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Article

Addressing Epistemic Injustice: Engaging Children as Environmental Communicators to Support the Long-Term Sustainability of Forest Ecosystems

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Abstract: Closure of a forest for biosecurity purposes led to the marginalisation and disconnection of Year 6 children from a local forest of significance to them in Aotearoa, New Zealand. The marginalisation of children's voices and concomitantly of their knowledge, ideas, and values from environmental issues can be viewed as an example of epistemic injustice, which manifests widely in the environmental area, particularly in relation to marginalised groups. To counter this marginalisation and promote epistemic justice, we explored how the creative arts involving a child-driven environmental communication project could foster children's sense of agency by supporting the protection of a local forest affected by a tree disease. We show that the creative arts could facilitate the children's meaningful engagement in environmental issues in a learning environment that fostered child-centric approaches that enabled children to express their visions for sustainable futures in distinctly unique ways that were relevant to them. Furthermore, enabling the children to participate as environmental communicators re-established their relationship with their local forest and re-balanced the power structures that had led to the children's sense of marginalisation. The insights on how this child-centred relational approach can promote epistemic justice and provide a meaningful contribution to the long-term sustainable management of forest ecosystems has implications for other marginalised groups.

1. Introduction

Environmental sustainability, such as the long-term protection of forest ecosystems, is by its very nature a complex issue, as it is characterised by significant scientific uncertainty and embodies diverse and often divergent socio-cultural perspectives [1,2]. This is why complex socio-environmental issues are often referred to as wicked problems [3,4]. As such, effective management of these complex socio-environmental issues demands transdisciplinary approaches that bridge academic, community, and indigenous perspectives so as to embody multiple actors with diverse values and epistemologies [2,5–7].

Given the intergenerational nature of complex socio-environmental issues such as sustainability [8,9], we argue alongside many other scholars for the specific inclusion of

children and youth voices in environmental issues [10–15]. We contend that children should participate as valued knowledge creators and communicators in their own rights and not simply as objects of inquiry or institutional outreach. Environmental communication, as a critical component of environmental management, should offer a platform for a range of voices, including children's voices, to speak out about and on behalf of the environment in an attempt to build people's awareness of environmental issues, shape their interpretations, and influence how complex socio-environmental problems are both understood and managed [16].

1.1. Creating Epistemic Injustice

Power structures can limit children's voices from being heard and marginalise them from making valuable contributions to environmental issues. The marginalisation or exclusion of people, including children, as credible 'knowers' is referred to as epistemic injustice [17].

We explore in this article an innovative child-driven environmental communication project using graffiti art on shipping containers and known as the container art project to enable children to contribute as vibrant social actors and knowledge creators to a local environmental issue. The project partnered with fifteen Year 6 school children, enabling them to use the creative arts to contribute to the management of a local neighbouring forest park that had been closed by the city council to limit the spread of kauri dieback, a forest disease caused by the forest pathogen *Phytophthora agathidicida* that threatens New Zealand's kauri tree (*Agathis australia*), one of the world's largest and longest-lived trees. First observed in 1972, kauri dieback has no known cause, and when present in kauri trees, almost certainly causes their death [18].

The children's school carried the forest park's name and had used the park as an educational amenity that the children had regularly visited before it was closed. The closure had, over time, led to the children feeling both physically disconnected from the forest and frustrated and marginalised by the council for not recognising the important role they could play in contributing to the park's management. We view the children's marginalisation as an epistemic injustice.

1.2. Engaging Children Using Arts-Based Practices

Arts-based practices, including art, play, and performance, provide a range of expressive and alternative modes of communication to enable children to participate in environmental management in ways that are distinct and unique [19,20]. The container art project was an extension project of Toitū te Ngahere: Art in Schools for Forest Health (TTN), a more extensive research programme that had included five schools in New Zealand. TTN sought to explore how arts-based practices could support children's engagement with forest health. The TTN transdisciplinary partnership consisted of specialists from the creative arts, social and environmental sciences, education and mātauranga Māori (indigenous Māori knowledge), as well as Māori and pakeha artists (of European descent) and a range of primary schools, their students from Years 1–8, along with their principals and teachers. Together the team co-designed and co-implemented the TTN programme (see [21,22] for more detail about the full TTN project).

Central to TTN was the recognition of the contribution that both Western science and mātauranga Māori or Indigenous Māori knowledge make to forest health. Mātauranga Māori is a system of ontology that weaves and interconnects all forms of knowledge, at times fluidly overlapping, but never in separation or hierarchically [23,24]. This contrasts with dominant Western ontologies that separate concepts often into hierarchies. A te ao Māori (Māori world) centred approach, calls for an emphasis to be on ngahere ora, or the wellbeing of the forest, rather than framing forest biosecurity solely through the lens of plant pathogens [25]. By placing mātauranga Māori as a central component of TTN's engagement with schools, it could also seek to address epistemic injustices to mātauranga Māori that have often been afforded lesser value and importance in environmental issues [25,26].

While TTN explored more broadly the use of arts-based practices for engaging school children in forest biosecurity, TTN's extension project—the container art project—sought to provide a unique insight into how a child-centric approach using art-based practices could be used to engage children in environmental sustainability to address epistemic injustice. The project directly responded to one of the TTN school's feelings of marginalisation and exclusion from decisions following the closure of their local forest because of kauri dieback.

It drew on a specific pool of children who the previous year had benefited from participating in the wider TTN programme. With no blueprint or roadmap available on how to address epistemic injustice with children, the research underpinning this project asked the question: How do we address epistemic injustice using arts-based practices to enable children to meaningfully contribute to an environmental issue of local relevance?

1.3. Engaging Children in Forest Biosecurity in New Zealand

The inclusion of children's voices is particularly relevant for the sustainable management of forest ecosystems in Aotearoa New Zealand, as intergenerational responses are needed to manage long-term biosecurity issues including kauri dieback. As natural ecosystems are deeply connected to beliefs, rituals, and cultural practices of Māori, the indigenous people of Aotearoa New Zealand, forest pathogens such as kauri dieback have profound cultural impacts [25].

Furthermore, disease management control measures, such as footwear and equipment cleaning stations and forest closures, have significantly impacted people's interaction with the forest [27,28]. These ecological, social, and cultural impacts make kauri dieback a complex socio-environmental issue requiring transdisciplinary responses that includes scientific knowledge, and indigenous Māori, local, and other knowledges that are often marginalised from environmental issues [29]. In this respect, we argue for the inclusion of children in conversations and decision-making processes that focus on forest health.

1.4. Outline of Article

The article begins by exploring the literature to examine how the privileging of Eurocentric approaches to environmental management marginalise 'non-science' voices and lead to epistemic injustices. We present the concept of epistemic injustice as described by Fricker [17], and examine this in relation to the marginalisation of children's voice and agency in environmental issues. We then draw on the writings of Anna Hickey-Moody [19] and Marianne Presthus Heggen [20], who call for 'a more-than-human world' to children's engagement in environmental issues, which values relationships with non-human actors and develops notions of living in a shared world as eco-citizens.

We present our findings of four key areas that emerged in our project as being critical for fostering epistemic justice for children. These were: equitable relationships; opportunities for deep engagement; spaces for individual and collective thinking; and time for deliberation and reflection. In our discussion, we examine our findings by revisiting Hickey-Moody's, Heggen's, and Fricker's work, discussing the key concepts of eco-citizenship, little publics, and the rebalancing of power structures.

Our evidence is qualitative. In this article, we both report on and critically explore our child-centric process for engagement within the context of epistemic injustice. We have not sought to sample a population. Our evidence, gathered from our own reflections and observations and from the children's recorded reflections and their artwork, and the many photos, videos, and other artefacts we captured during this year-long engagement, provide a rich array of data from which we draw our conclusions. While this article focuses on the marginalisation of children's knowledge in an environmental context, the findings and discussion have relevance to those working to address epistemic injustices in other marginalised groups.

2. Literature Review

2.1. Anthropocentric Approaches to Environmental Management

Environmental agencies responsible for managing the environment or setting policy directives, such as those that oversee biosecurity, view the environment as spaces that are boundable and controllable that need to be protected [30]. Environmental messages focus on changing people's behaviour to manage or control their interactions with nature and limit their environmental impacts. The behaviour change approach favours top-down deficit approaches to communication, with science as a reservoir of facts and knowledge and audiences as receivers and adopters of such facts [31]. Environmental agencies focus on educating the public in the hope this will bring about their acceptance of management regimes or policy decisions [32], thereby encouraging pro-environmental behaviours [33,34]. In this anthropocentric approach to environmental management and communication, the state is viewed as the key actor in managing the environment, with science as the principal epistemic authority [30,35].

However, in complex socio-environmental issues, there is a need to move beyond top-down linear approaches to management and communication [32]. This is because these approaches assume people equally share a desire to protect the environment, and so ignore the values-based nature of people's environmental decision-making [28]. In addition, linear approaches under-estimate the importance of working in local contexts and with local communities about issues that are of relevance to them [36,37]. Of most concern is that linear approaches limit the inclusion of knowledges and voices beyond science.

Inclusive, dialogic and co-produced participatory approaches to environmental management are promoted as more effective ways to engage stakeholders to address complex environmental issues like sustainability [38]. However, often these are science-led, with projects following traditional linear approaches that minimise opportunities for collaborative learning and knowledge co-production where science complements rather than replaces local and/or traditional knowledge [39]. Furthermore, participatory approaches remain subject to power dynamics that both limit participation and maintain existing power structures [40,41].

Power asymmetries in environmental management raise fundamental questions about whose voices are heard and whose remain silent. Which social identities are deemed powerful and legitimate, and which are undermined or undervalued? Whose knowledge is included, and whose is marginalised?

Anthropocentric approaches to environmental management therefore present significant challenges for enabling children's engagement in environmental issues because they see children as recipients of messages and not active knowledge creators; they reinforce unequal power relations [42] and do little to bring about change in systems of power that maintain western ideologies and marginalise voices beyond science. This leads to environmental and epistemic injustices [43].

2.2. Epistemic Injustice and Power Asymmetries

Fricker [17] (p. 1) describes epistemic injustice as "a wrong done to someone specifically in their capacity as a knower". Many scholars alongside Fricker contend that ideas, opinions, and knowledge matter for meaning-making, and so marginalising people based on their social identity can affect their ability to participate as active agential societal actors [11,44]. As Fricker says, "it cramps the very development of self" [17] (p. 163).

Fricker identifies two forms of epistemic injustice. The first testimonial injustice assigns a lower level of credibility to a person simply because of their social identity, and so they are not taken seriously or valued for bringing legitimate knowledge to an issue. Testimonial epistemic injustice stems from what Fricker (p. 27) calls "identity-prejudice", whereby social identities are shaped by social imagination that contains sets of assumptions about how social identities are to be viewed and treated [45]. For example, in environmental management, knowledge hierarchies can privilege scientific knowledge over other knowledges such as traditional indigenous knowledge [44,46,47]. Indigenous

Māori scholars argue this is deeply ignorant of Māori knowledge and culture [48] and colonially paternalistic [49].

The second form of epistemic injustice identified by Fricker [17] is hermeneutical injustice. Fricker claims this occurs when society's "collective interpretative resources" (p. 2) do not recognise a person's experiences because the experience simply does not exist as part of collective understanding, and so falls into a "blank gap in the available conceptual resources" and institutional structures that leads to marginalisation. This can be seen, for instance, in New Zealand power structures of colonial educational systems that marginalise Indigenous pedagogies and knowledges, such as mātauranga Māori, leading to lessons and teaching contexts following more didactic and directive-top-down ways. Holistic Māori approaches to education known as ako torowhānui which involve whānau (the family) in their tamariki's (children's) learning are usually discouraged from being part of the school classroom environment [50]. In colonial education systems, power structures therefore marginalise indigenous ways of knowing and doing.

The principal underlying cause of epistemic injustices therefore lies in unequal power structures. In environmental contexts, knowledge practices that are maintained and entrenched in power structures, such as in environmental management and funding structures, leads to epistemic injustice by deeming only some voices as ecologically worthy [51]. In these contexts, children are typically seen as recipients of environmental messages and not as knowledge creators who wish to make a valuable contribution to environmental decision-making.

2.3. Children and Epistemic Injustice

Studies are increasingly recognising that children experience and indeed are harmed by epistemic injustices in a variety of settings, most notably in health, for example [12,52], education, for example [10,44,53,54], law, for example [11,45], development and rural studies, for example [13,55], and in environmental issues, for example [56].

Scholars assign both testimonial and hermeneutical injustices to children's marginalisation. Marovah and Mkwananzi [13] claim children are disadvantaged by both social relations that shape how adults perceive them and through their limited ability to control others. They argue, that this provides a strong case for hermeneutical injustice, since social relations take place in adult-created and centred structures. Klyve [52] suggests that systemic power structures prevent children from making meaning of their experiences, and argue that undermining or undervaluing children's social standing, power, and epistemic legitimacy subjects them to testimonial epistemic injustices. Murphy [56], investigating climate change, found that youth were subjected to epistemic injustice caused by systemic structural factors that excluded them from political and policy-making deliberative processes. Bergmann and Ossewaarde [57] found that media framed children engaging in youth climate marches as 'dreamers' and 'truants'. Such framings affect a child's sense of epistemic worth. This may account for New Zealand researchers finding Year 12 and 13 youth had increasing levels of pessimism about environmental issues, and a decreasing sense of agency about how to meaningfully respond to these issues, compared to Year 9 and 10 youth [58]. The marginalisation of youth from public deliberations about global environmental issues has led to calls for more deliberative democratic processes to re-balance the power structures that limit children's genuine engagement in public deliberations and environmental and policy decision-making [56]. The container art project is a direct response to these calls for child engagement in environmental deliberations and decision-making.

2.4. Addressing Children's Epistemic Injustice

In considering how to address epistemic injustice through child participation using the creative arts, we draw on the extensive research and writings of Hickey-Moody, specifically Hickey-Moody et al. [19], and Heggen, specifically Heggen et al. [20], who

argue for child-centric and eco-centric approaches to promote children's engagement in environmental issues.

Hickey-Moody et al. [19] contend that children should be conceived as possessing the agency and capacity to contribute to society from an early age. They rethink western views of the public sphere that limit children's engagement and propose for the involvement of "more-than-human others" in publics which include "animals, plants, the built environment, rubbish, weather and (crucially) possibilities for change" (p. 24) to be recognised and valued. They (p. 26) claim that children assemble "little publics" when they call on or draw the attention of 'others' through, for example, art, play and performance. Taking expressive and alternative modes of communication seriously is viewed as essential if participation in the public sphere is to be widened. Art-based practices are seen as valid modes of civic participation and of "participatory community building" (p. 177), which can shape and change civic life, space, and relationships. When participating in art, children attend and respond to place, environment, ideas, materials, other people, and other beings and, in turn, these things attend to and respond to them in different ways.

Similarly, Heggen et al. [20] also rethink notions of child citizenship and children's connection to nature. They claim children are excluded from citizenship and political participation because of the perception of the child as not rational or complete. They propose an 'eco-centric' approach that is based on an "understanding of humans as part of the diverse life on earth, and that solidarity with the more-than-human world is necessary" (p. 388). This replaces the adult-centred view of children as not-yet-adults, with a more 'child-centred' understanding of children. They propose, "children as eco-citizens practising a child-sized eco-citizenship by their involvement in their local community and their local nature" (p. 391). They also call on the recognition of arts-based practices and play as valid forms of participation because, "In play, children create an imaginative space where their experiences and problems are investigated and where they produce something new" (p. 390).

Hickey-Moody and Heggen's concepts shift children's participation away from children having to be responsible for themselves or for planetary problems and towards valuing children's participation on its own terms, rather than expecting them to participate in the same ways as adults. Children are not seen as 'incomplete', 'fragile', and 'underdeveloped', or in a state of preparation for adulthood, but instead they are afforded "the same rights and capacities as adult citizens", but with a "different foci and goals from adult citizenship" [19] (p. 4). We revisit the key concepts of 'eco-citizenship', 'little publics', and 'more than human worlds' in the discussion section of this article to critically examine how effectively our child-centric approach using graffiti art on containers addressed epistemic injustice for children.

The literature provides a conceptual understanding of how child-centric approaches can engage children in imaginative and child-sized eco-citizenship to move engagement away from anthropocentric top-down approaches that limit the inclusion of knowledges and voices beyond science. However, it is less clear how these concepts operate in settings where epistemic injustices have led to children experiencing marginalisation from an issue of importance to them. As such the container art project fills an important gap in the literature by explicitly exploring how art-based practices may support children's engagement and develop their sense of agency in an issue where they feel they have been marginalised. The case also importantly contributes to understanding whether local initiatives that engage children can rebalance some of the underlying power structures that limit children's engagement in environmental issues. We turn now to presenting our case, methodology, and findings.

3. Case and Methodology

3.1. Background

The container art project was an emergent project that arose during the children's engagement with the Toitū te Ngahere (TTN) team in 2022, when the children and teachers

revealed a range of emotions including anger, frustration, and sadness at not being able to enter a neighbouring forest park due to its closure from kauri dieback. Central to the children's feelings was their repeated expressions of their loss of connection with the forest and frustration at not being able to contribute to the park's management. The park's closure occurred in 2018 when locked gates were unexpectedly installed by the city council at the entrance, with two official signs saying 'track closed due to kauri dieback'. The school had not been offered the opportunity to contribute in any way to the park's 'management' despite it being for many years a valued natural environment, educational amenity, and place the children enjoyed regularly visiting. This exclusion left a strong sense of marginalisation that was repeatedly raised by the children and their teachers during the year-long engagement with TTN.

The TTN team facilitated engagement with the city council who managed the park, initially through 50 individual letters written by the children, where they asked questions about the park's biosecurity status, its future management, and suggested ways they could contribute to its long-term management. This led to the council coming to the school to meet the children where it was agreed they would draw on their TTN experiences by using the creative arts to support the community's awareness and understanding of kauri dieback.

3.2. Case

The school offered two shipping containers on the school grounds to enable the children to use graffiti art to communicate their knowledge about kauri dieback and their visions for more sustainable environmental futures. In April 2023, fifteen Year 6 (10-year old) children, in their final year at primary school, agreed to engage in the container art project. The TTN activities and experiences provided the children with a foundational understanding of kauri dieback and forest health (ngahere ora) using science and mātauranga Māori, and through their engagement in the creative arts, so they could see themselves as epistemically worthy contributors to forest biosecurity [21].

A complementary storymap, with links to it from a large QR code on the containers, the school gates and eventually the forest park gates, records the children's journey with photos, video, and artwork [59]. The local community, who also did not have access to the park, were encouraged to visit the school to engage with the artwork and learn about kauri dieback from the children's perspective.

3.3. Methodology

A postgraduate tertiary student facilitator with experience in youth development and art-based education was contracted to manage the on-school engagement with support from TTN team members. Each weekly engagement session ran for 60 min over three school terms from April to November. These sessions were held during the school day, but the children attended outside their normal classes. Although no school teaching staff engaged in the sessions, on regular occasions a liaising lead teacher, the school principal, other members of the school community, including the school caretaker, and TTN members met to discuss the project and to manage logistics.

As Fricker [17] provides little advice on how to address epistemic injustice, the facilitator drew on three models from the participatory literature to inform the processes for engagement, Hart's [60] ladder of child participation was used to guide levels of engagement. However, to counter criticism that ladders of participation wrongly suggest a vertical hierarchy [61], the facilitator instead viewed the ladder horizontally, visualising it like a keyboard, where the children and the facilitator could move back and forth along stages of participation. For example, there were times where children were shown how to use a spray-can as acts of teaching, and there were times where the adults would remove themselves from a discussion, allowing the children to negotiate and decide on their own, as acts of deliberative democracy.

Additionally, Pohatu's Mauri Model [62] provided an approach to slow down the process of engagement. This model is built around "notions of *Mauri Moe* (the unrealised potential for change), *Mauri Oha*, (the need for change is acknowledged) and *Mauri Ora* (when change has been achieved)" [63] (p. 107, emphasis in original). Keelan [63] (p. 22) claims that, in a youth context, this model promotes "consideration before taking action". For example, it was clear early on the children were able to quickly create independent artworks, making individual decisions and depicting kauri dieback narratives that they illustrated by themselves. The challenge, however, was to develop a mural that shared their collective narrative, and achieving this required time and space to be allocated to understand their collective narrative and how they saw themselves in relation to kauri dieback.

The facilitator also drew from Dorothy Heathcote's *Mantle of the Expert*, "whereby a mantle of leadership, knowledge, competency and understanding grows around the child" [64] (p. 35). This methodology was implemented during collaborative discussions, drawing, painting, and reflection, where the children were constantly negotiating their own artistic material generated alongside their developing body of knowledge about forest ecology, kauri dieback, artistic practices, communication, and more. These negotiations allowed them to refine their own identities and purpose in creating their mural and to enable the facilitator to see what the children were seeing.

As the research was seeking to identify approaches that would foster epistemic justice through an iterative and inclusive action research project, opportunities were provided throughout the project for critical reflection. At the close of each session, time was allocated for the children, facilitator and TTN members to collaboratively plan and reflect on the development of the artwork and the processes of engagement. The facilitator compiled field notes at the end of each session to record her observations and reflections. Videos, photos, and artwork, which are included in the accompanying storymap, provided a record of the collaborative learning journey (see Supplementary Materials). Additionally, at the conclusion of the project, the children participated in a recorded 'go-along' interview walking around the containers with a TTN member to discuss and record their perceptions and reflections of their experience in the project. This interactive and dynamic qualitative research method captures participants' perceptions in a more natural way than structured interviews or focus groups [65]. Project reflections were grouped into themes [66] that collectively informed the key emergent findings presented below.

Prior to commencement, the research received human ethics approval from the University of Auckland as part of the wider TTN project. All children were aware of their engagement in this research project and they signed consent forms along with their principal and parents. The school's principal and staff also expressed full support for the project, its research, and the children's engagement in it.

4. Findings: Developing a Creative Process to Foster Epistemic Justice

Klyve [52] (p. 6) challenges researchers working with children to find ways to address epistemic injustice. The 'container art project' was conceived to meet this challenge by facilitating and fostering epistemic justice to support the children's desire to raise their community's awareness and understanding of forest biosecurity. At the same time, the project also sought to re-build the children's relationship with their neighbouring forest. However, Fricker [17] provides little guidance on how to promote epistemic justice.

Participatory approaches provide general principles and while our three models of participation provide a framework to guide engagement, they nonetheless do not provide a blueprint or specific roadmap for engagement [67]. We began from a starting point that viewed children as vibrant social actors who wanted to contribute their knowledge, ideas, and opinions to support the sustainable management of their neighbouring forest park. However, while some of us had years of experience as social scientists working in community-based research, this project like most participatory action research projects was an iterative learning-by-doing approach, co-created mostly on a week-by-week basis with the children. None of us—children and adults included—had any experience of

having ever painted art on shipping containers. The results we present in this section, therefore, are emergent arising from a dynamic, interactive, co-designed, and co-created child-centred approach.

We present four key themes that emerged as critical findings for developing epistemic justice when working with children. We illustrate each section with children's quotes from recorded discussions. However, as such methods for data collection largely capture only children's verbal reflections, we also encourage readers to visit the project's story-map to see the children's artwork, their videos, and project photos, and in so doing to view a rich array of data to supplement the verbal reflections that are contained in the findings below (see [59] or the article's Supplementary Materials to access the storymap).

4.1. Equitable Relationships

As senior students, the children had experienced the 'before' and 'after' reality of accessing their neighbouring forest park and then not being able to access it due to its permanent closure from kauri dieback. During the TTN project the children had expressed a deep sense of loss as a result of their inability to physically connect with the forest and a sense of powerlessness over a biosecurity decision that was out of their control, but which affected their daily lives. The TTN project had enabled the children to understand why the park was closed. While this provided important foundational learning, the container art project sought to build on this by supporting the children to develop a new relationship with the forest through the creation of the mural on the shipping containers.

By continuing TTN's approach to engagement with the children using the Māori concept of ako torowhānui (holistic learning), the learning process fostered the relationship by being an inclusive, student-led collaboration in all aspects of the project that reinforced the children's sense of empowerment. The children valued the collaborative nature of the process. As one child described, "The Tree Frog—I made it. I did the original design and [child's name] redesigned it and I painted it, so it was really collaborative".

To build the children's self-esteem as environmental communicators and to receive helpful feedback on their conceptual design, the children developed a short presentation for a class of new entrants and small group of teachers (see project storymap in Supplementary Materials). This allowed them to talk about the forest with children who had not had the same experience of seeing the forest open and then closed. It also enabled them to interact with an audience to explore how their narrative might be received. The children took the constructive feedback back to their project discussions to explore if they needed to modify their narrative.

To facilitate the children's learning journey and foster their sense of agency and epistemic worth and confidence, it was essential to establish and maintain an equitable, caring, and trusting relationship between the children and the facilitator, and with the TTN members who joined some of the sessions. Acknowledging the children's experience and also their social position in the school was important in the early phase.

The role of the facilitator was central to building a trusting relationship between the children and the adults in the project. The facilitator understood child-centred learning, youth development, and creative practices. While the TTN team joined into the project at various times, it was the facilitator who created the strongest bond with the children. Active and careful listening by the facilitator and the TTN members was critically important, as this demonstrated to the children their views, ideas, opinions, and justifications were respected without judgment. One student described the listening of the adults as "about as important as importance gets on a scale".

As a result of the relationship, the children were seen as knowledge creators, rather than through a predetermined adult perspective. This was critical given that the children recognised that their knowledge is often marginalised. As a child said, "some adults think because they are older, they know more, and they won't listen to anything you say". This was reinforced by another when they claimed, "when you are talking to adults, they pull a

very big poker face to make you think they are listening, but they are just nodding, and it is going through one ear and out the other".

The children's experiences coupled with the meaningful relationships they developed, reinforced their sense of epistemic worth as knowledge creators communicating about forest systems and forest health. The children's growing sense of epistemic worth was a direct result of the supportive guidance that flowed from the children's relationship with the facilitator and the TTN project team. As a child said about contributing to the community's resources of kauri dieback, "I feel very proud to know that you have done something".

4.2. Opportunities for Deep Engagement

A key objective of the learning process was to foster the children's confidence to develop their own artistic interpretations of forest health, using graffiti as an artform. To build confidence, the facilitator created a sense of excitement about using graffiti by introducing the children to the history of urban and graffiti art. They learnt about graffiti as vandalism, acts of writing, or 'scratching' messages in paint on walls. They learnt about the practice of graffiti art through the 1970s and 1980s, when graffiti 'writers' shifted to being graffiti 'artists', no longer solely interested in their content, but instead in how their message was created [68]. This created excitement amongst the children by their engagement with an art-form with a 'dark' political history.

A core practice initiated by the facilitator involved 'reading murals'. To do this, the children toured their school, identifying murals and artwork on walls around the grounds, spending time looking at them, then sharing one single word that came to mind when they viewed them. By using one identifying word, the children could share their thoughts without needing detailed explanation. This allowed space for others to respond non-judgmentally. Children started to recognise urban art in their community. They would come to the sessions excitedly sharing a few words of what they had 'read' in a mural they spotted from the back seat of their parents' car. This practice was integrated into how the children would read each other's creations as they emerged during the project's various stages.

The children needed to also develop artistic confidence. The facilitator got the children to begin by working on pieces of paper with paint sticks imitating the act of creating artwork on a larger canvas. Paint sticks encouraged a less specific way of drawing than a pencil or felt-tip pen, creating larger strokes with less detail. The paint stick provided a sensory experience where outline, colour, and shading changed with different strokes. Spray cans were introduced, and the children put together 'placards' about the environment for a school drama production. They also experimented using spray-cans on the container, practising the outlines of their own drawings. Although each child displayed various levels of mastery, these experiences contributed to both their individual and collective decisions about the artwork, as they considered bold, graphic reinterpretations of their illustrations to match their skill-base.

To promote the children's sense of agency, they were tasked with generating all of their own material. This celebrated their skill as child artists and their contributions to the collective narrative. The children benefited from the freedom the facilitator gave them of being able to develop far more material than would be needed, as this provided the opportunity to create and consider their own thoughts, opinions, and knowledge without being inhibited by the limitation of space. It combined both Pohatu's [62] and Heathcote's [64] participatory methods by empowering children to draw from and value their own knowledges, ensuring there was always time to deeply consider their individual and collective creations before taking action.

The children grew to recognise the need to slow the process down so they could consider things before taking action [62]. The children's recognition of engaging slowly in a process is represented by the following child's comment, "You have to go through the process, you can't just skip to the painting. If we did not learn about it, we would not understand it".

Combined, these experiences of deep engagement in a process of learning about artistic practice and forest health, developed the children's knowledge, skill base, and confidence to paint a mural the size of two shipping containers. It fostered in the children what Fricker [17] calls epistemic courage and epistemic worth. It resulted in the children recognising the value of meaning making to environmental communication. The children wanted their artwork to be meaningful and not simply beautiful as the following quote reinforces, "It does not matter if it looks good, it just has to have a meaning".

This desire for meaning in their narrative, over simply beautifully painted shipping containers, emerged as a direct consequence of their deep engagement as evidenced in the following children's comments. "It's not like we just painted—it's meaningful. Around the school there are lots of murals, some of them have a bit of meaning and some look really cool but they don't have a meaning". And another, "I have seen people painting things, little pictures of unnecessary things . . . there is this mural on my dairy and it's got like a skateboard on it to stop people spray painting, but it does not mean anything. They could have at least put some meaning into it". This prioritising of the narrative is further evidenced in the children's two visions of environmental futures painted on the shipping containers—a world with and a world without kauri dieback.

In addition their deep engagement in the process of learning led to them feeling proud for having persevered in a long learning journey, as evidenced by the following quotes; "You really need to trust the process". And another stated, "[Child's name] and I wanted to quit because we thought it was going to take too long, but we are both really glad that we stayed in". While another said, "We were kind of thinking, if you did quit you would not be able to finish it and you would then never know how good it was to finish it and to feel proud".

4.3. Spaces for Individual and Collective Thinking

Fricker states the marginalisation "cramps the very development of self" [17] (p. 163). To build self-esteem and develop individual thinking, workbooks were given to each child to provide a private space to journal their thoughts, feelings, and opinions in words and drawings and to practise sketches in their own time and during the sessions. Some children took their workbooks everywhere with them not knowing when inspiration would arrive. During a session, children would share a new creation and then work on transferring it from their workbook to a larger sheet of paper. To help them to share their sketches, children were asked to choose their favourite piece to enlarge, which avoided the facilitator from directing the child's choice of art. Children would sometimes seek their peers' opinions, creating opportunities for collaboration and empowerment that uplifted their self-esteem and reinforced their worth as knowledge and artistic creators.

The workbooks allowed the children to document their research and discoveries. The success of these books in building children's sense of epistemic worth about their continually growing knowledge of forest health was seen in the 'jottings' that children shared from these books. Some focussed on native animals which they independently researched, noting characteristics of endemic species to develop in their drawings. Others explored forest health and the positive and adverse effects of environmental and human impacts on te ao kararehe (flora and fauna). This learning was self-led and often involved personal discoveries that were not always shared.

While the workbooks encouraged individual thinking, a 'Design Wall' in the classroom in the form of a tree, known as toi rākau, provided a large space where children's sketches, drawings, and images could be pinned up for all to see. As the design wall grew and "turned into a big massive artwork", the children returned to 'reading' the artwork, slowly identifying repetitive images and colours. These observations were key for the children in making their later collective design decisions, informing for example their collective thinking around colour and motifs.

Group discussions were central to enabling the children to think as a collective to develop their narrative. Open-ended questions were used by the facilitator to provoke

discussion. For example, "If you make half the mural the sea and the other half the land, how would someone looking at the sea-side know your story of kauri dieback?" or "How do you wish to present your contrasting stories of kauri dieback and kauri/ngahere ora? How can you show 'risk and uncertainty or not knowing?"

These discussions enabled the children to develop the mural's collective narrative. They decided to present the land, the water, and the sky to show a connected natural ecosystem. They identified images from their design wall, such as maunga (mountain), te ra (the sun), and awa (body of water) as important elements in their narrative. They layered this with flora and fauna, including birds, frogs, mushrooms, and flowers. A key motif was a half-dead kauri tree. This reflected a real tree on a road near the school. It was a tree known to all, and this dying tree had been a dominant image in many workbooks. The children therefore drew from their own personal experiences and from their local environment.

By transferring their design wall to a smaller cardboard model of the shipping containers using a process of collage, the children were able to 'read' their mural using the previous technique of reading murals with one word. This revealed that their mural did not yet tell a story.

The children then decided to collectively focus their narrative on two contrasting environmental futures; a living forest and a dead forest, described colloquially by the children as the 'dead-side' and the 'alive-side'. The dead-side, painted in grey and white, showed a dire future which would be brought about by not responding immediately to the threat of kauri dieback. As one student stated, "if we sit back and relax now and leave it for another 10–15 years it will be too late". In contrast the brightly coloured alive-side, was as one child described, "This side is hope. So the hope is like—you see there is really green grass and there is no plastic and there is nothing in the water it is all clear. Everything is healthy".

Student-led collaboration enabled the children to think innovatively and creatively. They developed artistic iterations of microbes from the pathogen that causes kauri dieback inspired by a virtual reality show they experienced during one of their sessions. They referred to these as the 'kauri monsters'. These innovative fantastical characters were added to the mural in a size similar to the children themselves. On the white-and-grey-coloured dead-side of the mural, the brightly coloured kauri dieback monsters (pathogens) stood out to look "really evil and cartoony", and the choice of yellow and red colour made them "look more germy". Reflecting on their artwork as a way of communicating an important environmental issue, a child said, "I am very glad we did not just say it, I am glad that we can also show it".

The opportunities for individual and collective thinking that were provided in the project resulted in the children developing a message that had deep meaning and a strong narrative of alternative futures. Their innovative creations captured in their workbooks and transferred to the design wall for all to see led to their clear and central message that embraced both their individual and collective desire for action, urgency, and humans to take responsibility for the environment. As the children called out in unison at the conclusion of the project, "Look after the earth, save the kauri and start now". One child added, "Everyone must do their part. Everyone must do a little bit". They had developed epistemic confidence and wanted to share with their community their knowledge, vision, and call to action for kauri dieback and ngahere ora/forest health.

4.4. Time for Deliberation and Reflection

The slowing of the engagement process to enable time to consider before taking action as Pohatu [62] recommends, provided the time and space for deliberations. The facilitator provided space and time for the children to deliberate around a large table to reach decisions through consensus decision-making. However, on some occasions, the children could not agree. To promote the children's sense of agency they were invited to find their own ways through any disagreements, or as a child described, "we had to figure it out". On a few occasions, on a few challenging decisions, they opted for a voting process.

This occurred when choosing the containers' base colour, when diverse and divergent opinions emerged. Although not all children initially agreed with the chosen pale green colour, when eventually painted on the containers all agreed it was a "brilliant choice".

Opportunities for reflection are recognised as an essential component in adult learning as a way to think about and learn from one's experiences [69]. Similarly, reflection time was an essential component in the children's deliberative process. Reflection time often stimulated new ideas which were welcomed at all stages. Reflection time gave opportunities for the children to share what was working and what was not. It was in this reflection time that the children recognised and acknowledged how important the design wall was for their process of collective creativity. One student remarked, "It was the first time I forgot what work was mine and I knew even if I missed a class, all of it was our story". This shows evidence of a child valuing the importance of collective creativity and collective responsibility. Such thinking is essential for developing formative ideas around collective responsibilities needed by humanity to address environmental sustainability.

These experiences engaging in deliberation and reflection resulted in the children developing a changing relationship with the environment, one that recognised human impacts and responsibilities for the planet, as one child remarked, "I am a lot more vigilant person about the environment after these two years". While another student expressed her changing emotions about caring for the environment when she remarked, "If I am going to be honest, when I was little, I did not think it was fun to take care of the environment and now I kind of do think it is fun".

5. Discussion

In this section, we revisit Hickey-Moody et al. [19] and Heggen et al.'s [20] key concepts of 'eco-citizenship' and 'little publics' to examine our findings about how to address epistemic injustice using art-based practices. We also examine in what ways the container art project rebalanced the underlying power structures that Fricker [17] and others [70] argue drive epistemic injustices.

5.1. Developing Children as Eco-Citizens

The container art project provides evidence of how children can speak more broadly as eco-citizens practising what Heggen et al. [20] (p. 391) call "a child-sized eco-citizenship". Our findings show that these experiences allow children to engage with a "more than human world" that is relevant to them (p. 388). The children's engagement and growing sense of epistemic worth fostered positive relationships with nature through their engagement in the container art project, as evidenced by their comments, and their completion of the containers' mural which embodied a narrative showing contrasting environmental futures. Heggen et al. [20] highlight the link between curiosity and motivation to engage children in eco-citizenship. The container art project shows that when children are motivated, they can develop deep engagement in a process that allows them space and time to develop their individual and collective thinking with regard to vulnerable ecosystems. They show deep concern and interest in the future of the planet and can visualise different environmental futures depending on how quickly humans act. They want to be listened to and they want to be able to share with others their environmental views and visions.

Behavioural change approaches, which are favoured by anthropocentric positionings of environmental management to gain public acceptance of biosecurity controls, limit children's engagement and involvement in environmental issues since they view children only as recipients of messages and not as active vibrant knowledge creators. The container art project shows that child-centric approaches to learning which value children's views, knowledge, and opinions, can empower children in epistemically just ways to slow down, to dream, and to act to support positive environmental change.

Creative art practices undertaken in a child-centric learning environment, as documented in this research, can provide a way for children to express a sense of eco-citizenship. The children in the container project found it exciting in a slightly dark way to use graffiti

as an art form. Graffiti art on shipping containers offered a space for young children to comment and contribute from their own perspective through the act of narrative building, meaning making, drawing, and painting. Giving children agency to be 'dreamers' and 'activists' contrasts with the media's negative framings of these stereotypes [57]. As the children in this project show, it is exciting for children to develop 'how' a message will be communicated, and not solely 'what' they will say. Art-based practices provide an effective and engaging way for children to present material to wider audiences in meaningful child-centric ways.

5.2. Fostering 'Little Publics'

The findings show the importance of providing opportunities for children to critically think and deliberate about their understanding of their world and to collectively share in open and transparent ways. Collaborative tools such as the design wall and the reflective times provided opportunities to move beyond individual thinking, to work collaboratively, and to develop collective thinking.

The sessions which fostered discussion, debate, and other deliberative processes provided space for the children to develop their unique perspectives showing how "little publics are, by constitution, spaces in which young people are heard" [19] (p. 22). It also provided a space for children to bring into their publics the more than human world. This was evidenced in their mural which included mountains, rivers, the ocean free from plastic pollution, animals and birds—including a duck, gecko, and Myrtle the Emu, the half dead/half alive kauri tree from their neighbourhood which featured prominently in the centre of the mural, the 'kauri monsters' or pathogens, the factory billowing out smoke contributing to global warming, and the contrasting environmental possibilities—where humans act now to protect the environment and where they do not (see project storymap in Supplementary Materials).

A child-centred approach promotes epistemic justice by valuing children's perspectives. The container art project gave the children a sense of agency to express themselves in a distinctly unique way. Hickey Moody's concept of 'little publics' and art-making became valid acts of participation, enabling the children to communicate their environmental narrative and visions in ways that were relevant and meaningful to them.

5.3. Re-Balancing Power Structures

To address epistemic injustice requires the underlying power structures that cause such injustices to be rebalanced, as these lead to exclusion and marginalisation [17,70]. Local initiatives, however, are often criticised for not impacting on structural inequalities and for their limited ability to bring about any social change beyond those who participate [15].

Power structures were evident in the collective understanding and institutional structures of the agency responsible for managing the forest park, that did not recognise the children's experiences of connection with their neighbouring forest and then of their loss when it was closed. They also did not recognise the children's sense of marginalisation and feelings of exclusion from the environmental decision-making processes of a forest park that mattered to them and which they often visited. The children's sense of marginalisation was compounded by the suddenness and unexpectedness of the forest closure, the limited communication around the closure, and the agency's lack of ongoing engagement with the community over the long-term management of the forest.

Although the agency had not intentionally sought to marginalise the children, they nonetheless created a hermeneutical epistemic injustice. The agency's focus primarily on meeting regulatory obligations limited their ability to recognise those affected by their actions [36]. Furthermore, the agency had given little consideration to the likely wavering over time of community's acceptance of the forest park closure. We are not questioning the legitimacy of the decision to close the forest. However, the container art project shows that with such decisions comes social consequences and, concomitantly, we would argue,

responsibilities for environmental agencies to prevent affected communities from feeling marginalised and disconnected from their local natural environments.

Evidence from the container project showed that it did impact the underlying power structures that had led to the children's sense of marginalisation. The agency responsible for managing the park did visit the children at the school following the research team's approach, where they read the children's letters, engaged in dialogue, and explored options for ways that the children could be involved in the park's management. It was at this session that an extension project was proposed for a group of senior children to extend their engagement and learning from the larger TTN project and create artwork on forest health for the park's gates. The container art project emerged out of this dialogue.

While the agency was not actively engaged in the project's weekly engagement with the children, they have agreed to support an installation of posters derived from the container art on the park gates with a QR code to the storymap which tells the story of the project and which invites people to come to the school to view the containers and learn more about kauri dieback and the children's vision for environmental sustainability. In addition, the agency has expressed an interest in exploring how the project might act as a catalyst for other schools in the region to undertake similar initiatives to install children's art on the gates of other forest parks closed by kauri dieback.

Projects working with children should consider engaging policy and environmental agencies in their work. When this is done in a mutually respectful way, as occurred in this project, agencies and children can learn from each other and can explore ways to creatively engage children in environmental communication. The children's artwork has contributed to society's epistemic materials on kauri dieback and forest health through both the container art and the accompanying storymap. By facilitating the children's engagement through art-based practices and through their relationship with the agency, the children developed what Fricker [17] calls "epistemic courage". This enabled the children to establish a new relationship with the forest park, one that no longer required them to physically enter it, but instead where they could advocate for its protection. The agency's eventual recognition of the children as knowledge holders developed in the children a sense of epistemic worth.

The container art project also rebalanced the power relations that are often evident in the learning process. In addition to the child-centric approaches discussed above, the project also drew on TTN's approach to engagement with schools, which used the Māori concept of ako torowhānui (holistic learning). This approach embraces the various cultures students and teachers bring to a project, as a 'critical multiculturalism' to traverse and contest more normative individualist, disciplinary, and teacher–student hierarchical Western teaching techniques that isolate tamariki (children), particularly Māori, from their culture [71,72]. Holistic inclusive approaches to learning can benefit a wide range of learners by empowering them in the learning process. Furthermore, by drawing from Måori concepts of holistic learning, the container art project sought to address epistemic injustices that have also afforded lesser value to Indigenous Māori knowledge and approaches in educational settings.

6. Conclusions

Children represent one example of a marginalised group that faces epistemic injustices. This article deepens understanding about how to address children's sense of epistemic injustice in environmental sustainability contexts through their engagement in art-based practices. The children in both TTN and the container art project wanted to contribute to solutions to address forest sustainability and their reflections and artwork displayed both a sense of urgency to act and a responsibility towards protecting the forest and the wider natural world. The container art project shows that local environmental issues can provide suitable opportunities for children to engage and contribute to sustainability. This is particularly important when children feel marginalised from decisions that affect their ability to interact with their local environment. While the container art project worked with

only 15 children, the artwork and its accompanying resources extend beyond the children who participated.

The children's engagement in the container art project, and their reflections on their learning indicate that a child-centred approach which fostered an environment where the children's views, values, knowledge, and opinions were respected, enabled them to re-establish their relationship with their local forest park. Importantly, their re-established connection with the forest was no longer reliant on the children needing to enter the forest. By contributing to the forest's management as environmental communicators, the children told others about kauri dieback, and in doing so became advocates for the forest's closure to protect its kauri trees from kauri dieback.

We challenge largely top-down approaches of science outreach with children that focus solely on informing or educating children through didactic approaches to build their awareness and interest in science, as these treat children only as audiences of science messages. Programmes like the container art project that engage children as active learners and are child-driven and centred, can foster deep levels of engagement, and facilitate children's involvement in environmental communication. At the same time, children can develop meaningful relationships with nature. Importantly, they can also rebalance the power structures that may create epistemic injustice. When children, even young children are marginalised from decision-making, particularly around local environmental decisions, this can lead to a strong sense of loss, disconnection from nature, frustration, and even anger. Given the intergenerational nature of sustainability, children should have opportunities to contribute to addressing environmental issues.

Art-based practices can be seen to be particularly valuable for engaging children, as they enable children to be innovative and creative as knowledge contributors and to express their hopes and dreams for environmental futures in ways that are relevant to them. The marginalisation of art-based practices from science engagement can itself be viewed as an example of epistemic injustice. The container art project shows that engaging young children in programmes where they have opportunities to be creative and imaginative, and where the facilitators value their knowledge, ideas, and opinions, can foster children's epistemic courage and worth, and address epistemic injustices that otherwise continue to marginalise children from environmental issues and decision-making.

Limitations of the Research and Future Research

We recognise that transdisciplinary researchers partnering with schools, or with any organisation or community where there are marginalised groups, must commit significant time and resources to any engagement that seeks to address epistemic injustice. The siloed nature of science and academic institutions, and the westernised structures of schools with curriculum requirements and structured timetables, create significant barriers for this type of engagement.

We acknowledge that these projects are context specific, driven by local issues and local knowledge, so they cannot be replicated in an experimental sense. However, we hope others will draw from the key insights presented in our findings and discussion, and be inspired to explore similar engagement in different contexts.

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