structures, cultures, traditions, organisations and languages which constantly evolve and change. His idea of 'nested structures' (Bronfenbrenner, 1979, p. 22), or the child centred and belonging to a nested community, resonates with the bioecological aspect of education for sustainable development. Davis and Elliott (2014) caution that to be truly transformative and to change how we live and behave within our environment, we must all change how we think. For De Sousa Santos (2007), this change in thinking demands an ecology of knowledges, which 'expands the testimonial character of knowledges to embrace also the relations *between* scientific and non- scientific knowledge, thereby expanding the range of intersubjectivity as interknowledge' (p. 71). We extend De Sousa Santos' concept of ecologies of knowledge to also consider young children's participation in early childhood education for sustainability (ECEfs) through cultural production (Kuttner, 2015). Cultural production is integral to cultural citizenship which Kuttner describes as 'the right and capacity of people to develop and pass on diverse cultural traditions and identities while participating effectively in a shared cultural and political arena' (p.70). Embedded within the foundations of Early Childhood Education (ECE) is the recognition that the rights of the child are unconditional, thus, within our Watery webs of interconnectedness, we borrow from Professor Julie Davis and carry her argument related to recognition of 'ecocentric' rights which 'extend rights to the Earth's entire ecosystems' Davis (2014 p. 26).

Being and becoming: A rhizomatic methodology

The study participants included early childhood teachers and young children who engaged in diverse environmental action initiatives. Data were collected through ethnographic methods of observations, field notes, and semi-structured interviews. Pseudonyms have been used to maintain confidentiality in accordance with ethics approvals for the respective case studies. The research embraces the idea of multiplicity in qualitative research and intentionally moves across different theoretical ideas in order to provoke, open up spaces and encourage 'nomadic' thinking (Deleuze and Guatarri, 1987) in the researchers, research participants and the reader. The authors feel it is important to note that the research was not driven through the power of funded research projects (ie, through international grants/agencies), but through the agency of individual researchers, linked together through a self-organised group (Transnational Dialogues in Early Childhood Education for Sustainability; TND), and whose work is sustained through a common interest in children as participants in the ongoing project of ecological sustainability. The paper is informed by respondents' narratives (early childhood teachers and children) alongside our own subject positioning as members of the TND, who seek opportunities for 'rhizomatic vegetation' (Deleuze & Guattari, 1987, p. 382) and to 'make kin' within safe spaces for composting and sharing ideas (Haraway, 2015, Verlie et al., in press). Our primary focus is to shine light on the creative ways in which educators implement early childhood education for sustainability (ECEfS) and the authors draw on a combination of different theorists, different applications and varying interpretations of the data. In this sense, our diverse epistemologies are woven throughout the research paper as we 'fold' (Deleuze, 1993) our subjectivities in to the research (Sellers, 2013).

The authors engage with rhizoanalysis (Deleuze and Guatarri, 1987) to 'loosen the seams' of methodological normality and epistemological generalisation (Schostak and Schostak, 2008, p. 38) to open up new ways of thinking about 'knowledge', including cultural production (Kuttner, 2015), the politics of knowledge, (Jocson, 2015, Moss, 2007) and the notion of ecologies of knowledges (De Sousa Santos, 2007). With the global reach of the Sustainable Development Goals's (SDG's, UNESCO, 2015-2030), and the need to 'ensure all learners acquire the knowledge and skills needed to promote sustainable development' (SDG4.7), we draw on De Sousa Santos (2007) and consider 'an ecology of *knowledges*, premised upon the idea of the epistemological diversity of the world, the recognition of the existence of a plurality of knowledges, beyond scientific knowledge' (p. 67). The authors see this as a *space* for new lines of inquiry, which can build complex, diverse and rich research in the area of ECEfS, where other possibilities and other ways of knowing can be mapped, while remaining open to re-writing them. For Deleuze and Guatarri (1987), this endeavour evokes the image of the nomad, searching around, working in the middle of things in order to discover the new and the different. We present three case studies from our respective countries, (England, USA and Australia), where each researcher is exploring for 'nomad' ECEfS thinking within the context of watery webs of interconnectedness.

The idea of children engaging with locally-relevant environmental issues has been a topic of considerable research in the field of early childhood education for sustainability (Davis & Elliott 2014) and the case studies offer interesting pedagogical and philosophical opportunities (rather than recipes on 'how to'), as innovative ways to approach work *with* young children. Each case study travels in its own rhizomatic direction. In our detailing of the respective case studies, there is a focus on the cultural production that children were engaged in. Building upon Kuttner's (2015) work around cultural citizenship through cultural production, we conceive of the notion of cultivating ecologically oriented cultural citizens, through participation in the creation of cultural artefacts which engage with ecological systems and human impacts upon ecological systems.

Case study one: *Beach Kindy as a transformative pedagogical approach in England*

Context

This case study utilises the award winning (OMEP, June 2017), Early Childhood Education for Sustainability Framework (ECEfSF) in England, (Boyd, Hirst and McNeill, 2017), which draws on the internationally renowned Eco Schools principles associated with ESD; the themes within Eco Schools England; the characteristics of effective learning (*how* children learn) from the English Early Years Foundation Stage (DfE, 2017); the three dimensions (pillars) recognised in the Brundtland report (1987) and place based learning. Whilst learning *in* and *about* the environment is embedded into early childhood education, learning *for* the environment helps to lay the foundations for sustainability and to encourage children to explore human/environment interactions as causal in sustainability problems and aspects (Davis, 2009). Very young children have been found capable of sophisticated thinking in relation to socio-economic aspects and the earlier ESD ideas are introduced, the greater their impact and influence can be (Siraj-Blatchford, Smith, & Pramling, Samuelsson, 2010). The research project was cognisant of all nine themes that underpin the Eco-schools program (Energy, Waste, Water, Litter, School Grounds, Transport, Healthy Living, Global Perspective, Biodiversity), the value of place based learning and the characteristics of effective learning (DfE, 2017) which resonate with Education *for* Sustainability, with children playing and exploring, actively learning and thinking creatively and critically.

ECEfS initiative

Phase one

Wirral's Wonderful Waders

Every autumn and winter, wading birds in their thousands come to the Dee Estuary and the coast of North Wirral to feed on the rich diversity of food to be found on and around the mud and sand of the estuary and beaches. The different lengths and shapes of their bills are used for different types of food, most of them feed on molluscs and worms in the mud. The Dee Estuary and North Wirral coast have been designated internationally important *Sites of Special Scientific Interest (SSSI)*. At times of high water, the birds are forced to retreat to the top of the beaches where they roost, waiting for the tide to go out.

Wirral's Big Seaweed Search

In the Good Beach Guide (2015) Wirral boasts three beaches gaining the highest 'Excellent' rating based on water quality. The Wirral estuary and coastline is also home to a wide variety of seaweeds and plant life. The most common seaweeds found along the beaches are the Serrated Wrack, the Knotted Wrack and the Bladder Wrack. In 2009, the Natural History Museum launched the Big Seaweed Search and encouraged communities to take part and gather data over time, demonstrating how the distribution of seaweeds around the UK is changing. The focus was to highlight rising sea temperatures and the impacts of this on sea life locally. The main emphasis was to note the arrival of non-native species of seaweed and how geographically these species are spreading around the coast, and look for signs of ocean acidification. During the pilot phase of the ethnographic research project (Boyd & Hirst, 2017), Beach Kindy was promoted during the summer months in 2016 with a small group of children, parents and park wardens.

Phase two of the project built on this engagement and included five Early Childhood Educators from an independent pre-school located on the Wirral peninsular in the North of England. The pre-school is attached to a local primary school but is an independent provider with a group of around twenty children between two and four years. During the Beach Kindy research, visits were made to the local beach during February 2017 over a four- week period. The educators are participants in an ongoing

collaborative inquiry and action research related to the practical application of the ECEfSF, and a trusting relationship had developed between the teachers and the authors.

Prior to the weekly visits to the local beach, the educators engaged the children in dialogic inquiry related to their local environment and parents and carers were informed of the pending visits to the local beach. The educators read related environmental stories with the children and the project included unhurried walks to the local beach with recognition of cultural connections within the built environment, such as the renovated sustainably built lifeboat station. During one walk to the beach, an impromptu visit to the lifeboat station included conversations with the lifeboat crew and one child drew attention to a photograph depicting his great, great grandfather.

Findings

During planning sessions with the researchers, the educators noted that they did utilise the local environment, for example, they did visit the beach but 'not in the winter months as it was so cold'. The teachers recognised the value of play based learning and the health benefits of outdoor learning and they characterised their summer visits as excursions or 'trips' where they took time out during the summer months to have fun, make sandcastles and eat their snacks outdoors.

Armed with packs related to the local beach environment, including information on the wading birds and classification of different seaweeds, the educators often talked in a self-deprecating way and articulated a need to 'swat up', 'gain more knowledge' and learn more about the different species of birds, the relationship of the different species of seaweed, and following conversations with the lifeboat crew, the possible erosion of the sand with the explosion of marsh grasses. The children were observant and their natural curiosity was exemplified with sophisticated observations around tide lines of seaweed, and associated detritus including skeleton remains of a seagull. I pads were used to record these observations leading to contextualised discussions related to the 'rubbish', which became the basis for the subsequent recycling initiatives within the pre-school routine. Children's conversations were documented revealing their emerging thinking about wading birds and the watery environment:

Comment Child 5 (age 4)

The waves have ice, why?

The ground is hard coz its freezing!

The birds may be cold – their feet are in the water

Where do they go? In the sky?

Comment Child 4 (age 4)

Examining the skeleton in the tide line..

Its come from a bird but I don't know which. It could be a pigeon or a fish...

Adult: what other birds live by the sea?

I don't know- it could be a seagull...

Comment Child 4 (age 4)

Discussion related to the wading birds and dogs

No dogs live in a house and birds are in the air

They can't both be here coz they are scared of each other

Dogs should be on a lead so they won't escape and scare the birds

Dogs should not be on the beach coz they poo

During the research, the educators (including a trainee teacher on placement), highlighted tacit frustration with the comparisons they were making between the Beach Kindy 'adventures' and every day practice with one teacher commenting "I'm actually sad that this time is restricted and I'd like to

do more of this and actually enjoy our world!”. Teachers and adults reported feeling “more relaxed” in the beach environment, which another participant indicated was a place where they normally “would march here for some exercise then back to pre-school”.

Alternative modes of learning were made possible in the beach kindy environment. One participant commented “I can’t get over the conversations we are having! We spend so much time checking they know this and can do that for their profiles, that we forget”. Another educator said “Its lovely to see the children running around free, rather than waiting for the next instruction”. A trainee teacher who participated in the research commented “When I practice, I’m going to make sure that I use spaces like this – it’s real learning- look at them (the children)”. Such comments suggest that the beach kindy visits were experienced as a different way of *being* within early childhood education.

This also brought challenges for some educators, with one indicating “I felt daft last week so I’ve started watching Winter watch so I can discuss different birds with the children if they ask this week!”. Another educator found the dead bird too confronting, commenting “I hurried the children away from the bird as I wasn’t sure how to deal with it...” These comments reveal that the educators were in a space of learning with the children.

A significant change enacted in their pedagogical interactions resulted in transformative (Davis and Elliot, 2014) and deep learning with comments related to the locality. Whilst the collaborative inquiry included the acquisition of new knowledge (Oates and Grayson, 2004), the explorations remained within a child centred and playful context and this Education *for* sustainability provided opportunities for participatory and empowering education around local and global issues (Davis and Elliott, 2014).

Case Study two: A Sea Turtle Protection collaboration from the United States

Context

Today, despite a litigious, often risk averse societal mentality (New, Mardell & Robinson, 2005), an increasing number of young children in the United States are attending early childhood programs situated within outdoor environments (Sobel, 2016). The growth in popularity of non-traditional school environments, like forests and parks, reflect shifting societal values about methods to enhance children’s development and learning. It also reflects a reaction against technocratic educational and residential policies that separate children from nature (Louv, 2010). Over time, these shifting societal values and attitudes may permit teachers to utilise other outdoor environments, like beaches, as sites for collaboration between themselves, young children and community members when addressing local sustainability issues.

This case study from the United States focuses on collaboration to address waning sea turtle populations. It is based on the perspectives of three early childhood teachers at Cooper Park Elementary (CPE). In this discussion, the collaborative roles of children, parents, community organisations and teachers are explored.

CPE is a private school situated in the downtown peninsula of Charleston, South Carolina. The campus has an early childhood centre for children ages 2-5. In addition, the school has lower, middle, and secondary schools. The CPE early childhood program is inspired by the practices of Reggio Emilia. It features an *atelier*, or arts space for the children to weave creativity into their daily explorations. The *atelier* is overseen by the *atelierista*—or arts teacher—who encourages the children to express their knowledge and observations through song, movement and art. The children also have access to several unique outdoor environments on campus in the form of bee hives, raised

garden beds, and a bear cave. The children's colourful work is displayed in the classrooms and hallways and illustrates how the centre's teachers are able to integrate the arts and outdoor learning with early childhood content standards.

CPE is committed to creating a culture of sustainability that extends beyond the school campus. On a weekly basis, children are transported to a local beach. The teacher's role is to facilitate exploration and discussion. Teachers encourage the children to observe and question the relationship between living and non-living elements of the beach ecology. Ecological principles such as biodiversity, life cycles, and human-nature interdependency (Stone & Barlow, 2005) are presented to children as young as four years old. The CPE teachers believe these experiences will foster a deeper connection to nature in their children (Elliott, 2010).

ECEfS initiative

Sea Turtle Protection

The impetus for child participation in local sea turtle protection initiatives occurred after several children visited an aquarium on a weekend outing. Upon returning to school on Monday, the children informed their teacher they had enjoyed watching a loggerhead sea turtle swim in a large tank alongside other aquatic life such as sharks and clownfish. The children noted sea turtles were an endangered species. The teacher explained:

The children were really upset about the sea turtles being endangered. They said they didn't want them to die. And, tell you the truth, I really didn't know what to say...until one of the children asked if we could, as a class, do something about it.

While the teacher's lesson plans did not include sea turtles, she decided to honour the children's concerns and interest in a local sustainability issue. The teacher and children collaborated on a research project that provided the most pertinent information regarding the sea turtles. The class learned that irresponsible human behaviour (e.g. beach development, marine debris, oil spills) had contributed to the classification of all sea turtle species living in US waters as 'threatened' or 'endangered' by the U.S. Endangered Species Act (ESA, 2012). While this information was troubling to the class, it served as motivation to participate in three sea turtle protection initiatives over the next eight months. The three sea turtle protection initiatives included:

- Folly Beach Turtle Watching Program- A volunteer group licensed by the SC Department of Natural Resources (SC/DNR) to protect sea turtles, their nests and hatchlings on Folly Beach. Volunteers contribute their time and energy each turtle season (May-October) to protect nests on Folly Beach. Nest protection includes recording new nests, assessing site selection and moving the nest if necessary to protect it from tidal flooding, monitoring each nest's progress until hatching and inventorying nest contents after hatching has taken place. Data is collected on each nest's success and submitted to SC/DNR.
- Clean-Up the Litter- A protection initiative that aims to remove beach litter before it enters the Atlantic Ocean. A cause of death for sea turtles is the digestion of marine debris like plastic bags. *CPE children also completed a clean up the litter on their campus after learning that trash entering street-level water drains will eventually end up in coastal waterways.
- Adopt a Sea Turtle- An online program that allows classrooms to select a sea turtle for adoption. Children are able to track the sea turtle progress and migratory paths. The program is maintained through donations.

Findings

While it is acknowledged that high-quality teacher collaboration has a positive impact on children, teachers, and schools (Ronfeldt, Farmer, McQueen, and Grissom, 2015), little is known about how

teachers make sense of their role as a collaborator. This investigation is significant in gaining a deeper understanding of how the extent and process of collaboration, teacher attitudes, and community ecologies ('webs of connectedness') interact to affect children's learning.

During the research process, the CPE early childhood teachers offered their varying perspectives on the sea turtle protection initiatives, and how well it aligned with their original conceptions of "collaboration". The teachers' comments, analysed and themed as questions, suggest a rethinking of former attitudes about engaging young children in local sustainability initiatives.

Question 1: HOW do you collaborate?

The CPE teachers described the beginning stages of the collaboration process as "unfamiliar", "unsettling", and "daunting". These feelings stemmed from their lack of training and experience in HOW to collaborate. The teachers cited that individualised performance measures at their university and present worksite had conditioned them to think in narrow, individualised ways. A teacher thinking back to her pre-service courses commented "I can't remember one assignment where I worked with any other intern. I would have enjoyed learning how my classmates were approaching the content". Such comments reveal teachers' desire to collaborate with their peers. Such opportunities may offer emerging teachers an intimate context where diverse pedagogical perspectives and practices are shared.

As the school year progressed, the teachers learned to tackle the HOWs of collaboration by dedicating additional time, focus, and communication towards the sea turtle protection initiatives, as one teacher confessed,

Before we would only meet about once a week for an hour. While it was nice to get the lesson plans done for the next week and catch up on each others' lives, that was about it...Once we started having a focus on the sea turtle project, the meetings were more meaningful...We spent a lot of time calling for support from people and organisations around town...At times, it was exhausting.

This teacher's comments illuminate the perseverance and commitment needed by teachers who educate *for* sustainability. Those in administrative positions should take this in to consideration as early childhood teachers are continuously facing unrealistic worksite demands that delimit opportunities for collaboration.

Question 2: WHO should I collaborate with?

While the CPE teachers valued the input of community members, they learned that their students were some of the most knowledgeable and influential partners in the collaborative process. One teacher explained,

I always felt the need to get our parents invested in our environmental projects...but I found out that I also needed to listen to my students more. They had a lot of ideas about how to help the turtles...Really this is how the project got started.

As aforementioned, the sea turtle protection initiatives would not have been possible if the teachers did not honour the interests and concerns of their students. Shifting towards *being* and learning with the children was a critically important aspect of the collaborative process.

Case study three: 'Being and becoming' with seabird breeding cycles Australia

Context

This case study outlines a vacation care initiative in an early childhood education (ECE) centre on Tasmania's east coast where young children became involved in an environmental issue of local relevance. The centre is located near Great Oyster Bay, a region of Tasmania which is home to a range of vulnerable seabird populations, including Fairy Penguins, Pied Oyster Catchers, Shearwaters

and Hooded Plovers. Here webs of interconnectedness are explored between young children, teachers, a parks and wildlife services officer and the local seabird populations and ecological systems.

Part of the centre's ongoing learning program involved young children in a project where they learnt about the connections between habitat change and the breeding patterns of a nearby fairy penguin colony (Emery et al., 2017). This initial 'breeding box project' will be briefly explained, before outlining the second phase of the webs of interconnectedness project which involved a shorebird breeding awareness campaign. This case study is based on data collected through interviews with the centre leader, Linda, and her documentation of the students' explorations.

ECEfS Initiatives and Findings

Phase one: The breeding box project

The breeding box project began with a visit to the ECE centre from Kelly, a parks officer for the region. Kelly informed children about a penguin colony that was in decline and at risk of extinction on nearby Little Christmas Island. Centre leader Linda explains the children's response:

The children had lots of questions. They wanted to know how come the penguins had to live on that island? And why was their population declining. Kelly was quite open with them, and told them about the changing habitat and their food and resources declining, causing them to stop breeding and the population collapsing.

The parks service invited the centre's children to support their work through a project of assembling breeding boxes for the penguin population. It is important to note that this project was voluntary for children to participate in, therefore respecting children's rights. According to Linda the children were keen to be involved and were supported by the centre's groundsman, Bill;

All the children had a go at nailing boxes together. They got to use the tools and even though they couldn't use the electric drill, they had turns at holding on to the equipment, and they all worked together assembling the boxes with Bill.

Through this project young children engaged with the environmental issue of habitat change in an action-oriented way. The installation of breeding boxes into habitats is a direct action that the parks service engages in to mitigate factors which have caused the penguin population to become vulnerable and sharing this information with the children was a necessary part of the project. With help from the centre's groundsman, the children assembled six timber breeding boxes designed to provide a safe habitat for nesting penguins.

The parks service installed the boxes on the small rocky island, and over the following year provided information updates to the childcare centre to keep children informed about the ongoing breeding cycle of the penguins as Linda explains.

In October, parks officers sent them another poster, this time with the photographs of the penguins using the breeding boxes. There were photos that even showed an egg being kept warm under a penguin. They [the children] were so surprised. I don't think that they thought it was real, that the little penguins were going to go in there and make some more little penguins.

In this way children began to understand a locally relevant sustainability issue in a real context. Linda explained how parks officer Kelly also located this inquiry in relation to human impacts on the small island:

She talked about the problem of erosion on the tiny island caused by people visiting and walking all over it. That sparked a big conversation about how humans destroy things but at the same time love things. The children talked about humans and animals sharing the planet, and also thinking about the good that we can do.

Linda continued the connection with the marine theme through an evolving display in the centre created by the children's marine focused art works. (For more information about the breeding box program please refer to Emery et al. (2017)).

Phase two: Protecting shore nests

Following the success of the breeding box project, the centre engaged with the parks service in a further initiative designed to raise children's awareness of shore bird breeding habitats. Species including Hooded Plovers and Pied Oystercatchers live along the beaches near the centre and make their nests in the dry sand above the high-tide mark. Some species have recorded significant declines in populations, for example beach signs reveal that surveys show "Hooded Plover numbers have decreased on some beaches by up to fifty per cent since 1982" (Tasmanian Conservation Trust, n.d.).

In a further visit to the ECE centre, parks officer Kelly shared information with the children about shore bird nesting habitats, using the centre's sand pit to demonstrate how the birds make nests in the dry sand. Raising children's awareness about the nesting season between September and March is an important strategy for preventing damage to nests and protecting eggs from people walking or playing close to nesting sites. Linda explained how Kelly invited the children to build understandings of shorebird nests in a hands-on, experiential way:

She showed us how [the nests] look like just a pile of twigs and the birds cover them over with sand, so you don't see the eggs. So she had all the kids in the sandpit building their own little nest popping their own pretend eggs in.

Linda also shared how the children learned about the damage caused by 4 wheel drive vehicles driving on the sand, a message that they appeared to understand in a personally relevant way:

Kelly got the children to start thinking about 'when we're at the beach, are we kicking up sand? Are we driving cars across the beach? Are we leaving rubbish?'. She actually brought a [deceased] Pied Oystercatcher in and it had eaten that much plastic, its insides were full of it. When parents were picking [the children] up, the kids were saying 'mum when we go to the beach don't drive on the sand, and you don't leave any rubbish, because it kills off the birds.'

Linda's comments provide insights into the ways that children connected the birds' capacity to thrive in the future with their own actions at the beach and how they took on an advocacy role. The shorebird breeding habitat initiatives were designed to help children understand the web of interconnectedness that links their activities to the lives of other species. The engagement of young children in learning about vulnerable sea bird populations through direct involvement in conservation actions supported young children to experience themselves as being part of an ecological system and participants in the human impacts that are contributing to species decline.

Through focusing on the webs of interconnectedness between humans and nature (Inoue 2014), this ongoing Tasmanian collaboration between a child care centre and the local parks and wildlife services demonstrates how early childhood learning can incorporate education for sustainability by involving children in a real-life local environmental issue. This program of participation supports the

national curriculum outcomes of the *Early Years Learning Framework for Australia* (Department of Education Employment and Workplace Relations (DEEWR) 2009), in particular, Outcome 2: "Children are connected with and contribute to their world" (p 29).

Living in the middle; Findings and analysis

The three case studies in this paper present examples of educators engaging with young children in early childhood education for sustainability in freshwater and marine habitats, all of which are under-utilized pedagogical spaces in ECE. Through these case studies we hope to expand understandings of ways of drawing upon diverse aquatic environments that offer young children opportunities to cultivate a more intimate relationship with the earth. Findings revealed that teachers viewed local freshwater and marine habitats as pedagogical spaces where action initiatives for sustainability can be conceived and incorporated into ECE curriculum. A contribution that this collective body of research makes is that in these case studies educators supported young children to engage with the natural world, including its environmental issues, in complex and nuanced ways. Much literature argues for engaging children *in* the environment (Wilson, 2012, Knight, 2009, 2013). Much less literature supports educators in understanding pathways to engaging children *in* environmental issues in ways that go beyond simple environmental actions (such as beach clean ups, recycling activities, composting or tree planting ceremonies). While such environmental actions are important and necessary, authors have argued the need for education for sustainability to go beyond 'low hanging fruit' environmental actions (Reid, 2009, p.236) and to support young children's engagement with the complexity of sustainability issues in sensitive and appropriate ways. These case studies contribute to this space.

Webs of Interconnectedness

The 'webs of interconnectedness' lens (Emery et al., 2017; Inoue, 2014) considers the ecological interactions and interrelations of humans and nature. It possesses a holistic and interdisciplinary orientation, and has been adopted by early childhood teachers in diverse cultural settings (Inoue, 2014; Emery et al., 2017). In the case studies reported here, young children were involved in ongoing conversations and practices they signalled interest in being part of. Early childhood teachers facilitated experiential and emergent learning opportunities that were hands-on and thought-provoking. Local or impacted places have been recommended as pedagogical sites for educational endeavours that seek to educate for sustainability (Hill, 2013). The initiatives served to capture the children's imagination while simultaneously promoting civil responsibility and environmental stewardship (Stone & Barlow, 2005). Each of the case studies supported the adoption of an ecocentric approach where 'the value judgements underlying the discourse of human and environmental questions became framed differently' (Davis, 2014, p. 30). Children were involved in dialogic inquiry related to thorny issues of rights beyond binary responses. Examples of these issues included the respective rights of wading birds and dogs on the beach, human plastic litter entanglements with the death of sea turtles, and recreational vehicles on the sand disrupting shorebird breeding sites. These are new and emerging lines of enquiry, which highlight the complex interactions and interrelationships between people, places and more-than-human species in which young children are participants.

Working to unravel protective discourses

Duhn (2012) makes a plea for 'making Early Childhood Education more than a sheltered enclave that is dominated by romantic notions of childhood and nature' and she suggests that this, 'requires imagination, courage, heart, body and mind' (p. 27), thus, she argues that early childhood educators need to examine their own understandings of early childhood. In a similar vein, Barron (2016) argues that academics engaging in early childhood teacher education should be ethically supporting early childhood educators to engage with 'other discourses' (2016, p. 337) and he draws on Hammond, Powell and Smith (2015, p147) who suggest finding ways to engage in early childhood

practice which involves ‘participation, empowerment and mutuality’ which ‘is neither pre-determined nor defined by intended outcomes, yet is conscious of the requirement to attain them’. Sellers (2013) refers to this interpretation as ‘presenting curriculum as a dictionary of possibilities’ (p. 177), where educators are mindful of the requirements of national curricular frameworks while continuing to ask, ‘how does it work?’, thus allowing for thoughts which challenge human capital and technicist approaches (Moss, 2007) with ethically situated repertoires which may ‘emerge from the shadows through thinking (with)...and...and....and’ (Sellers, 2013, p. 178). Reviewed with a holistic lens, the combined case studies offer a repertoire of opportunities for risk taking and embracing unknown territories, both physical and in terms of personal epistemologies, with clear orientation towards education *for* sustainability. While we posit that approaching waterways as pedagogical sites, helps to ‘decentralise anthropocentrism in favour of an interdependence and co-existence’ (Sellers, 2013, p. 162), we note that each case study also reflects the complexity and real world sensitivities regarding appropriate topics of conversation with young children, including death. Case study one sees adult uncertainty when faced with children’s observations of a dead bird in the tide line, case study two refers to children’s agency in promoting practical actions to help the endangered sea turtles, and case study three included children confronting the prospect of species extinction, and observing the dead Pied Oystercatcher to see the causal effects of plastic in the ocean. Haraway (2015) warns that mourning irreversible losses is part of living with climate change, arguing “[r]enewed generative flourishing cannot grow from myths of immortality or failure to become-with the dead and the extinct” (pp. 160-161).

Cultural production

The authors acknowledge children as active participants in culture and cultural production (Kuttner, 2015) and suggest this has implications for children’s processes of identity formation as ecologically minded cultural citizens. Teachers linked the importance of ecological learning and curriculum integration to children’s ability to experience themselves as being part of an existing ecological network of other living things in their communities, which we refer to as ‘webs of interconnectedness’. In the three case studies we found evidence of young children participating in cultural production through their involvement in early childhood education for sustainability. These experiences of cultural production included everyday activities, such as the building of sandcastles, sketching and story-telling, children modelling their own shore bird nests in the sandpit, clearing beaches of debris, and constructing structures to protect sea turtle egg nests or serve as breeding boxes for an endangered penguin colony.

We argue that participation in such ‘everyday’ cultural production can offer young children different identity positions, for example as artists, designers, builders, conservationists and makers of cultural artefacts, who are able to contribute to a shared culture and communicate their views about their experiences of the world. We further contend that through such participation, and the identity positions cultural production affords, children can come to perceive themselves not only as members of society but also as planetary citizens ‘with the ability to produce knowledge, to use particular forms of knowledge to challenge normalised ways of thinking and doing’ (Jocson, 2015, p.47).

Through affording the types of participatory experiences of cultural production outlined in the three case studies, we argue that educators can make available new identity positions for children to take up, for example as ‘agents for change’ *for* the environment. The findings of this research lead us to encourage educators to engage young children through early childhood education for sustainability, in exploring webs of interconnectedness, including engaging with environmental issues which humans are part of.

Conclusion: Eschewing one version of Knowledge

As researchers, we are not searching for one, secure and stable foundation for knowledge, rather, we are always amongst different meaning-making assemblages (as TND members, PhD

students, teachers, university lecturers, etc), which legitimises opportunities to invent, create and experiment with multiple 'truths', including intertextual readings of the case studies. Rhizoanalysis offers ways of expanding the range of discourses through which meaning is generated, opening up different possibilities without seeking to offer an *absolute knowledge* (Deleuze, 1993). One of the aims of this paper has been to challenge conceptions of education for sustainability (inclusive of culture), as a stable and unproblematic body of knowledge transmitted from one generation to another. Rather, the authors see this learning as a dynamic process, where agents create meaning by drawing on different cultural forms. Weaving its way throughout the data, is the sense of children as active agents in these processes of meaning making. At times, children were the catalyst for action, for example, in case study two, the children clearly led the teacher with their empathetic responses to the sea turtles as endangered species.

Our collaborative writing resonates with critiques of overly standardised and controlled early childhood education and we argue that early childhood educators need to be consciously aware of their interactions and co-constructions *with* young children. Duhn (2012) argues that a pedagogy that challenges dominant understandings of childhood requires early childhood educators who are able to work with complexity, uncertainty, risk and imagination (Garrard, 2010 cited in Duhn, 2012 p21). We argue that utilising waterways as pedagogical sites in authentic ways can offer rich potential for interactions where children are viewed as 'responsible and 'response-able' thinkers and learners' (Sellers, 2013, p. 18) able to engage with complex knowledges. The pedagogies employed by educators in the case studies presented here reflected the constant questioning and incomplete answers which De Sousa Santos (2007) posits as the basis for 'prudent knowledge' (p. 79) foundational to an ecology of knowledges.

Understanding SDG 4.7 of ensuring 'learners acquire the knowledge and skills needed to promote sustainable development' through this discussion acknowledges the importance of the recognition of knowledges as multiple, including recognition of indigenous and traditional knowledges, rather than as a single truth. Duhn (2012) highlights how Indigenous knowledges and ways of being and doing are a core aspect of engagement with global issues of ecological sustainability and caring for the environment cannot be separated from caring for self and other. She further argues that, from a New Zealand perspective (Maori knowledges), 'the Western separation between global and local seemed irrelevant- caring for self and other meant caring holistically for the earth' (p. 12). De Sousa Santos, (2007) argues that forging credibility for non-scientific knowledge, does not mean discrediting scientific knowledge and the promotion of the interactions between scientific and non -scientific knowledges expands intersubjectivity, or what Oates and Grayson call 'the meeting of minds' (2004, p. 314). With this in mind, the publication of this paper is ethically centred to support educators to give themselves permission to learn and *become with* children (Sellers, 2013) and to be politically and ethically conscious educators and researchers.

As Julie Davis succinctly notes, 'as members of the TND we recognise that our perspectives are framed by our lives as academics from the wealthiest nations, both East and West, and as researchers we are limited by our own lenses, experiences and capacities to understand the entire global picture of ECEFS' (2014, p. 3). Our collective writing resonates with Deleuzian notions of 'being and becoming' (Deleuze & Guattari, 1987) and in this sense we offer these cases as support for early childhood educators to *become with* children on the journey towards cultural citizenship, in and through early childhood education.

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