



Worrying with Children and Water in ECEC: Exploring the Pedagogical framing Effects of Actions for Climate Change

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Abstract

Based on Sustainable Development Goals, a recent flurry of activity has begun concerning the responsibilities of teachers to support young children in recognising and responding to aspects of climate change. Less, however, is understood about the emotional impact of these interventions on children themselves, or the extent to which the way they are framed can impact on the actions that follow. The extent to which children are encouraged to worry about water and their responsibilities concerning its sustainability is of relevance to the children of Aotearoa New Zealand and orients the focus of this paper. Walking with 3–4-year-old children over several days across three early childhood education and care sites located near waterways in the South Island, researchers share examples of worrying that took place for these children as we walked together with water. Utilising Bilandzic et al. (Sci Commun 39:466–491, 2017) goal frames to analyse their significance, the ways children worried are explored in a series of narratives that identify as series of positive and negative frames and their consequences. The paper concludes by highlighting the considerable effects of worrying and their consequences for activating children towards climate action. Teachers are invited to take a nuanced view that ameliorates the counter-productive outcomes of negative frames that can immobilise action, in contemplation of positive frames with water as a relational encounter with potential for empowerment and change. As such, a shift from emphasising activities for climate change to the framings that orient their significance through children's worrying encounters with and about water.

Keywords Early childhood education · Water · Sustainability · Children · Identity · Culture · Bicultural curriculum · Pedagogy

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Resumen

Basado en los Objetivos de Desarrollo Sostenible, recientemente ha comenzado una oleada de actividad relacionada con las responsabilidades de los maestros de ayudar a los niños pequeños a reconocer y responder a aspectos del cambio climático. Sin embargo, se sabe menos sobre el impacto emocional de estas intervenciones en los propios niños, o en qué medida la forma en que se enmarcan puede afectar las acciones siguientes. PA1 El grado en que se anima a los niños a preocuparse por el agua y sus responsabilidades con respecto a su sostenibilidad es de relevancia para los niños de Aotearoa Nueva Zelanda y orienta el enfoque de este documento. PA2 Caminando con niños de 3 a 4 años durante varios días a través de tres sitios de educación y cuidado de la primera infancia ubicados cerca de vías fluviales en la Isla Sur, los investigadores comparten ejemplos de preocupación que tuvo lugar para estos niños mientras caminábamos juntos con el agua. Utilizando Bilandzic et al. (Sci Commun 39:466–491, 2017) marcos de objetivos para analizar su significado, las formas en que los niños se preocupan se exploran en una serie de narrativas que se identifican como una serie de marcos positivos y negativos y sus consecuencias. El documento concluye destacando los considerables efectos de la preocupación y sus consecuencias para activar a los niños hacia la acción climática. AQ3 Se invita a los docentes a adoptar una visión matizada que mejore los resultados contraproducentes de los marcos negativos que pueden inmovilizar la acción, contemplando los marcos positivos con el agua como un encuentro relacional con potencial para el empoderamiento y el cambio. Como tal, se debe pasar de enfatizar las actividades para el cambio climático a marcos que orientan su significado a través de los preocupantes encuentros de los niños con y sobre el agua.

Abstrait

Sur la base des objectifs de développement durable, une vague d'activités a récemment commencé concernant les responsabilités des enseignants pour aider les jeunes enfants à reconnaître et à répondre aux aspects du changement climatique. Cependant, on comprend moins bien l'impact émotionnel de ces interventions sur les enfants eux-mêmes, ni la mesure dans laquelle la manière dont elles sont formulées peut avoir un impact sur les actions qui s'ensuivent. AQ1 La mesure dans laquelle les enfants sont encouragés à s'inquiéter de l'eau et de leurs responsabilités concernant sa durabilité n'est pas pertinente pour les enfants d'Aotearoa, en Nouvelle-Zélande, et oriente l'objet de ce document. AQ2 En marchant avec des enfants de 3 à 4 ans pendant plusieurs jours dans trois sites d'éducation et de garde de la petite enfance situés à proximité de cours d'eau dans l'île du Sud, les chercheurs partagent des exemples d'inquiétudes que a eu lieu pour ces enfants alors que nous marchions ensemble avec de l'eau. En utilisant Bilandzic et al. (Sci Commun 39 : 466-491, 2017) des cadres d'objectifs pour analyser leur signification, les façons dont les enfants sont inquiets sont explorés dans une série de récits qui s'identifient comme une série de cadres positifs et négatifs et leurs conséquences. L'article conclut en soulignant les effets considérables de l'inquiétude et leurs conséquences sur l'incitation des enfants à l'action climatique. AQ3 Les enseignants sont invités à adopter un point de vue nuancé qui atténue les résultats contreproductifs des cadres négatifs qui peuvent immobiliser l'action, en-

contemplant des cadres positifs avec l'eau comme une rencontrerelationnelle avec un potentiel d'autonomisation et de changement. En tant que tel, on passe de l'accent mis sur les activités liées au changement climatique à des cadres qui orientent leur signification à travers les rencontres inquiétantes des enfants avec et à propos de l'eau.

Introduction

The impacts of climate change are now difficult to ignore, and this is especially the case for younger members of the population. There is growing evidence to suggest that youth are worrying a great deal about the planet in general, and that they are frustrated with the lack of action taken by older generations (Goldman, 2022; Hickman et al., 2021; Ritchie et al., 2023; Thunberg, 2023). Davidson and Kecinski (2022) emphasise the negative emotional impacts of such worrying in the absence of action, since young people do not have the opportunity to influence politics in the same way adults do. According to Bilandzic et al. (2017) these negative framings—where youth feel powerless to bring about change—can lead to feelings of hopelessness and despair. Conversely, worrying can also act as a galvanising force for active change and empowerment when framed appropriately (Goldman, 2022). As a consequence, there are urgent calls for better understandings of the effects of worrying on young people, and the extent to which it can lead to action for climate change or, conversely, inertia and feelings of despair.

Considerably less is known about the emotional reactions of preschool children to climate change, or to the framings that impact on their responses. While Sustainability Development Goals (United Nations, 2023) and education for sustainability guidelines are now being widely implemented by early childhood education (ECEC) teachers (OMEP, 2021), little attention has been granted to the emotional aspects of these efforts. By association, the extent to which young children are emotionally burdened or activated by these framings appear to be largely overlooked in the promotion of sustainable approaches to learning. Emphasis is placed on activities that may bring about awareness of sustainability, but little is known about the emotional framings that are associated with these, or their consequences.

This paper explores a series of 'worryings' that took place for young children across three ECE sites in bicultural curriculum in the South Island of Aotearoa New Zealand (hereafter described as ANZ), as part of an international pilot case study (Authors, 2023). Borrowing from the frames of worrying of Bilandzic et al. (2017) frames of worrying with adults, we explore examples of different kinds of worrying that took place in preschool children's everyday experiences with waterways. We ask if children are worrying about water and, if so, how are these worries expressed in curriculum. Our discoveries suggest that these children are worrying a great deal about water and that teachers were framing these worries in a variety of ways, with diverse consequences. We explore how various framings of water—utilising bicultural understandings as part of a bicultural curriculum—can influence the ways worrying can lead to positive action for climate change versus fear and inertia. We argue for nuanced attention to the effect of the framing effects of young children's worrying—those that more positively orient towards relational responsibility,

collectivism, hope and action for sustainable engagement with waterways in ways that are appropriate for young learners and their localised contexts.

Worry and Climate Change

One in five youth feels unprepared for climate change based on their education and are asking for more information to grasp its complexity. Youth have emphasised the need for interdisciplinary, action-oriented education that is both globally relevant and tailored to local realities, along with adequate teacher support. (United Nations, 2023, p. 39).

Teaching about climate change and sustainability poses its own challenges around children's hopes, desires and anxieties about the future of the environment (Everth et al., 2021). Emotions such as worrying are widely known to play a significant role in motivating action (or inaction) for climate change. Current interventions in education that are focussed on motivating climate change rely to some extent on emotional responses to the negative effects of global warming as personal threat which are perceived as a trigger for action (Davidson & Kecinski, 2022). Studies (Bilandzic et al., 2017; Ritchie et al., 2023) suggest that intense emotional distress of this nature can have the *opposite* effect when accompanied by feelings of powerlessness, doom, grief, guilt, despair or fear. These effects can be especially felt by younger members of the population who do not yet have the opportunity to activate change on adult terms (e.g. by voting, through policy, etc.) and who rely on adults to provide access to the necessary information.

Greta Thunberg was one of the first youth to publicly declare her worries about climate change—establishing a global movement of youth activists who share similar concerns (Thunberg, 2023). In a recent survey of 10,000 young people aged 16–25 years across 42 countries, Hickman et al. (2021) found that 59% are extremely worried about climate change, with 45% reporting that their daily lives were affected by negative thoughts and feelings of betrayal by adults—which the authors describe as “moral injury” (p. 864). The authors describe young peoples’ feelings of being let down by their governments and seeking reassurance in what they perceive to be a lifelong fight for their environments. Similarly, Ritchie et al. (2023), in a recent set of focus group interviews with Māori and Pacific youth and young activists from age eight to their early twenties identified feelings of grief and despair—calling for educators to help them learn “how to deal with the fact that they’re growing up in a world that is literally on fire” (p. 25). Youth in this study asked for teaching programmes that were values-based and which offered strategies for successful change and hope. Such strategies were identified to be more accessible through cultural frames for engagement which move beyond what one interviewee described as monologic “white saviourism” to relational encounters that take account of diverse frameworks for understanding. Davidson and Kecinski (2022) reinforce this point, arguing that reasoning comes only after emotional responses, suggesting that taking account of these from the outset is more likely galvanise individual and collective

action where threats are perceived as both worrying and real—leading to feelings of belonging, connectivity and solidarity that, in turn, validate personal identity and the capacity to contribute to change.

Goldman (2022) cites seven kinds of grief that may be experienced as a consequence of worrying about the climate. These include i) environmental grief (due to observed loss of ecologies and landscapes); ii) anticipatory grief (where loss is anticipated sometime in the future); iii) dis-enfranchised grief (in cases where concerns are trivialised, dismissed or ignored); iv) collective grief (where climate effects are felt by all); v) prolonged (often evidenced in social media); vi) retraumatised (as a consequence of repeated climate disasters) and vii) relentless grief as a consequence of ongoing trauma caused by the impacts of global change. Evidence from 12-year-old children (Ojala, 2012) has suggested three primary routes that young people use to navigate troubling concerns about the environment. Coping strategies can see children dealing with their feelings of worry by: (1) working to avoid the feelings (emotional), (2) finding solutions to the issue (problem-focused) or (3) finding ways to generate positive emotions about the issue (meaning-focused). With climate change as a stimulus, these strategies all centre on dealing with emotional reactions such as anger, guilt and worry (Davidson & Kecinski, 2022) and finding ways to respond appropriately (Goldman, 2022).

According to Bilandzic et al. (2017), based on a German case study of sample adult populations (aged 18 years to 60+), perceptions of climate change threats and responses based on worry can galvanise positive or negative action, depending on how they are presented. In other words, it is *the way climate change is framed* that orients the outcome of worrying (or related emotions) for action. The authors explain that a ‘positive goal frame’ looks at what would be gained when a recommended action was taken, motivating action; while a negative frame focusses on what would be lost if an action was not taken, thus increasing the perception of threat. The authors suggest that certain combinations of positive and negative frames can lead to change when framed as ‘gain-negative’—a framing that recognises that there is a worry, but also looks for solutions as a consequence. However, if the framing is too optimistic or ‘hopeful’ it can decrease perceptions of threat and eliminate the need for sacrifice. Conversely, if the framing is too negative, it can immobilise action through fear or inertia. The extent to which one or the other is activated will depend on the group involved, calling for nuanced approaches in cases of vulnerable populations with limited opportunity to activate change.

(i) Climate Change and Young Children

Treble et al. (2023) suggest that climate change should be viewed as an existential threat for children, as it is likely to affect every part of their lives—including their early development. Since 2008, OMEP have focused on raising children’s voice, sustainable practice, intergenerational dialogue and equality (Engdahl, 2015) to support learning around sustainability and the environment in early childhood settings. Recent calls to “ensure that all learners acquire the knowledge and skills to promote sustainability development...” (UNICEF, 2023, 4.7, p. 16) as both a right and a responsibility increase these obligations.

United Nations (2023) argue that “Interventions during early childhood and adolescence can prevent subsequent limitations...” (p. 52) and commits to transforming early childhood care and education to address these issues. Momentum is building in this regard, with international as well as national curriculum guidelines for young children now targeted interventions on the part of teachers (OMEP, 2021; UNESCO, 2022). However, UNESCO’s (2019) survey of curricula across ten case countries suggests a declining pedagogical emphasis on the social or emotional dimensions of sustainability, in favour of cognitive or social aspects.

Studies of the emotional responses of very young children to climate change, and how these are framed in curriculum appear to be less prevalent in the literature according to Furu et al. (2023). There are several reasons for this, not least as a result of perceptions that “the youngest age groups may not have the cognitive maturity to truly understand the problem” (Ojala, 2019, Coping strategies section, para. 1), or views that young children should be spared from such worries. As a consequence, much of the literature concerning young children and climate argues for the engagement of children in nature, in order that they might develop a love and respect for it, leading to a long-term attitude of guardianship (Kelly & White, 2012). According to Jones and Greenway (2021), such engagement promotes positive outcomes for young children such as: more creative play, social and cognitive development, as well as considerable health effects including enhanced immune function and better psychological health. Ritchie and Alcock (2018) further suggest that making connections with nature establishes young children’s sense of obligation about their roles and responsibilities in becoming advocates for climate change in their own right (see also Mackey, 2012).

(ii) Why Worry About Water?

Water courses through many of the Sustainable Development Goals (hereafter “SDGs”) that have been established to promote sustainable practices for our future world¹ (United Nations, 2015). The 2030 Agenda for Sustainable Development (United Nations, 2015) specifically call for conservation of waterways, and associated biodiversity, ecosystems and wildlife, including the effects of water scarcity and pollution. Despite this ambition, a recent report (United Nations, 2023) calls for lifelong learning approaches to address further decline to water health and associated priorities are now seen as a long-term solution, implicating governments and local communities, and which are inclusive of ECEC.

Water is thus a central theme to explore concepts related to sustainability and climate in ECEC along with opportunities for learners to explore and experience water in their natural, built and play environments (Chalufour & Worth, 2005). Water has also become a central theme for OMEP—according to Wagner and Samuelsson (2019) water provides multiple learning opportunities from a breadth of curricular vantage points. Yet, as Pacini-Ketchabaw

¹ In particular, those related to health and well-being (SDG3), quality education (SDG4), clean water and sanitation (SDG6), climate change, (SDG13), and life below water (SDG14) are implicated in these plans.

and Clark (2016) point out, water introduces a tension in ECE between its management as a resource (i.e. for handwashing, drinking, etc.) and its exploration as a curiosity (for play). The extent to which water should be presented as something to worry about, or not, and the extent to which such worrying brings about action for change, permeates this tension for the field.

(iii) Localised Worries in ANZ

As a country characterised by coastal communities, ANZ is seldom remote from water or the effects of climate change on its waterways. But as a bicultural nation water takes on even greater significance. Water is a source of food, drink, recreation, hygiene and washing, swimming; but it is also at the heart of *Mātauranga Māori* (hereafter “MM”) knowledge (Stevens et al., 2021). MM is grounded within the sharing of ancestral knowledge through waiata (songs), pūrākaru (stories), whakataukī (proverbs) and kōrero hītori (historical accounts). These are all ancient traditions in Māori culture which have been used for many years as the tools for the transmission of intergenerational knowledge: these convey traditional values and foster communication. While often wrongly relegated to the genre of ‘myths and legends’ oral traditions are central to the sharing of philosophy, knowledge culture and worldviews (Lee, 2009). *Te reo Māori* (the Māori language) is mapped onto these waterways through the *wai*.² The question often asked by *tangata whenua*³ “*Nō wai koe*”⁴ is therefore viewed as a fundamental form of identity located in place. In this worldview, education for sustainable practices starts from the day a child is born into the world⁵—out of the water of the womb—where they will be expected to play a lifelong custodial role. Guidance is offered based on traditional forms of navigation and the *maramataka*.⁶ Water is thus viewed by many as the source of all life and an obligation by all to care for. This view is reflected in language and cultural heritage⁷ As Stevens et al. (2021) explain: “Pūrākau and maramataka comprise knowledge critically verified and updated through time and therefore can be both accurate and precise” (p. 8.), forming the basis of localised responses to climate change with an emphasis on water.

From this MM standpoint, the devastating impacts of climate change on water provide a tangible living example of the colonisation of culture.⁸ These effects are keenly felt both historically (Beattie & Anderson, 1994) and in

² For example well known waterways and regions in Aotearoa NZ: *Waikato* (flowing river); *Waitaki* (weeping waters); *Lake Waikaremoana* (Lake of rippling waters); *Wairarapa* region (glistening waters).

³ The original inhabitants of Aotearoa NZ.

⁴ Translates to “who’s waters are you from?”.

⁵ *Te ao mārama*—the world of light.

⁶ *Maramataka* Māori begins each year in June/July with the reappearance of the Matariki star cluster to signal the New Year. This is now viewed as a pivotal framework towards implementing bicultural curriculum. The *maramataka* directs all engagements and interactions with the world, including the waterways and the actions that orient their sustenance.

⁷ Such as in *karakia* (incantations), *kōrero tawhito* (histories), *pūrākau* (stories) and *waiata* (songs and dance) and *whakataukī* (proverbs) to name a few.

⁸ The deprivation of land, resources and culture experiences by Māori because of colonisation for the past 184 years have had detrimental effects. Māori have had 159 years of intergenerational trauma and are still disadvantaged today in their own country.

contemporary worlds (Ritchie et al., 2023). From the mountains to the sea (Ministry for the Environment, 2019) and in terms of the way waters are governed, and by whom (Brown, 2023), MM ways of knowing, doing and being activate custodial responsibilities and responses concerning climate change both today and for future generations to come. From birth, the children of ANZ are fully implicated.

(iv) Curriculum Orientations in NZ ECE

water therefore plays a special role in the lives of the children (*tamariki*) of ANZ. Water is embedded within broad principles of a bicultural early learning curriculum framework (Ministry of Education, 2017) that invite children to utilise their working theories to make sense of the natural world (via the curriculum strand of ‘Exploration’), with connections to sustainability and climate change through goals encouraging an understanding of how they can adapt to change and build connections between land and people (via the curriculum strand of ‘Belonging’) (Ministry of Education, 2017). Embedded within MM frames of knowledge, curriculum emphasis is also given to lifelong obligations of care and accountability towards all living things (Kelly & White, 2012), with broader *Te Tiriti o Waitangi* obligations concerning *kaitiakitanga*⁹ (Browning, 2022) and the associated well-being of all.

Despite these commitments, the extent to which these approaches invoke children to worry about water, and the impacts of such worrying, are not well known. Drawing inspiration from the goal frames of Bilandzic et al. (2017)—which establish four ways of framing worries about climate change and the consequences of these—we look at the emotional implications of each frame as well as how it is activated within these ECEC contexts as a consequence. We look at the expressions of worrying by children themselves and speculate on their capacity to respond to climate change in their localised ECEC contexts as an outcome of these emotional investments.

Introducing the Study

The data that informs this paper draws from a pilot project that took place in November 2022 as part of a wider international project led by Western Norway University of Applied Sciences. The broad aim of the project was to understand how children conceptualise water and represent their discoveries in ECE curriculum across different waterscapes around the globe. The ANZ arm of this project focussed on the South Island—*Te Wai Pounamu*¹⁰—where the lead researchers

⁹ Implementation of resource management plans, strategies following Māori ways of knowing and doing to ensure that resources are sustained for all now and for the generations still to come.

¹⁰ *Te Wai Pounamu* derives its name from Indigenous Māori migration stories that refer to the bow of the canoe of Aoraki (also the name of a mountain), and translate to both water (*wai*) and precious greenstone (*pounamu*)—both of which hold special significance to Ngāi Tahu iwi (the principal tribe of the area). Water is used for special occasions such as cleansing, baptisms, blessings, for certain occasions. Together with local Government agencies and Hydro-power companies, iwi have worked together over a number of years to reduce the impact of both farming and aquatic pests on these waterways.

were located. A separate ethics application for this portion of the study was made to University of Canterbury ethics committee—which involved agreements between local ECEC sites (and their employers), teachers, families, children and iwi.

Three different ECEC sites in this region were selected for the ANZ study based on their location near to i) estuary (Site 1), ii) river (Site 2) or iii) ocean (Site 3). Each offered unique opportunities for understanding local waterways and their significance to sustainability. Each catered for approximately 40 learners aged between 2 and 5 years old. The qualified ECEC teachers across sites were informed by the ANZ curriculum—*Te Whāriki* (Ministry of Education, 2017)—and the stories from each of the local waterways themselves in establishing a localised curriculum response. ECEC sites were recommended to the research team by ECEC service management due to their knowledge of their teachers sustained and declared commitments to climate change in their settings.

(I) Research Questions

The broader pilot study asked a set of generic questions about the ways children represent water, how they express these representations, and the presence of water in ECEC curriculum (Denton et al., 2024). However, given our emphasis on worrying, this paper orients to questions concerning children's specific expressions of their worries about water, and the ways these are framed. We ask:

1. What, if any, worries do young children express about water in these ECEC contexts?
2. How are these worries 'framed' and what are the actions/inactions that arise as a consequence?

(II) Methods

The ANZ study was informed by walking-as-method approaches to data generation (Pacini-Ketchabaw, 2012) which called for the full immersion of four ECEC researchers and one photographer for up to four days per site (a total of 12 days). This method intentionally guided the researchers to collaborate with children by paying attention to the ways in which place, in this case water, held particular status for them. As Wintoneak and Jobb (2022) point out, this method allows researchers to exceed the taken-for-granted assumptions that underpin childhood narratives in their encounters with nature, opening up possibilities for nuanced pedagogical perspectives. In our case this meant granting access to children's emotional responses as well as experiences within the pedagogical frames at their disposal.

Walking with children in the current project meant that researchers walked alongside children as they engaged in their everyday experiences with water

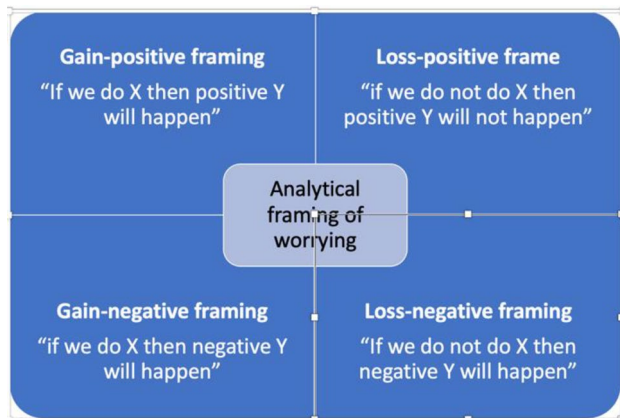
across the broad spectrum of the curriculum. Since each site included excursions to waterways as part of these experiences, researchers joined children and teachers on their trips to beaches or rivers and sat in on their discussions and representations about these and other aspects of water.

As researchers walked with children in and outside of their ECEC sites, they took field notes and photographs that were written into narratives about their various encounters with and about water. No data were taken without the express permission of the children themselves—who were invited to share their experiences as and when they wished. Photography included creative manipulations of images concerning children’s representations of, and encounters with, water as well as waterscape images, and are reported elsewhere (Denton et al., 2024). Narratives depicted the diverse forms of expression that took place and ascribed meaning(s) through rich textual descriptions and form the basis of this paper.

Each ECEC setting was approached initially through their employer—who recommended the sites based on their knowledge of their location and interest in sustainable practices. Due to the visual nature of the data and our emphasis on water and the landscape that surrounds the ECE service—it was not always possible to de-identify the centres involved, and this was clarified from the outset. However, assurances were given that individual faces would not be shown in any of the data generated and all data has been de-identified. As well as seeking written permission from each Kindergarten Association, Kaiako and families/whanau (by proxy) in each ECE centre, researchers additionally sought the verbal assent of children each day of field work *before* photographing or collating any of their representations. In the case where consent was not given, no aspect of that person’s representations were included in that data set. Processes of assent and consent were therefore utilised throughout the project—with researchers maintaining vigilance as to the comfort levels of all participants. A series of meetings took place prior to, and following, commencement of field work with local ECEC settings and the researchers, as well as their agenda, were introduced to children at group times from the outset of the project.

(III) Analysis

Analysis drew explicitly on a rich repertoire of 80+ narratives that were generated over 12 days. These provided insights into the different ways such worrying was framed in curriculum—by teachers and children themselves—and what this meant for their capacity to act upon these worries. The researchers interpret worry as a particular set of emotional responses to aspects of climate change concerning water, including fear, guilt, anxiety or uncertainty. Four framings of climate change and the kind of worrying effects they are likely to galvanise were classified, as follows:



Model 1 Frames for worrying. Drawn from Bilandzic et al. (2017)

In the section that follows we explore the extent to which the associated worrying frames that took place support children to see themselves as active agents in bringing about change, as opposed to indifferent, fearful and/or immobilised by their worrying. We also question the extent to which such framings are appropriate for young learners and explore some of the ameliorating pathways to positive action at our disposal.

Discoveries About Worrying About Water

Our analysis suggests that many of these children across the three ECEC sites were, indeed, worrying about water (and being encouraged to do so) in a variety of ways. Their worries were expressed in relation to the state of water, its preservation and the impact of its loss for animals and themselves. These worries brought with them considerable tensions as children made sense of the rules, routines and their own priorities in everyday curriculum experiences. Selected narratives below illustrate these, and their location in curriculum:

- (1) Worrying about the state of the water—its cleanliness and health. Such worries were observed during teacher-led group activities, peer play events and throughout excursions to the waterways themselves. Across all sites children were encouraged to attend to the ‘paru-dirty’ nature of water—primarily for their safety. The following narrative takes place during a teacher-led group activity:

i) A teacher has set up a board with a series of questions about water. She says “I want to know what you know about water” to a group of children as they are eating their lunch. One child lifts up his drink bottle and says, “You drink it”. The teacher responds: “Do we drink dirty water?”. The

children call out “Noooo” in unison before turning to discussions about rain followed by the functionality of water in toilets. [Site 2]

The second narrative highlights the associated tensions of such worrying, and their solutions that took place concerning the state of the water during peer play:

ii) During outdoor play there is a lot of drinking the water out of a water trough—either out of cups (or in the case of a younger child, sucked up the black pipes). A teacher nearby tells them not to drink the water because it is para (dirty), but they continue drinking, nonetheless. Relenting, she asks them what it tastes like and one child replies “like toothpaste!”. Two children bring an older peer a cup of water from the trough to where he is sitting. He watches as a younger child drink it and then looks at me and explains in a very serious tone—“It’s for pretend drinking you know”. [Site 1]

While the third illustrates worries about the state of the water during a regular trip to the beach:

iii) Several children are on the lookout for rubbish—they tell me they want to keep Papatūānuku¹¹ clean. As we walk, they pass plastic bottles and wrappers to the teacher so they can be put in the rubbish bins back at the ECEC site. Returning to the bottom of the cliff some of the children start to pick up large clumps of dry clay and throw them on the ground. A four-year-old tells me that last time he was here, there was “dirt up there, but the sea made it all fall down”. I watch as he experiments with the consistency of the clay—working out what happened when dry versus wet clay was thrown to the ground—before climbing the cliff. Another four-year-old begins to cry as he tried in vain to pick up rubbish with a stick. I ask him why he is using the stick. He tells me that he does not want to use his hands because he might get sick and that he thinks his grandmother might then get sick too and die. [Site 1]

- (2) Worrying about the preservation of water—its wastage. According to Siraj-Blatchford, Morgharrebán and Park (2016) economies of this nature are the most difficult aspect of learning for teachers. A similar tension was observed in the present study concerning the rules concerning water use for drinking, its preservation in play ‘with’ water or in routine events where water was a requirement. The former expressed in the following narrative:

i) After watching a peer fill up her drink bottle from the water fountain, a three-year-old boy attempts to follow suit. The teacher notices and says [name], remember we only fill our water bottles when they are empty that is the rule.” The boy becomes very upset, banging the table with his hand and stomping his feet on the ground. The teacher writes a note to the boy’s family and sticks it on the drink bottle. It reads: “[Name] really wants to

¹¹ Papatūānuku—Mother Earth.

fill his own drink bottle at Kindy but the rule is that it must be empty first. Could he come to kind with an empty drink bottle please?" [Site 3]

At this same site a reticulation system had been set up with the help of the children who expressed significant tensions in relation to the playful use of water and its preservation:

ii) A three-year-old boy—having observed his older peers filling their buckets from the rainwater tap and transporting the water to the sandpit—attempts to fill his bucket too. However, he is unable to turn the tap off and the water overflows. Others who are now waiting in the queue for the tap start to scream and run for the teacher. The boy runs away in panic as the tap is still running. I ask his peers: "do you know how to turn off the tap? A four-year-old replies "Oh...yes" and immediately turns off the tap. His peers continue the game in the sandpit, but the three-year-old boy does not return. He seems a bit shaken by the situation. [Site 3]

While at Site 1 and Site 2 water was preserved by means of limited access:

iii) The water is not limitless here, and children are reminded that their buckets are almost empty. The younger child tips the remaining vestiges of water out into the tyre rim. "Oh no" call his peers who quickly utilise teapots that are then transported to the garden to water the plants. Some carry the water to the sandpit where they explain to me, they are making pancakes—they experiment with consistencies and quantities, shouting out "too much" or "more" as they work together to achieve their goals.

Similarly, at Site One, children were encouraged to turn the tap off after washing hands, albeit through a different strategy:

iv) Towards the end of group time a teacher asks "Ko wai tēnei Ranginui¹²?" A three-year-old points this character out on the mural that the children made during Matariki. "Ae, his tears are pouring down. He was crying". Another child replies "The sky was raining", recalling the stories that were told at that time.¹³ The teacher softly replies: "Āe, he was crying. That is why we always must remember to be careful with water. In the bathroom we turn the tap off after we have washed our hands so that we can look after it". The children are then invited to go to the bathroom to wash their hands using this protocol. [Site 1]

- (3) Worrying about the impacts of water damage on the biosphere—a theme at the very heart of climate change. Firstly, through the dramatic play that took place between four-year-old boys who had considerable background and interest in fishing:

i) At the carpentry table two four-year-old boys want to use glue to make a hook to catch fish: "We gonna catch fish". "How many" asks the teacher. "We gonna catch a hundred!" one replies. "Remember" explains the

¹² Ranginui—Sky Father.

¹³ All three site's bicultural programmes follow the implementation of the maramataka Māori commencing with the rising of Matariki (in June-July of each year) and are steeped in the pūrākau, stories of the iwi that pertain to whakapapa (identity), language (te reo Māori) and culture (tikanga). These were evident in the artwork, waiata (songs), karakia (incantations), daily teaching kōrero (oral language) and assessment documentation.

teacher “we need to leave some fish for the other people. I think you are allowed 50 mussels a day... If you take too many the fisheries people will say you’ve exceeded your quota... If we take too many, what do you think might happen to the fish?” she asks. “None left” says one of the boys. “That’s right, they become extinct” the teacher affirms. “Mmmm poisonous fish food” one of the boys offers. “Uhuh” responds the teacher. And what would happen if we ate poisonous fish? “We would get sick” is the matter-of-fact reply offered to the teacher before both boys run off the boat in the playground with the hook and glue which is used to paint tiny leaves and sticks together (they seem to resemble fish?). “They are very poisonous” (carefully winding the wire around the leaf). “Wind it up!” That’s poisonous fish food. That’s poisonous fish food” they repeat as they use the wire to bring the ‘fish’ into the boat. [Site 3]

At this same site we observed some degree of panic about the impact of soapy water on animals. The centre had added blue dolphin signs around all the drains which children were very aware of and talked to the researchers about at length.

ii) Following prompts by his teacher, a four-year-old boy shyly explained to me that the soapy water goes from the drain “to the water treatment place” and that “the water is cleaned there with filters”. Later that day I observed him playing with a friend at the soapy water table where they are collecting bubbles. The boy explains to his peer: “I’m putting all the wastewater here! Oh no! Soapy water has gone to the ocean! We need to get the soap out and save the animals!” He retrieves some plastic animals from a nearby basket and puts them into the water. “All this wastewater can’t go to the ocean!” shouts his peer. “Into the wastewater container!” he replies as they pour the bubbles into a container. [Site 3]

And also evident in discussions following children’s experiences concerning the effects of climate change on fish during their regular excursions to water:

iii) Prompted to recall the impact of rubbish during a group time experience, a three-year-old points to a driftwood mobile that is hanging in the centre, made several weeks earlier and laden with rubbish. He says, “we go to the beach?”. The teacher replies “yes when we go to the beach, we always pick up the rubbish and put it in our pepe [bag]. If animals swallow that rubbish, they might get sick. They might think it’s food”. Later he asks, “We go beach today?” to which the teacher answered “I’m not sure, Tangaroa¹⁴ might be feeling hōhā [annoyed/irritated] today. If Tangaroa is on the rocks, we are not allowed on them, are we?” “No” replies te tamaiti. [Site 1]

¹⁴ Tangaroa—Atua Māori of the sea.

Table 1 Worrying frames and their consequences across ECEC sites

Worrying Frame	Outcome	Kernel state (as discerned from narratives)	Action by children
Gain-positive Positive action correlated to positive outcome	Accepts status quo and frames existing positive action and feelings of hope	“When we pick up rubbish; we keep Papatūnuku clean” [1iii] “Do we (that is, you) drink dirty water? Nooo reply to the children” [1i]	Children continue to pick up rubbish and preserve water as a result of its personalised importance Positive outcome is related to consensus and approval with no apparent rationale or consequence
Gain-negative Negative action correlated to positive action	Increases perception of threat, leading to action and feelings of sacrifice	“If we pick up rubbish, we will stop the soil eroding” “If we pick up rubbish and put it in our bag; the animals won’t swallow it” “If we stop bubbles going down the drain; the animals will be protected” [3ii] “If our younger peer tips water out of the trough; we can use containers to water the garden” [2iii] “If you turn the tap off after washing your hands, Ranginui stops crying” [2iv]	In both cases, children play an active and sustained role, and understand why based on long-term engagement/excursions in terms of their effects on land or animals Children are able to independently transfer actions to other spheres of curriculum, and support others to see their significance Negative action on the part of a younger peer invites older children to problem solve and develop alternative strategies Personalised rationale for action that creates an emotional frame to galvanise change
Loss-positive If a certain action is not undertaken, a negative outcome will occur	Increases perception guilt, evokes inaction in the absence of hope	“Don’t drink that (particular) water because it is dirty (and you will get sick)” [1i; 1ii]	Message ignored or agreed with in principle

Table 1 (continued)

Worrying Frame	Outcome	Kernel state (as discerned from narratives)	Action by children
Loss-negative Desirable outcome will not be achieved if a certain action is not undertaken	Increase perceived fear, may immobilise in the absence of action	"If you do not turn the tap off when your bucket is full (or spill it); you will waste the water" (2ii) "If you do not finish the water in your water bottle before refilling it; you will break the rules" [2iii] "If you catch too many fish; they will become extinct" [3i] "We do not go to the beach if Tangaroa is angry" "If I pick up the rubbish and get sick my grandmother might die"	Withdrawal from the experience (and peer group) by younger child, with older peers seemingly immobilised This rule has inadvertently caused extreme stress for this child (and their family). It is doubtful that their conceptions of water will be altered as a consequence The message conveyed by the teacher is ignored and potentially misunderstood (ie extinct versus poisoned fish) In this case the intention is to immobilise the action of going to the sea in the case of strong waves. An explanation that the children accept with ease based on their prior experiences The task of picking up rubbish has evoked a fear in this child concerning his grandmother who he is clearly worrying about already

Frames for Worrying

It is evident from these narratives that children across all ECEC sites were presented with many diverse opportunities to worry about water. Their worries were manifest in the emotional expressions, articulations and representations across curriculum that were shared with researchers as they walked with these children and their teachers. Returning to Bilandzic et al's (2017) frames for worrying, however, we discern a series of sources and outcomes that frame up very different outcomes for children's relationships with water as a consequence of the 'cause-and-effect' propositions at play. The differences here, conceptualised in the positive or negative wording of a "kernel state" (p. 468) which essentially outlines how the message is received and its consequences. According to this view gain-negative frames are more likely to evoke action as a consequence of perceived threat to inaction; while feelings of guilt—associated with loss-positive frames—may also galvanise action by pointing out the consequences of their lack of action. According to this view worry is a necessary feature of action for climate change. Its negative effects can be alleviated when there is a sense of hope that accompanies a willingness to sacrifice, and where there is sensitivity to the unintended consequences of actions. In the absence of this kind of response, sustained action is less likely. For this reason, the impact of negative frames is more likely to diminish over time; whilst frames that are too positive are less likely to motivate action.

In the Table that follows, each frame is summarised in relation to the narratives presented above, and the actions that followed (Table 1).

In each narrative conveyed in these ecologically oriented ECEC sites and the waterways around them, it appeared that worrying was a necessary stance on the part of these children. However, when worrying was not supported by adequate explanations of 'why' or in a pejorative manner, for example: generic rules, the effects on children appeared to be limited or, in some cases, upsetting. Alternatively, where worrying was established out of sustained relationships—with water, peers and teachers (and about animals or deities' children knew well)—and with a rationale that related to their experiences and understandings, it became a galvanising force for change and a strong sense of accountability (commitment to enacting *kaitiakitanga practices*) on the part of these children.

The mediating role of teachers cannot be understated here. Where teachers implicated themselves alongside learners in responding to the negative effects of water, or in reminding them of prior experiences of positive change, children appeared to view themselves more agentically—using 'we' pronouns, with peers taking on greater responsibility. *Te Whāriki* promotes and supports collective approaches through enacting whanaungatanga in action (strong working relationships to people and places; and with objects) as children know they are not alone, and that they have a wider set of acquaintances that provide support, assistance, nurturing, guidance and direction, when needed (Williams & Broadley, 2012). The influence of curriculum was thus keenly evident in these pedagogical frames.

Table 2 Atua Māori in relation to curriculum

Atua Māori	Guardian of	Dispositions	Enactment in curriculum
Ranginui	Sky	A strategist	The importance of planning
Papatūānuku	The land	Endurance, action, caution, hope, courage, judgement, fairness	Identity, health of the land and blood (waterways) reflects the health of the iwi. This is about the management of resources: through protection and sustainable practices
Tāne Mahuta	Forests flora, fauna	Action, caution, resourceful, strength, determination	Provider of shelter, food, tools. Karakia (incantation) to seek permission to use. Acts of respect and protection
Tawhirimātea	Weather	Attachment, bonding, unpredictable	Like the change in the weather so too are the changes in personalities and persona
Tangaroa	Sea	Perseverance, a provider of resources	Giving back first catch an act of conservation ensuring the continuation of the source

Framings where children were told what they *ought* to do or when generic rules are applied in negative frames appeared to be less sustainable in bringing about positive action and were often characterised by “you” pronouns. Loss-negative frames imposed by teachers may even be counter-productive, supporting the view of Bilzandric et al. (2017) that these can lead to increased feelings of guilt in the absence of avenues for action. In this case, burdening children with worry in the absence of shared commitment or capacity to bring about change.

Ameliorating these effects, the attention given to personified Māori Deities or Gods (hereinafter: Atua Māori) as a means of making sense of climate change enabled children to interpret their responses within more positive frames. That these personified characters are impacted by the actions of humans—what Lu (2016) describes as a sadness frame—combined with their call to personified call to action appeared to have a mediating effect on otherwise negative goal frames. Māori genealogical descent and lineage is interwoven within *Te Whāriki* as it alerts teachers to the importance of place-based education in executing authentic applications of bicultural curricula. Respect of Māori views of the world and the child’s connection through time to the land, to Atua Māori and to ngā tūpuna (ancestors). Atua Māori provide the platform that Māori refer to as ‘the realm of ultimate reality’ starting with the primal parents Ranginui (Sky Father) and Papatūānuku (Mother Earth) and their children reign over the various elements and environments of Te Taiao (the Natural World) (see, Williams et al., 2015; Ministry of Justice, 2001; Barlow, 1991). While water is specifically implicated through Tangaroa—the God of the sea—it is also connected to all other deities. Table 2 provides an overview of the significance of these combined elements for curriculum enactment in ANZ and their implications for learners:

Children were able to readily draw on these Atua Māori as a means of orienting their responses—with both a sense of hope and purpose that assisted them in not only understanding the effects of climate change on water, but in actions that transpired as a consequence (e.g. picking up rubbish along the waterways, strategic planting on the land, prayer before eating food, paying attention to the weather). Their capacity to do so was reinforced by teachers who understood the embedded nature of MM in their bicultural ECEC curriculum. Such engagements in the natural world that, according to Ritchie and Alcock (2018, see also Kelly et al., 2013) are already an embedded feature of ECEC teaching and learning programmes for many young children in ANZ, so perhaps this finding is not too surprising given the context and curriculum in which these children are embedded.

Concluding Remarks

The pilot study reported throughout this paper is based on a small number of ECEC sites where children had ready access to waterways with teachers who were attuned to the environmental significance of these, alongside the associated impacts of climate change. These teachers are therefore more likely to demonstrate a commitment to sustainability in their practices than those in other ECEC settings who may not share these aspirations. Furthermore, the locatedness of the sites in Te Wai Pounamu and within a bicultural ECEC curriculum establish a very particular context

that render all discoveries as context specific. For this reason, it is not possible to universalise the findings of this study, nor to make claims that we have fully represented the worries of these children, or their teachers for that matter.

The walking with methodology employed throughout this study also meant that researchers have only been able to report on what took place when we were present, or which was evident in the representations and stories that were told while they were there. We recognise that children may be worrying out of our sight and in dynamic, embodied ways that exceed our interpretations or understandings. In this regard we invite additional methodological routes to discovery through the voices of children themselves.

What is, however, possible to conclude from this pilot study is that water did not only provide a source of exploration and embodied learning for these children, but it also invited children to notice, recognise and emotionally respond to the detrimental effects of climate change on the waterways that surrounded their ECEC settings. The role of teachers and curriculum in facilitating these experiences cannot be understated. The pertinent question that might therefore be asked is therefore not whether children ought to worry about water, or be encouraged to do so by their teachers, but rather *how that worrying is framed*. As Bilandzic et al. (2017) suggest, such frames have potential to positively or negatively reinforce climate engagement; but the question of what “dose” (p. 484) should be given to any particular group remains unknown.

Our analysis has shown a series of different framings and their consequences for action, as well as some of the ameliorating effects for these young children. These bring nuanced orientations based on the specialised emotional needs of children and their associated dependence on adults in supporting their aspirations to climate change. In these ECE settings, where teachers share these aspirations, reminders or prompts concerning why actions are needed, or in many cases reinforced through everyday practices, are typically based on establishing a clear rationale for why they are necessary. Findings suggest, however, that these are less likely to be provided based on scientific explanations or lofty ideals for this age group, but through their lived curriculum encounters with water itself—reinforcing Davidson and Kecinski’s (2022) claim that emotions arise out of social interaction and feelings of groupness (that is, the ‘we’ as opposed to the ‘you’) and generating feelings of collective powerfulness and activating change. Conversely, if teachers assert their own views of climate change on children as a set of rules that ought to be obeyed, it seems that children are less likely to respond in a sustained and agentic manner.

A further finding is that MM knowledge appeared to make these understandings more accessible to children, as they connected empathetically with Gods [Atua/ whose stories they (and their teachers) regularly drew upon. Feelings of empathy are viewed as an important precursor to climate change because they have direct implications for affective and intuitive responses (Marx et al., 2007). As a consequence, engagement with these characters may have an ameliorating effect on the impact of certain framings because they support children to emotionally connect with water as part of a wider ecology in which they are collectively implicated but not burdened by personal responsibility alone. A similar trend is noted for animals, whereby children appear more motivated to change their behaviour when they see them as under threat and in need of their intervention—a theme also expressed by Goldman (2022).

Positive framings highlight the importance of relational encounters with waterways through regular engagements where upon children and their teachers play an active role in responding to the effects of climate change. Where they are framed around a gain it appears that they reinforce existing practices; while when a negative consequence is summoned to the frame children are motivated to act in more sustainable, hopeful and agentic ways. Conversely, negative frames tend to orient towards less mobilising responses on the part of children, as asserted by Léger-Goodes et al. (2022). While Bilzanic et al. suggest loss-positive frames may lead to feelings of guilt that galvanise action, we rarely saw this happening for the children in this study. The extent to which this is a result of their developmental capacity to cope with loss or their desire to see the relevance for them at this point in their lives—a point also made by Ojala (2019) and Goldman (2022)—that is worthy of further exploration for the field.

Returning to the SDG goals concerning climate change, the results of this study provide a potential route to addressing some of the most immediate concerns for young children's engagement with climate change through ECEC curriculum. They suggest that positive frames may hold more potential than negative ones for young learners, and that children are more likely to engage in sustained actions when they understand their implications for relational engagement—aligning with Goldman's (2022) discoveries of children in other cultural ECEC contexts and the call from Ritchie et al. (2023) for culturally relevant frames (Williams et al., 2023). Emphasising practical engagements over time with water, and realistic negotiations rather than imposed rules (or activities for that matter), appear to hold the greater potential for agentic actions on the part of young learners. Indeed, these results suggest that burdening children with weighty concerns about the effects of climate change may even be counter-productive, though ameliorated when framed through a relational stance. In this respect MM approaches to understanding climate change concerning water offer much potential for teachers wishing to frame climate change in ways that young children can not only understand on relational terms but, importantly, *act upon* as a result of their emotional responses.

Glossary

Aotearoa	Generally referred to as the Māori name for New Zealand
Atua Māori:	Māori Deities:
Ranginui	Sky Father
Papatūānuku	Mother earth
Tāne Mahuta	Atua of the forests
Tangaroa	Atua of the sea
Tāwhirimātea	Teacher
kaiako	Molecular weight of gas
kaitiakitanga	Management to enact the processes and practices of protecting and managing the environment and all tangible and intangible resources.
karakia	Incantations said to invoke spiritual guidance and protection

Kaupapa Māori	Asserts a position/topic (being carried out/discussed at this time) to be imbued within Māori ways of being, knowing and doing.
kōrero hitori	Oral historical accounts
Mātauranga Māori	Shared knowledge repositories across time, places and people.
Ngā Tūpuna	Ancestors
Nō wai koe?	From who's waters do you come from?
pūrākau	Oral stories
tamaiti	Child
tamariki	Children
tangata whenua	Original inhabitants
Te reo Māori	The Māori language
Te Taiao	The natural world
Te Tiriti o Waitangi	Te reo Māori written version of the Treaty of Waitangi NZ's founding dual heritage agreement doctrine
Te Wai Pounamu	The Māori name for the South Island of New Zealand
Te Whāriki	Colloquial name given to NZ's early childhood bicultural curriculum document.
ΔP	Differential pressure across PNT resistive element
tikanga Māori	Māori cultural customs and practices
wai	Water
waiata	Songs
Whakapapa Māori	Māori genealogical line of descent, lineage
whakatauki	Proverbs inclusive of hidden messages and meanings
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Declarations

Conflict of interest None to declare.

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References

- Author 2., & Broadley, M. E. (2012). *Resource kit for student teachers*. Ako Aotearoa. Resource kit for student teachers (ako.ac.nz)
- Authors 2 & 1, Denton, A., Gibbons, A., Mackie, G. & Author 3 (2023). *Expressions of wai in ECE: Te Wai Pounamu*. National report to international pilot project 2022: Wash from the start—Local conditions for children's access to water. *Expressions of Wai in ECE - OMEP Aotearoa*
- Barlow, C. (1991). *Tikanga whakaaro. Key concepts in Māori culture*. Oxford University Press.
- Beattie, H., & Anderson, A. (1994). *Traditional lifeways of the southern Maori: The Otago University Museum ethnological project, 1920*. University of Otago Press.
- Bilandzic, H., Kalch, A., & Soentgen, J. (2017). Effects of goal framing and emotions on perceived threat and willingness to sacrifice for climate change. *Science Communication*, 39(4), 466–491. <https://doi.org/10.1177/1075547017718553>
- Brown, S. (2023, 14 December). *Government to repeal Three Waters legislation*, <https://www.beehive.govt.nz/release/government-repeal-three-waters-legislation>
- Browning, C. R. (2022). *The woven Treaty—kaitiakitanga as a theory of the guardian relationships and principles of te Tiriti o Waitangi / the Treaty of Waitangi* [Doctoral Thesis, University of Otago]. OUR Archive. <http://hdl.handle.net/10523/13647>
- Chalufour, I., & Worth, K. (2005). *Exploring water with young children*. Redleaf Press.
- Davidson, D. J., & Kecinski, M. (2022). Emotional pathways to climate change responses. *Wiley Interdisciplinary Reviews: Climate Change*, 13(2), e751.
- Denton, A., Gibbons, A., Authors 1, 2, & 3. (2024). Ko Wai Au – Ko Wai Au: Expressions of Wai: Visiblising Pedagogies. *Video Journal of Education and Pedagogy*. <https://doi.org/10.1163/23644583-bja10050>
- Engdahl, I. (2015). Early childhood education for sustainability: The OMEP world project. *International Journal of Early Childhood*, 47, 347–366. <https://doi.org/10.1007/s13158-015-0149-6>
- Furu, A., Chan, A., Larsson, J., Engdahl, I., Klaus, S., Anna, M. N., & Niskač, B. T. (2023). Promoting resilience in early childhood education and care to prepare children for a world of change: A critical analysis of national and international policy documents. *Children*, 10(4), 716. <https://doi.org/10.3390/children10040716>
- Everth, T., Bright, R., Morey, C., dePetrus, T., Gaze, S., Barker, A., et al. (2021). *Building capacity for climate-change education in Aotearoa New Zealand schools*. Wellington, NZ: New Zealand Council of Educational Research.
- Goldman, L. (2022). *Climate change and youth: Turning grief and anxiety into activism*. Routledge.
- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., Wray, B., Mellor, C., & van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: A global survey. *The Lancet. Planetary Health*, 5(12), e863–e873. [https://doi.org/10.1016/S2542-5196\(21\)00278-3](https://doi.org/10.1016/S2542-5196(21)00278-3)
- Jones, L. & Greenway, K. (2021). The more children know of the natural world, the more they will want to protect it. *The Guardian: Opinion: Environment*. <https://www.theguardian.com/commentisfree/2021/aug/22/children-natural-world-protect-earth>
- Kelly, J. & Author 1. (2012). Pedagogy beyond the gate: The Ngahere Project. *Early Childhood Folio*, 16, (2), 5–11 <https://doi.org/10.18296/ecf.0136>
- Kelly, J., White, E. J., Dekker, M., Donald, J., Hart, K., McKay, F., & Wright, G. (2013). *The ngahere project. Teaching and learning possibilities in nature settings*. https://www.researchgate.net/profile/Janette-Kelly/publication/338189038_The_Ngahere_Project_Teaching_and_learning_possibilities_in_nature_settings/links/5e05f05492851c83649e2dd8/The-Ngahere-Project-Teaching-and-learning-possibilities-in-nature-settings.pdf
- Lee, J. (2009). Decolonising Māori narratives: pūrākau as a method. *MAI Review* (2).
- Léger-Goodes, T., Malboeuf-Hurtubise, C., Mastine, T., Gagnéux, M., Paradis, P., & Camden, C. (2022). Eco-anxiety in children: A scoping review of the mental health impacts of the awareness of climate change. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2022.872544>
- Lu, H. (2016). The effects of emotional appeals and gain versus loss framing in communicating sea star wasting disease. *Science Communication*, 38, 143–169.
- Mackey, G. (2012). To know, to decide, to act: The young child's right to participate in action for the environment. *Environmental Education Research*, 18(4), 473–484. <https://doi.org/10.1080/13504622.2011.634494>

- Marx, S. M., Weber, E. U., Orlove, B. S., Leiserowitz, A., Krantz, D. H., Roncoli, C., & Phillips, J. (2007). Communication and mental processes: Experiential and analytic processing of uncertain climate information. *Global Environmental Change*, 17, 47–58.
- Ministry of Justice. (2001). *He hinatore ki te ao Māori. A glimpse into the Māori world*. he-hinatora-ki-te-ao-maori.pdf (justice.govt.nz)
- Ministry of Education. (2017). *Te whāriki: He whāriki mātauranga mō ngā mokopuna o Aotearoa early childhood curriculum*. <https://www.education.govt.nz/assets/Documents/Early-Childhood/Te-Whari-ki-Early-Childhood-Curriculum-ENG-Web.pdf>
- Ministry for the Environment: Summary. (2019). *New Zealand's environmental reporting series*. <https://environment.govt.nz/assets/Publications/Files/our-freshwater-2020-summary.pdf>
- Ojala, M. (2012). How do children cope with global climate change? Coping strategies, engagement, and well-being. *Journal of Environmental Psychology*, 32(3), 225–233.
- Ojala, M. (2019). Eco-anxiety. *RSA Journal*, 164(5576), 10–15.
- OMEP. (2021). *Education for sustainable development (ESD)*. <https://omepworld.org/education-3/>
- Pacini-Ketchabaw, V. (2012). Acting with the clock: Clocking practices in early childhood. *Contemporary Issues in Early Childhood*, 13(2), 154–160.
- Pacini-Ketchabaw, V., & Clark, V. (2016). Following watery relations in early childhood pedagogies. *Journal of Early Childhood Research*, 14(1), 98–111. <https://doi.org/10.1177/1476718X14529281>
- Ritchie, J., & Alcock, S. (2018). Early childhood education in the outdoors in Aotearoa New Zealand. *Journal of Outdoor and Environmental Education*, 21(1), 77–89.
- Ritchie, J., Skerrett, M., & Glasgow, A. (2023). Young people's climate leadership in Aotearoa. *Journal of Peace Education*. <https://doi.org/10.1080/17400201.2023.2289649>
- Siraj-Blatchford, J., Mogharreban, C., & Park, E. (Eds.). (2016). *International research on education for sustainable development in early childhood* (pp. 1–11). Springer. <https://doi.org/10.1007/978-3-319-42208-4>.
- Stevens, C. L., Paul-Burke, K., & Russell, P. (2021). Putahitanga: The intersection of western science and matauranga maori in the context of Aotearoa New Zealand's physical oceanography. *New Zealand Journal of Marine and Freshwater Research*, 55(1), 249–263.
- Te Rūnanga o Ngāi Tahu. (ND) *Mahinga Kai*. <https://ngaitahu.iwi.nz/te-runanga-o-ngai-tahu/our-work-pou/strategy-and-environment/customary-fishing/>
- Thunberg, G. (2023). *The climate book*. Penguin Press.
- Treble, M., Cosma, A., & Martin, G. (2023). Child and adolescent psychological reactions to climate change: A narrative review through an existential lens. *Current Psychiatry Reports*, 25(8), 357–363. <https://doi.org/10.1007/s11920-023-01430-y>
- UNESCO. (2019). *Educational content up close: Examining the learning dimension of education for sustainable development and global citizen education*. <https://sepn.ca/resources/report-educational-content-close-examining-learning-dimensions-esd-gced/>
- UNESCO. (2022). *Tashkent declaration and commitments to action for transforming early childhood care and education*, World Conference on Early Childhood Care and Education: 16 November 2022. <https://unesdoc.unesco.org/ark:/48223/pf0000384045.locale=en>
- UNICEF (2023). *Mapping the global goals for sustainable development and the convention on the rights of the child*, <https://www.unicef.org/media/60231/file>
- United Nations. (2015) *Transforming our world, the 2030 agenda for sustainable development*, General Assembly Resolution A/RES/70/1. <https://sdgs.un.org/2030agenda>
- United Nations. (2023). *The sustainable development goals report: Special edition*. <https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals-Report-2023.pdf>
- Wagner, J. T., & Pramling Samuelsson, I. (2019). WASH from the START: Water, sanitation and hygiene education in preschool. *International Journal of Early Childhood*, 51(1), 5–21. <https://doi.org/10.1007/s13158-019-00236-5>
- Williams, N., Carroll-Lind, J., & Smith, L. (Eds.). (2015). *Tōku anō ao Māori. My very own world*. Wellington: Te Rito Maioha.
- Wintoneak, V., & Jobb, C. (2022). Walking laboratories: Experimentations with climate and waste pedagogies. *Children's Geographies*. <https://doi.org/10.1080/14733285.2022.2071599>