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Sustainability education: researching practice in primary schools

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Many teachers are keen to implement sustainability education in primary schools but are lacking the confidence, skills and knowledge to do so. Teachers report that they do not understand the concept and cannot integrate sustainability into an already overcrowded curriculum. Identifying how teachers successfully integrate sustainability education into their teaching practice can offer important insights into how these perceived problems can be overcome. The paper is based on data from the third year of a longitudinal study about teacher education and teacher professional learning for sustainability in primary education. The third year of the study investigated teachers' understandings of sustainability and how sustainability education is manifested in eight rural and regional primary schools in Victoria, Australia. Data included photographs of school grounds and sustainability projects, audio recordings of focus groups with teachers and principals, and field notes of meetings with school staff. Sustainability education was found to be an emergent practice necessarily constituted in the relation between teachers, students and community members and the materialities of local places. Partnerships were found to be an essential part of integrated sustainability programmes which extended into communities and places beyond the schools. The processes of learning involved pedagogies of creative problem-solving and inquiry learning that enabled children to lead the way.

Keywords: sustainability education; pedagogy; teaching practice; materiality

Background

This paper analyses data from the third year of a longitudinal participatory action research study designed to investigate teacher professional learning and teacher education for sustainability in Victorian primary schools. In the first year of the study, two teacher educators researched the practice of integrating sustainability into teacher education (Power and Green, forthcoming). In the second year, the two authors partnered with the deputy principal, a lead teacher and two Grade 3/4 teachers from an exemplary school in the Latrobe Valley region of Victoria, to trial a process for the integration of sustainability into teacher education and teacher professional learning (Somerville and Green 2012). In the second year of the study, we had observed that the pre-service teachers often experienced resistance to their new learning during placement, reinforcing their own anxieties in relation to sustainability education. In response to this observation, we sought schools that were practising sustainability education for the placement of teacher education students in the third year of the project.

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The schools selected for Year 3 were self-identified in a previous research study 'Mapping sustainability initiatives in the Gippsland region' (Somerville and Green 2013). The aim of the parallel mapping study was to understand how to connect individual local sustainability initiatives to each other across a region in order to gain greater momentum for transformational change. In collaboration with local sustainability and climate change networks, we developed a mapping survey to investigate the location, nature and type of sustainability initiatives in the region. The mapping survey added further data and insights to previous studies of sustainability initiatives in Gippsland, highlighting conservation and land management projects, kitchen garden/food and health programmes, wetlands/frog pond projects, natural resource management, community partnerships and community gardens, biodiversity, and water, waste and energy management. Eight of the ten schools that responded to the mapping surveys nominated for further in-depth research and were contacted to participate in the third year of the longitudinal study. The eight schools agreed to take small groups of pre-service teachers so that they could experience a practicum placement in a school with active sustainability education programmes.[1]

Sustainability education as teacher practice

Described as a relatively new concept that is still 'finding itself' in terms of its establishment and practice (Kemmis and Mutton 2012), education for sustainability is now recognised as an important element of the Australian Curriculum that educational institutions are required to address (Steele 2010). Even though Australian schools are expected to teach sustainability as a cross-curriculum priority[2] (ACARA 2013), pre- and in-service teachers' lack of confidence and preparedness to conceptualise and practice sustainability is identified as one of the key barriers to its implementation (Evans, Whitehouse, and Gooch 2012; Kennelly et al. 2012; Nolet 2009).

There is now an extensive body of literature that advances the theory and practice of education for sustainability, for example sustainability frameworks (Sterling 2012), sustainability reports (AGDEH 2007; Henderson and Tilbury 2004), plans (New South Wales Government 2002), sustainability reviews (Skamp 2010; Tilbury, Coleman, and Garlick 2005) and government mandates (ACARA 2013). Despite the intent of the literature, the definition of sustainability remains broad and ambiguous (Jickling and Wals 2008), resulting in a barrier to how it is, or is not, implemented into curriculum discourse and practice (Chi-kin and Williams 2006; Kennelly 2010; Wilson 2012). The focus of this study is to elucidate sustainability education through a study of its practice (Kemmis and Mutton 2012). We use the concept of sustainability-rich programmes as self-identified by the participating schools as the sites for our research.

Teacher practice is understood to include the personal, practical and implicit theories of individual teachers, including their values, knowledge systems and hopes as key determinants of how students are brought into learning (Boon 2011; Noddings 2006). These practices involve how teachers make things happen on the ground, including classroom dynamics, decision-making processes and how they understand themselves in the world (Hart 2003). Hopwood's (forthcoming) theorisation of practice and pedagogy through themes of time, space, bodies and things elaborates the multiple and complex layers that underpin professional practice:

Practices and the activities which instantiate them respond to, shape and negotiate material conditions and events, have material ends, attune to objects, and are prefigured by them. Practices are also material in the sense that they are bodily, and the body can be understood as a material thing. (Schatzki 2002, cited in Hopwood, forthcoming, 3)

The idea of 'practice as materiality' opens up new ways of understanding teacher practice, including how teachers embody pedagogic space (Watkins 2007).

Some of these ideas have been taken up more recently in a study that examined how education for sustainability practices are formed, enacted and understood. Utilising similar practice theories, Kemmis and Mutton (2012) illustrate how practices – such as the practice of education for sustainability 'are held in place by preconditions that enable and constrain some kinds of actions at the expense of others' (188). These preconditions or 'practice architectures' include 'pre-existing cultural-discursive, material-economic and social-political orders and arrangements that enable and constrain practice, respectively, in semantic space, physical space-time and social space' (188). The overarching argument is that until the architectures that hold existing practices in place are changed, teachers will remain reluctant to engage in sustainability education. Therefore understanding the practice of teachers in sites where the practice architectures support sustainability education has potential to inform the field.

Place and practice

The concept of place framed the three-year study and our analysis of teacher's sustainability practices, and is applied as the constituent meeting point of the three overarching pillars of sustainability that generate ecological, economic and social/cultural community relationships (Marsden 2011). In common with many other studies 'place' underpins our theorisation of sustainability (Comber, Nixon, and Reid 2007; McInerney, Smyth, and Down 2011; Reid 2007; Zachariou and Symeou 2009). This study seeks to understand how teachers conceive sustainability through the lens of place, including the social and environmental interactions between students, teachers and the wider community in shared local places (Malone 2008; Rafferty 2012; Ross and Mannion 2012; Waite and Pratt 2011).

Also referred to as intergenerational education (Glowacki-Dudka, Murray, and Isaacs 2012; Mannion and Adey 2011), community-based education (Malone 1996; Smith and Sobel 2010) and place-based education (Gruenewald and Smith 2008; Penetito 2009; Sobel 2005), place-based sustainability education tends to privilege children's embodied interactions with the human and non-human entities that occur with and without the assistance of adults (Duhn 2012; Rautio 2013) and with action-outcomes in mind (Tilbury and Wortman 2006; Uzzell 1999).

Despite its contested nature place has long been noted as an organising principle in Aboriginal ontologies and epistemologies by both Indigenous and non-Indigenous Australian scholars (Somerville 2010). Building on the idea that pedagogical practices impact the well-being of the social and ecological places we inhabit (Gruenewald 2003a, 2003b), and on the understanding that place and the practice of sustainability are inextricably linked (Somerville and Green 2011, 2012), the study investigated the intersection of sustainability practices and the spatial and temporal exchanges that occurred across those spaces where sustainability was happening (Massey 2005; Sack 2004).

The study

The participating schools were located in Gippsland, which is a distinctive region in south-eastern Victoria that has particular identity, and identifiable sustainability and climate change challenges. Due to its geographical and demographical diversity, the six Local Government Areas (LGAs) within Gippsland face unique environmental, social, cultural and economic challenges that include rising sea levels, urban development, high unemployment and declining natural resources. Four of the six LGAs were represented in the study and included one Catholic school and five government schools. The schools consisted of a mix of large and small rural and regional schools with none located within close proximity to a large metropolitan area.

During preliminary contact with the eight participating schools, principals were asked to identify suitable mentor teachers for the pre-service teachers' three-week practicum placement and to consider placing them in groups in order to promote cross-classroom sustainability collaborations. The researchers made three visits to the eight participating primary schools (24 research visits in total) that involved communication with 16 in-service teachers and five principals. The first visit introduced principals and teachers to the aims of the study, authorised the three-week practicum placement and organised focus group interviews. The second visit occurred during the placement practicum and focused on sustainability teaching and learning by mentor and pre-service teachers. Focus group interviews with groups of 2–3 teachers and principals about their practice of sustainability education framed the final visit.

Unlike other studies that identified teacher's personal knowledge and understanding of environmental issues as inhibiting factors for teaching sustainability (Summers, Corney, and Childs 2003; Wang 2004), teachers in this study shared a common interest in environmental and sustainability education and were confident to use alternative classroom sites such as school grounds, gardens and nearby community locations including wetlands, woodlands and watercourses. They were motivated to expand sustainability discourses and practices in their respective schools and were often instrumental in developing whole school sustainability policies.

The data analysed in this paper was derived from digitally recorded semi-structured focus groups with teachers and principals and photographs of the sustainability-rich sites in which the learning occurred. The focus groups were designed to bring teams of teachers and principals together to share their understanding, interpretation and practices of sustainability across their respective schools. They were guided by the following questions:

• How is sustainability understood in your school?
• What are some of the key sustainability initiatives in your school?
• How is sustainability implemented in the curriculum?
• Where does sustainability learning occur?
• What are some of the challenges in teaching sustainability at your school?

A field journal was kept to record observations from each of the school visits. Photographic images included woodland interpretive trails, murals, trees with bird boxes, vegetable gardens and glasshouses propagation.

Analysis and discussion

The analytical strategy of storylines, as developed in feminist post-structuralism (Davies 2000; Søndergaard 2002) was used to analyse the stories of teachers' sustainability education practice: 'A storyline is a condensed version of a naturalised and conventional cultural narrative, one that is often used as the explanatory framework of one's own and other's practices and sequences of action' (Søndergaard 2002, 191). Davies (2000, 81) notes that '[s]tories we observe, hear, read, both lived and imaginary, form a stock of imaginary storylines through which life choices can be made'. While the analysis of focus groups was language-based, the addition of the visual element consisting of photographs of sustainability sites in schools enabled us to access the material expression of sustainability practice. These were analysed according to the frequency and significance of the visual elements appearing in the photographs, complementing the storylines identified from the verbal data.

The photographs and teachers' storylines identified sustainability education practice across most of the schools within the following sets of relations:

- the materiality of school grounds;
- connections with local places;
- partnerships with community; and
- creative processes.

Although these sets of relations were typical across most of the schools, the creative processes.

The materiality of school grounds

The schools developed sustainability practices through standard discourses of sustainability education, influenced by the programmes available for schools such as the Stephanie Alexander Food Garden programme and the Victorian government AussieVic 'Reduce, Re-use, Recycle' programme. All of the schools in this study, for example, had food garden programmes, most had energy and waste management programmes, and some had biodiversity and resource conservation programmes. An examination of these programmes in practice, however, reveals how they are shaped by the materialities of school grounds as the most immediate of their local places and the most readily available pedagogically.

The following extended example of one teacher's practice illustrates this category. This teacher explained that she had left the planning of the sustainability unit open because she wanted the children to drive it. The following sequence reveals the nature of the material relationships that shaped the pedagogies of this practice.

> Two weeks ago we did a compost, like a mini land fill experiment. I took the kids out and we got some – well first of all we all sort of discussed the experiment and predicted what we thought might happen and then we went outside with a bucket and got some dirt and put some dirt in the bottom and we had different items – a leaf, a chip packet, an apple core, a tissue and a piece of paper and we buried them at different levels and sprinkled a bit of water through it as we went and just kept burying them and layering it up and we said we will dig that up in two weeks time.

In this example, the school grounds provide all of the pedagogical material for this lesson. The children learn through the interaction of soil, water, apple core, paper,

leaf and chip packet in an intentionally designed pedagogical encounter. Time is an added dimension to this pedagogical inquiry experiment as the children wait for two weeks to see what will happen.

> We dug it up today and that was very interesting. The kids had to go through and I said it's like we're excavating – we really have to filter this through and find out what's going to be inside. They went through and they all took turns to carefully get some – one of the poor kids found the apple, it was just a little ball of moosh. I didn't think it would have decomposed that quickly – but we discussed there's obviously a lot of mini micro-organisms living in the soil and the tissue was completely gone – there was no tissue at all and the paper was exactly the same. We couldn't find the leaf. And the chip packet was exactly the same and I said you know in 100 years this is still going to be exactly the same, this chip packet. So then they had to come back in and write the results about that because a couple of weeks ago they did all their predicting and wrote out the experiment and today they finished that off.

The children learn about the micro-organisms whose activities are made visible in their effects on the material elements of their experiment. They learn how compost is made by the decomposition of organic materials and the implication if the materials are not organic and will not decompose through these processes. Writing is included in this pedagogical activity as language that is produced from within the linking of children, soil, waste materials and learning. Each such pedagogical encounter is linked to others in a sequence of teaching and learning as the teacher describes in the next iteration: 'I get a link sent to me every week ... I have registered myself now and we watched this other one which was called Plastic Oceans and it was amazing'.

> Like one of the facts was 3.5 million pieces of plastic go into the ocean every day and I paused that and I repeated that to the kids and they were like 'Oh My God every day' – and we talked about – because the habitats – they know that plastic can end up out in the ocean but that's a lot, and then my integration aide – she is just amazing – she came over with the globe and she goes – 'Do you see this part of the ocean here? – this is actually – she said all the tides create this sort of circular motion' – she said 'apparently there is a massive bit of plastic the size of America in the ocean in that part' – and it just gets stuck because it can't escape because of the tides and so we talked to the kids about that and they were like 'Oh My God'.

The teacher's connection to other materialities through the rhizomatic networks of digital technology is added to the pedagogical sequence when the teacher comes across a YouTube video that connects to their previous lesson. The integration aide adds her knowledge using a model of the globe to show the children where the mass of plastic is formed in the vortex of the ocean's tides. In this way, children's experience of the irreducibility of plastic litter from the school playground connects directly with global problems through this video, connecting their actions in their school grounds to the plastics that are carried to the sea from every little waterway of the world.

The analysis of a single pedagogical encounter and its accretion through a series of interlinked connections offers an insight into educational processes that are produced from the relational materialities of everyday life in the school grounds. The practice of sustainability within their school grounds is a common theme throughout all of the schools and exposes students to new and authentic ways of seeing, being in and understanding their world. Predominantly experiential and experimental in nature, the emergent pedagogies are engaging and exciting with unpredictable outcomes that provoke students to further inquiry.

Connection with local places

Sustainability practices across all of the schools were grounded in the locality, region, landscape or place where learning occurred. Sustainability learning involved direct engagement with the world beyond the school through practical activities in local wetlands, woodlands, gardens, creeks and rivers. This engagement with local places connected to disciplinary learning in literacy and numeracy, history and the arts, science and Aboriginal studies through action-based learning. A community-created wetland in a logging town, for example, framed sustainability pedagogies through environmental science, conservation studies, history and physical education.

> We've also looked at town planning and had a very integrated unit of work on the town planning, and we had town planners from Traralgon from the government area come in and talk to us about how towns are planned, and we looked at that ourselves, and then looked at Heyfield itself, and the wetlands were part of that, and looked at what the wetlands were before, you know, sort of as in they were a – it was a football oval.

In this town, the evolution of the wetland has become a 'living commons' that is maintained and shared by the wider community (Gibson-Graham, Cameron, and Healy 2013). It is used extensively as a pedagogical site by two local primary schools that access it regularly by a 5-min walk. Students' town-planning research unearthed the layered settler history of the site – a sheep and tobacco farm, a horse racing track and a football oval. This history was complemented through investigations of the Aboriginal clans who originally inhabited and travelled through the same country thousands of years earlier.

The wetland is central to sustainability education that is practised through integrated curriculum activities that draw on community expertise.

> Well we're having another one in November – John Caldow, who runs the Bug Blitz programmes, he's an ex-teacher of ours from here, and he was in contact last week just to organise a date for this year's Bug Blitz, and he's going to have an Aboriginal elder doing something down there, he's not sure yet what, but he knows he does have someone involved. Peter Ware, the bird man will be making nests out of material that they collect down there with the children. The DSE[3] will be doing something else. Last year they did a – they brought their fire awareness trailer, but they'll be doing something else.

This annual event at the wetlands involves relationships with large numbers of community members who bring many years of expert knowledge that enrich children's learning. As in the example of soil, compost and litter described previously, language activities emerge from the children's experience of the place itself.

> … the children made documentaries about the wetlands, and they came at it from different points of view, didn't they, each group – some were the historical point of view. We also looked at the – one group interviewed a water quality scientist from the West Gippsland Catchment Authority. Some looked at different animals, didn't they, the different animals that were in the wetlands, and some of them just touched on just insects, as well. Yes and some did an interview with the people who had been responsible for setting up the wetlands in the early years, who started it off.

The sustainability pedagogies arising from children's connections with local places have a significant impact on student learning: 'they [students] are aware that the wetland belongs to them the way the town belongs to them'.

If they use the wetland a lot they think of it as theirs, and we encourage that too, and just looking at rubbish and drainage and, you know, over the years when we're doing units of work, you know, town planning, we look at where does all of the stormwater go, and we can actually go out onto the road and stand there and look, and show the children how the stormwater does drain down into the wetlands and say, everything that you drop, or all the oil, or everything, and they can actually see how it is going to, they can follow the path.

Another teacher, who defined sustainability through community practice, walked her class to a nearby community garden to discuss the Bunwurrung people's inhabitation of the place hundreds of years earlier. Sitting underneath the 300-year-old manna gum she asked students: what would kids of your age have been doing in this place? What does it mean to grow a community? The questions fuelled a collective inquiry into why townspeople choose to work in a shared project in a community place, with a pedagogical motive to connect students to a network of relationships that exist across and through local places, in and beyond school life through a shared sense of purpose (Ferreira and Davis 2012).

The meaningfulness of local places in children's lives and learning has been found to be strongly supportive of their learning (Roberts and Green 2013; Smith and Sobel 2010). Local places inform and shape teacher practice, which in turn is translated into children's embodied place learning. Teachers' sustainability practices foregrounded place-responsive curriculum and pedagogies that engage with the local, cultural, environmental and broader context of a place (Orr 2005).

Partnerships with community members and organisations

Teachers expressed an ongoing need to find innovative resources and expertise to expand their own, as well as their students' understandings of sustainability. This often involved reaching out to the wider community to create connections, networks and partnerships with other schools, teachers, parents, local shires, tradespeople, conservation groups, volunteers and other community organisations. Teachers identified the benefits of expanding sustainability practice to include a committed collective of adults who share environmental knowledge, skills and community heritage.

Teachers intentionally foster these pedagogical partnerships as they draw on sustainability initiatives that are organised within their local communities to incorporate into their students' learning experiences. One teacher, for example, uses the local farmer's market for students to sell their produce, thus creating an enduring relationship between learning and community engagement.

We initially started off with the children working up the street with the kitchen garden at the local farmers' market, where the children would go and cook dips and use the produce from the school and take it around to just the local people who were at the market. And they loved doing that. They loved sharing what they were learning at the school and what they were making. And people were astounded by what they were actually capable of doing and what they were actually eating.

Community members also attend the activities organised by teachers as volunteers, adding immeasurably to the resources available for the students' learning.

Without them things just wouldn't happen. Most of our volunteers are people who have no connections to the school whatsoever. So they're not grandparents and they're not aunties or uncles. They are just community members who believe in the [sustainability]

program. And we're getting more and more of those … they just come off the street and say, 'Can I come and volunteer?'

Partnerships involved engagement with community organisations such as Landcare, Waterwatch and Aboriginal elders who are invited to share environmental and historical knowledge. At one school, woodcrafters from the local Men's Shed were asked by teachers to work with small groups of disengaged boys to build furniture and nest-boxes. The nest boxes were later installed at a community wetland day where a cluster of rural schools participated in a biodiversity field day. During the field day, volunteers and other community instructors assisted small groups of mixed-age students to rotate through diverse environmental activities: student bird watchers walked the trails with binoculars and bird guides with a local ornithologist; another group planted trees with parent volunteers as part of the ongoing wetland revegetation project; and an environmental science teacher worked with students in a bug audit activity.

Community partnerships offered schools substantial leverage to pursue sustainability, and cultivated a gathering of people able to support and create socially healthy and ecologically sustainable communities (Smith 2013). It is this coming together of teachers, students and generations who engage with the materialities of local places that essentially informs how sustainability curriculum is made and practised (Ross and Mannion 2012). The layering of webs of connection between schools and their local places and local community members and organisations produces an active social ecology of place that underpins sustainability education practice.

Creative processes

The photographs of the sites of sustainability activities highlighted some of the creative processes involved in this learning, which were taken up differently in each school, and in some schools not at all. In one school's woodland, for example, children's hand-drawn botanical and bird illustrations were mounted on metre high boards that lined an environmental interpretation trail. A cluster of rural schools participated in a biodiversity project that installed painted bollards adorned with images of birds, butterflies, beetles, dragonflies, bees and spiders across several school grounds. At a small two-teacher school, children's expression of community life is represented on a painted mural that covers one side of a school building. Colourful mosaic tiles made in an art class were used to create a school ground sundial at another school that communicated time through casting shadows from children's bodies.

Accompanying the arts-based approaches was creative processes that enhanced sustainability learning through inquiry, problem-solving and investigative processes. An example of the use of such processes involved the design of miniature solar ovens that were built as part of an investigation into renewable energy. From using recycled cardboard boxes, tape and pieces of foil, students were able to test the capacity of the constructed 'hot boxes' to toast bread and melt cheese (courtesy of the sun) in the space of an afternoon. This particular activity and the earlier example of investigating buried rubbish exemplify how children were encouraged to draw on known and unknown knowledge that informed their predictions about how the world works. These activities demonstrate the unpredictability and uncertainty that underpin creative pedagogies, which tend to encompass experimental and experiential approaches.

Fostering creative inquiry requires a major shift from traditional pedagogical approaches that privilege teacher knowledge and control. In the solar oven and buried rubbish scenarios, for example, teacher practice involved emergent pedagogies that created a rich and productive learning environment involving less teacher influence and more unpredictability. The emphasis on creative and emergent learning processes, directed by the students, was a significant characteristic of teacher practice in this study.

> We will help you to work it out, and we will help you to work out where you need to go, and we can point you in the right direction but we're not here just to tell you things.

The creative arts-based approaches, as evidenced in the photographs, and the inquiry approaches discussed in the focus groups, permeated each of the other categories. They were used in school ground pedagogies, in extending beyond the school ground to local places and communities, and to the creative work of building partnerships. The cultivation of risk-taking, innovation and creativity were an important aspect of all sustainability education practice.

Conclusion

This paper focuses on an analysis of teacher practice. Rather than attempting to define what sustainability is we focused on what sustainability can become through investigating practice in schools which self-identified as having implemented integrated sustainability programmes. Teacher accounts of their practice illustrate the ways they interacted with the materiality of local places as an essential part of sustainability education. Sustainability learning was framed in actions that engendered a sense of regard for local places and community. Teacher's pedagogical practices determined curriculum development and illustrate the embodied nature of sustainability education, particularly in relation to children's embodiment in/of place. Their place responsive approaches were ultimately responsible for the ways teachers build new sustainability architecture within their respective schools.

Viewing the data through the analytical lens of teacher practice gave rise to four meta-level categories through which to understand the essential elements of sustainability education as emergent within material interactions at different scales. It is constituted within the immediate materiality of school grounds, and extends to connections to local places. It is a collaborative and community-based practice that employs creative processes both in terms of arts-based practices and of the problem posing and inquiry learning approaches commonly employed. These characteristics move beyond the possibility of standardised recipe-based approaches for teachers to prepare innovative and creative future-oriented generations to move forward confidently in a precarious world.

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Notes

1. Due to the focus on teacher practice, the nature, scope and outcomes of the practicum placement are not discussed in this paper, and will be taken up at a later time.
2. The period in which the study took place preceded the implementation of sustainability as a cross-curriculum priority in the Australian curriculum (ACARA). Schools were implementing the Victorian Essential Learning Standards.
3. DSE is an abbreviation for the Victorian Government's Department of Sustainability and Environment now known as Department of Environment and Primary Industries.

Notes on contributors

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Margaret Somerville is professor of Education and Director of the Centre for Educational Research, University of Western Sydney. She has undertaken empirical research about sustainability education in early childhood, schools and community settings. She is interested in applying Indigenous and new post-human frameworks to the investigation of the interrelationships between social and ecological systems.

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