

# International Journal of Early Childhood Environmental Education

Addressing Policy, Practice, and Research That Matters  
Yash Bhagwanji, Editor

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**Yash Bhagwanji**, Editor  
Florida Atlantic University, USA

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## Editorial Note

### Early Childhood Protostars, Formative Entanglements, and Later Environmental Advocacies and Actions

**Yash Bhagwanji**

*Florida Atlantic University, USA*

Two of the lead articles in this issue address different parts of the process in understanding the enigma of children's connection with nature. One addressed the experiential entanglements of teachers from two different nature-based preschools, while the other addressed the many different types of entanglements involved in the process of connecting children with nature. The topic of children's connection with nature has been a long-standing interest of mine and many others and had, in fact, served as a significant motivator for the founding of this journal. While it may have been an intuitive notion early on, many supporters had unhesitatingly and inspiredly participated in the launch and success of the journal. The topic has maintained a prominent interest in the field-at-large today, as evidenced by the growth of research, related scholarly activities, and practices based on this foundation. My heartfelt gratitude to all contributors, including authors, researchers, reviewers, special issue editors, and leadership and staff at Natural Start Alliance and NAAEE, as always.

Following the journal's recent tenth year of publication, I took time to reflect on what had been achieved and what was needed to advance our collective work. After several months of both introspection and rumination, in relation to children's connection with nature, my thoughts clustered around two types of conclusions. One, more collective work is required to demonstrate the benefits of nature-based learning experiences on children's development, motivations, and educational outcomes. While research addressing these topical intersections has been represented prominently - and in a significant portion - in this and other academic journals, I do not believe we are quite there yet. More research is required, employing innovative and varying methodological configurations, that draw us further into contemplating and making sense at a deeper level regarding benefits of nature-based learning experiences for children. The second conclusion, it seems to me, is related to the first one in that there is an absence of convincing evidence that speaks to, or articulates about, associations among early nature-based experiences and later pro-environmental advocacies and actions. This gap, or lack of research, may be related to several factors, including dearth of nature-based early education programs and challenges related to conducting longitudinal studies. Nevertheless, I believe, where opportunities exist, many types of longitudinal studies are essential in understanding the nature of continuing pathways and needed supports along those pathways. Methodological innovations in research will be key again. Longitudinal research literature from fields of medicine, psychology, and sociology may be helpful in framing possible innovations in longitudinal research designs that trace children's early experiences to later pro-environmental behaviors.

A corollary thought that occurred to me related to the absence of more meaningful theoretical frameworks that linked children's early experiences and later environmental advocacy and action. While some of the traditional child development frameworks address life-span pathways, they do not, however,

explain or inform about trajectories specifically related to early nature-based learning and later pro-environment activism. I would like to speak more about this and offer a possible conceptualization using nomenclatures and ideas from astronomy and formation of stars, in particular.

Consider a *protostar* as being akin to an individual child who later adopts and practices pro-environment lifestyle, as a starting point. Protostars require further ignition and grow and expand to become stars. And consider stars to be individuals, each of whom are pro-environment in some way. Each star develops to produce a different magnitude of luminosity, and where each of the stars will affect the generation of new stars in different ways. See illustration below for a three-stage framework describing the astronomical process, followed by its alignment with nature-based early childhood development, growth in interest and sense of agency, and environmental commitments.

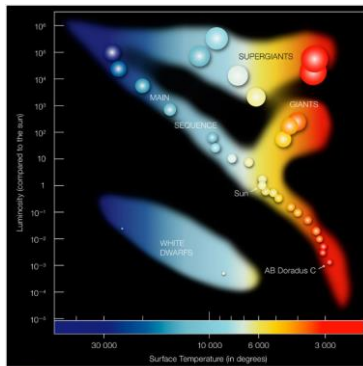
Stellar Evolution Globule Stage: Development of Protostars	Stellar Evolution Main Sequence Development: Ignition and Expansion	Stellar Evolution Main Sequence Lifetimes: Solar Magnitudes
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The Tarantula Nebula, captured by the Hubble Space Telescope, 3 February 2023

Source: <https://www.skyatnightmagazine.com/space-science/beginners-guide-nebulae>

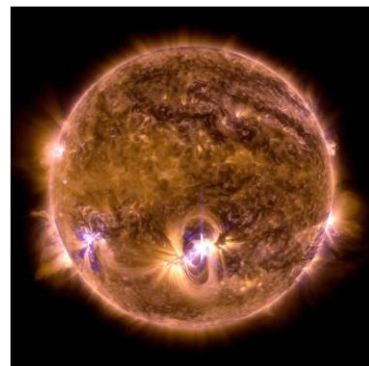
Nebulae are nurseries where protostars may be born. Each nebula composes of large clouds of cosmic matter and gases. Nebulae take many forms and not all nebulae produce protostars. A protostar, formed as a result of gravitational pull of gases into a ball, is a very young star.



CWDE ESO

Source: [The Life Cycle of a Star - Stages of a Star and More from Little Passports](https://www.littlepassports.com/learn/the-life-cycle-of-a-star)

Protostars expand and grow through nuclear fusion and complex cosmic entanglements. A protostar turns into a star when it has enough mass, reaches temperature of about 18,000,000 degrees Fahrenheit, and does not collapse under the force of gravity.



Our Sun, a main sequence star, emits a strong solar flare flares in this image captured by NASA's Solar Dynamics Observatory NASA/SDO

Source: <https://science.nasa.gov/universe/stars/>

Stars have different magnitudes of brightness or luminosity. The luminosity of each star is affected by its size, temperature, and amount of energy it generates.

Magnitudes of stars or suns include:

- Hypergiants
- Supergiants
- Bright Giants
- Normal giants
- Subgiants
- Dwarfs or Main Sequence Stars
- Subdwarfs
- White dwarfs

The energy and material cast by each star until its time of death affect the generation of new nebulae and new star formations.



**Experiential Funnel:  
Nature-Based Early Childhood  
Development**

**Experiential Funnel:  
Growth in Interest and Sense  
of Agency**

**Experiential Funnel:  
Environmental Commitments**



Source:  
<https://blogs.bcm.edu/2022/08/23/gardening-with-kids-promoting-healthy-eating-and-responsibility/>



Source: <https://floristkid.com/tree-planting-activity/>



Source:  
<https://www.childhealthinitiative.org/blog/2016/october/unicef-2-billion-children-affected-by-air-pollution-with-huge-health-impact>

Early experiences take many forms and are provided in many types of settings

Childhood and adolescent entanglements - formative influences through adolescence and later life

Strength of environmental advocacies and actions – different levels of commitment to environmental causes (conservation, restoration, and sustainability)



**EXAMPLES OF HELPFUL RESEARCH QUESTIONS**



What are the benefits of children’s connections with nature? How do enjoyable and motivating nature-based experiences look like? What experiences promote early development of pro-environmental behaviors?

What experiences promote ongoing development of pro-environmental behaviors in adolescence and adult life? How do adolescents become community leaders? What opportunities, supports, and skills development are required?

How may magnitudes of pro-environmental behaviors be conceptualized? What experiences and entanglements are related to the different levels of magnitudes or environmental commitments? What implications can be drawn to inform experiential funnels?

In applying this framework, please carefully consider the nuances of stellar evolution (i.e., nuances in experiential funnels in the human lifespan) and how concepts, entanglements, and transformations might

be appropriately aligned, defined, and studied in research and practice. For example, Ruth Wilson, a long-time educator, and Research Library Curator at Children & Nature Network, articulated the importance of child-nature reciprocity studies (personal communication, March 2, 2024). The topic of child-nature reciprocities alone can generate countless number of studies considering all the distinct variables available related to children, flora and fauna, contexts, facilitation and learning processes, settings, and possible outcomes. One other notion to keep in mind is that pathways moving through this proposed human lifespan are likely not to be linear. And lifespans are not separated into distinct experiential funnels either, but rather as singular flowing and enmeshed experiential funnels. Although this framework is rudimentary and unpolished in its presentation, the overall idea here is start generating lifespan views, and that it is both specific and generic enough to fit many explanations. Work is needed to start mapping the many pathways where children can be nurtured and guided on their journeys to becoming environmentally literate citizens and who, at the least, become main sequence stars. The proposed framework, and others that can be generated, must be frameworks that can accommodate many starting points or early experiences, many intervening influences, and many ways of expressing environmental advocacy and action.

Now I should like to further consider the idea of environmental commitments or the many ways of expressing environmental advocacy and action. If I may be presumptive and beg your indulgence, my proclivity for the Romantic verses may inform of a type of a priori outcome. The desired outcomes must ultimately be defined, I believe, if we are to have direction and advance in the work we do, through both a priori and a posteriori outcomes. Otherwise, the whole of the end result looms large and blurry and it would be difficult to link later advocacies and actions back to earlier experiences.

Consider these two quotations as examples of as possible intermediaries, nascent or concurrent requisites, or demonstrations of desired individual or collective environmental literacy outcomes, a priori as mentioned, that could be sought through our work in education and related fields (for those beguiled or to revisit, please see more complete verses in Appendix A):

***The exceeding beauty of the earth, in her splendour of life, yields a new thought with every petal. The hours when the mind is absorbed by beauty are the only hours when we really live... all else is illusion, a mere endurance.***

(From *The Life of the Fields* by Richard Jefferies, first published by Chatto & Windus of London, England, in 1884), and

***Inebriate of air am I,  
And debauchee of dew,  
Reeling, through endless summer days,  
From inns of molten blue.***

(From *I Taste a Liquor Never Brewed* by Emily Dickinson, first published in the Springfield Daily Republican, May 4, 1861, and later in the *Collected Poems of Emily Dickinson* in 1982)

I cannot resist, here's another one, from William Blake:

***To see a World in a Grain of Sand  
And a Heaven in a Wild Flower***

*Hold Infinity in the palm of your hand  
And Eternity in an hour*

(From William Blake's notebook referred commonly as the *Pickering Manuscript*, likely written in 1803, and later published in several collections of poetry and biographies of William Blake)

These three favored quotations have kept me in awe of everything nature. The verses have assisted me in making more meaningful and deeper connections. But how is one facilitated, or how does one get, to those state of minds, those states of deeply felt awe or emotion and understanding? I believe many of us - and not just environmental educators, naturalists, researchers of biological diversity, and nature advocates and conservationists - have cultivated different manifestations of this state of mind, some more purposely or intently integrating it in life and work (at the level of giant stars, if you will, in astronomical nomenclature presented earlier, or main sequence engagement at the least), while others content with ongoing journeys of further self-discovery (somewhere along a continuum of protostars, if you will) related to this sense of the mind. The process has seemingly many random components, beginning with the shaping of each nebula (akin to an individual child's early childhood environment and influences) to the many varied adoptions and consequences in environmental behaviors. And imbedded within journeys or pathways are consideration of different personalities and vast, diverse, competing, conflicting, and changing and dynamic social and cultural experiences in one's lifetime. The advocacy effort and work of Rachel Carson, Richard Dawkins, Jane Goodall, Wangari Maathai, Greta Thunberg, E.O. Wilson, and other trusted persons (or hyper- or supergiant stars, if you will), however and for example, does point to the power of this state of mind in influencing human actions for the greater good. Love of the earth at a deeply felt magnitude, to put it in another way, can be a significant leverage on individual actions. Many good people, both living and those who have passed on, have been involved in preserving the beauty of our earth through a wide range of thoughtful actions. Thus, circling back, and justifiably, the preoccupation with how early experiences influence later understanding and actions in the preservation of the earth's splendour has been, and continues to be, an important subject of study in many education and related disciplines. And, especially in recent times considering the urgencies about and surrounding children's futures, the concept has emerged as a forefront consideration in both early childhood education and environmental education disciplines of study.

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APPENDIX A

I TASTE a liquor never brewed,  
From tankards scooped in pearl;  
Not all the vats upon the Rhine  
Yield such an alcohol!

Inebriate of air am I,  
And debauchee of dew,  
Reeling, through endless summer days,  
From inns of molten blue.

When landlords turn the drunken bee  
Out of the foxglove's door,  
When butterflies renounce their drams  
I shall but drink the more!

Till seraphs swing their snowy hats,  
And saints to windows run,  
To see the little tippler  
Leaning against the sun!

(Emily Dickinson, *I Taste a Liquor Never Brewed*,  
in *Collected Poems of Emily Dickinson*, 1982, p. 28)

The exceeding beauty of the earth, in her splendour of life, yields a new thought with every petal. The hours when the mind is absorbed by beauty are the only hours when we really live, so that the longer we can stay among these things so much the more is snatched from inevitable Time. Let the shadow advance upon the dial - I can watch it with equanimity while it is there to be watched. It is only when the shadow is not there, when the clouds of winter cover it, that the dial is terrible. The invisible shadow goes on and steals from us. But now, while I can see the shadow of the tree and watch it slowly gliding along the surface of the grass, it is mine. These are the only hours that are not wasted - these hours that absorb the soul and fill it with beauty. This is real life, and all else is illusion or mere endurance. Does this reverie of flowers and waterfall and song form an ideal, a human ideal, in the mind? It does ....

(Richard Jefferies, *The Life of the Fields*, 1884, p. 14)

## Deconstructing Settler Colonialism in Early Childhood: North American Nature-Based Preschool Teachers' Perceptions of Nature

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### ABSTRACT

Nature-based early childhood education (NBECE) is a growing field for children aged 3-6 in North America. This growth demands the need for NBECE professionals. Often grounded in personal journey and perceptions, pedagogical practices of NBECE teachers play a vital role in learning experiences and nature-connectedness. This qualitative research delves into North American NBECE professionals' perceptions of nature, their journey into NBECE, and their responses to the pervasive influence of settler-colonial values in education. The data was generated through teacher interviews with four outdoor preschool teachers. Each teacher participated in two interviews. Between the two interviews they wrote a journal entry. At the end of the second interview, I led each participant through a cognitive mapping exercise in which they created a visual representation of their journey with nature. Findings indicated that these teachers have a close connection and history with nature. This often translated into their feelings about NBECE. Framed within settler-colonial studies, I deconstructed teachers' discussions to illuminate examples of resisting a nature-culture divide and human exceptionalism. I identified most teachers exhibiting awareness of settler-colonialism, with more experienced teachers thoroughly exploring their connection to its ongoing influence.

**Keywords:** early childhood, preschool teachers, teacher perceptions, settler colonialism, human exceptionalism, nature-based education

Nature-based early childhood education (NBECE) is growing tremendously (NAAEE, 2020, 2023) in North America. Teachers play a key role in nature-based education, particularly in preschool. While previous research has explored the views of preservice early childhood educators on outdoor settings (Ernst & Tornabene, 2011) and in-service teachers' perspectives on natural play (Wishart & Rouse, 2018), there is little discussion regarding the beliefs and perceptions of practicing outdoor preschool teachers concerning nature, particularly in the context of settler-colonialism and the separation of nature and culture. Therefore, I argue it is important to examine teachers' perceptions of the natural world in relation to the cultural or 'human' world, what Bang and Marin (2015) refer to as nature-culture relations.

Examining NBECE teachers' perceptions of nature is especially important if we are to find ways to resist dominate settler-colonial constructs of humans and nature as separate (Bang & Marin, 2015), ecological domination and extraction, and human exceptionalism (Nxumalo, 2018). I aim to reveal how teachers counter these constructs, shaping their nature-culture relations and pedagogical beliefs. Guided by the research questions below, my study unpacks teachers' views on nature, nature-culture relationships, and their reflections on settler-colonialism.

1. How do NBECE teachers conceptualize nature and their own nature-connection.
2. What is the perceived role of NBECE teachers in outdoor nature-based learning spaces?

3. In discussing nature and NBECE, how do these teachers perceive settler-colonialism, multispecies interactions, and human exceptionalism in their pedagogical roles?

### **Key Literature and Conceptual Framework**

Nature-based education (NBE) is gaining recognition in education and child development, with expanding literature supporting its significance (Bailie et al., 2023; Blackwell, 2015; Chawla et al., 2014; Ernst et al., 2021). As the field experiences growth and acknowledgment, there arises a demand for more professionals. NBECE teachers occupy a distinctive role in shaping children's school and nature experiences (McClintic & Perry, 2015). Hence, it is imperative to delve into this expanding domain, focusing on teachers' perspectives and pedagogies. The following literature review illustrates the necessity for preschool teachers to recognize the interconnectedness of multiple species and the presence of settler-colonialism within the early childhood education field in conjunction with the standing research on the influence of teacher perception on pedagogical beliefs and practices.

### **Nature-Connectedness: Responding to Entanglements**

In this growth, Nxumalo's work (2017; 2018) is a valuable guide to explore how children and educators respond to what she terms "multispecies entanglements" in which learning takes place within entangled multispecies social and physical worlds. This raises questions about how educators and children relate to non-human entities and acknowledge the *interconnectedness* of humans and more-than-humans. My study responds to these questions by considering a teacher's nature-culture relations, personal development of nature-connectedness, and how this shapes their pedagogical beliefs when working with young children.

Research underscores how outdoor experiences are integral to a child's sense of nature-connectedness (Barrable & Booth, 2020; Pruneau et al., 1999; Robson & Rowe, 2012). Further, strong nature-connectedness can support pro-environmental attitudes and behaviors (Chawla, 1999; Yilmaz-Uysal et al., 2020) and environmental stewardship (Bailie, 2012; Chawla, 1999). This above research establishes that nature-based education not only has a positive influence on child development, but also on a child's ability to bond with the natural world. Coming to intimately know the natural world creates opportunities for reciprocal relationship building and exploring interconnectedness between beings and systems.

When learning with natural systems and multiple species, children and teachers are pushed to collide with complications of entanglements (Houston et al., 2018; Murdock, 2020; Nxumalo & Pacini-Ketchabaw, 2017) and nature-culture relations (Bang et al., 2015). When preschool takes place outdoors, children and teachers *will* encounter multispecies entanglements and must respond. For instance, Fikile Nxumalo (2018) provokes us to consider how this happens as she stories the relations between educators, preschool children, and Western bumblebees. Examining the encounters children have with dead and dying bumble bees, children confront their fears and learn about vulnerability, agricultural practices, pesticides, colonial farming and bee breeding. This inquiry raises questions about how teachers understand their role in these relationships, respond to interspecies entanglements, and consider the impacts of settler-colonialism. Given the growth of nature-based preschools, research is vital to explore these issues, particularly how teachers may challenge dominant settler-colonial views of human exceptionalism and a human-nature divide through their perceptions of and interactions with natural systems and more-than-human species.

### **Settler-Colonialism and the Environment**

While outdoor learning programs offer numerous benefits for young children, increasing implementation brings challenges, particularly in the context of settler colonialism. These challenges are alarmingly evident when we acknowledge the violent disruption that settler colonialism has on the relationship between humans and the environment (Bacon, 2018; Tuck & Yang, 2012; Watts, 2013; Whyte, 2018). Scholars have pointed out that prevailing Western settler-colonial views in the school systems often construct humans as separate from nature, thus impacting teaching practices (Medin & Bang, 2014; Whyte, 2018). These views, rooted in separation and domination, often contradict the cultivation of caring, reciprocal relationships between humans, more-than-humans, and natural

systems, which Indigenous scholars have emphasized as an essential part of human existence, (Kimmerer, 2013; Salmón, 2000).

These settler-colonial constructs create an imbalanced understanding of nature-culture relations. This imbalance can lead to insufficient understandings of natural systems, lack of relationship with nature (Louv, 2008; Orr, 1993), unsustainable practices (Bang & Marin, 2015), and in a broader scope, environmental degradation, and environmental injustices (Makey et al., 2022; Whyte, 2018). Amid the epoch of the Anthropocene (Steffen, 2007), where human activities greatly affect ecosystems and climate (Hodges, 2021; Nxumalo & Pacini-Ketchabaw, 2017), it is essential to examine educators' views of the natural environment. This scrutiny helps address human-nature relational imbalances, especially as more educators embrace NBE. Settler-colonial studies frame the risks of the NBE boom, including reinforcing human exceptionalism, causing environmental harm, and perpetuating a dominant Western approach to nature engagement. Following, I focus on the potential teachers hold to either alleviate or perpetuate these risks.

### **Teachers: Perception and Influence**

Teachers' beliefs have long been known to significantly impact their curriculum choices (Clark & Lampert, 1986; Spodek, 1987) and their responses to information in the classroom (Fang, 1996). Newer research confirms this finding when investigating teachers' attitudes toward outdoor play and nature, revealing barriers and hesitations in facilitating nature engagement with children (McClintic & Perry, 2015; Yalcin and Erden, 2021).

Hesitancy to engage children in nature is troubling when we consider Dowdell et al.'s (2011) finding that for children to connect with nature and effectively partake in outdoor learning, teachers must be enthusiastic and supportive of the outdoor environment. If teachers put up barriers and create division, it impacts curriculum and children's experience. More significantly, it may also reinforce children's alienation from nature in alignment with settler-colonial dualisms. Through exposure of what Pacini-Ketchabaw and Nxumalo (2015) call a "series of situated, small, everyday stories" of children and nature, children can wrestle with the nature-culture divide and experience entanglements.

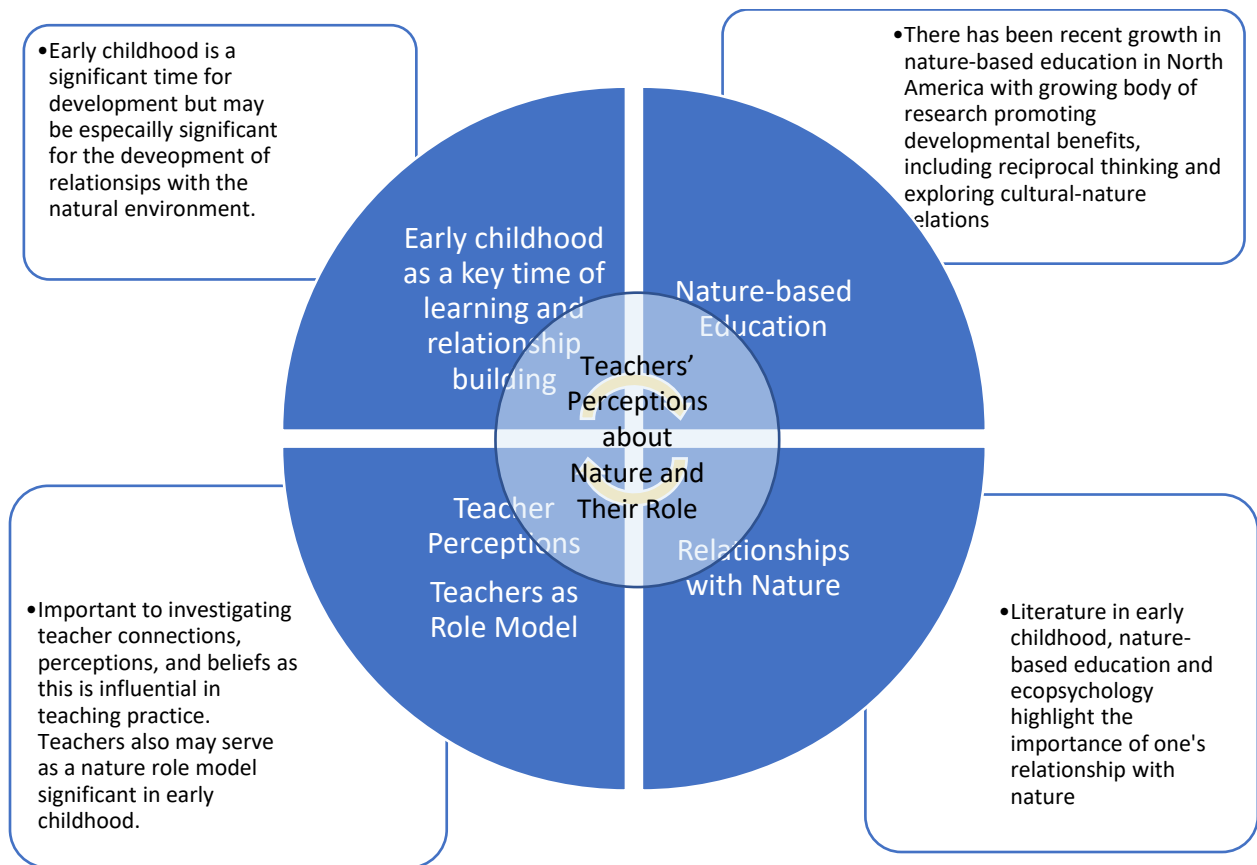
The early years offer immense potential for nature connections (Chawla, 1999; 2007; Robson & Rowe, 2012), impacting future environmental views (Chawla, 1999). Positive nature-engaged role models (Chawla, 2007) like teachers, along with nature experiences (Barrable & Booth, 2020; Chawla, 1999; Robson & Rowe, 2012), are impactful when forming nature-culture connections. Teachers in early learning settings, especially those immersed in nature, can play a pivotal role in fostering balanced nature-culture relations and offering diverse lifeworld perspectives beyond settler-colonial constructs. As such, my study delves into how teachers navigate entanglements, perceive nature-culture relations, and discuss settle-colonialism in their teaching practice.

## **RESEARCH STRATEGY, DESIGN, AND METHODS**

In undertaking this study, I aimed to understand nature-based preschool teachers' perceptions of nature and their role in the outdoor classroom. Through this research I also learned about their journey in becoming nature-based educators and their relationship with nature over time. Within the theoretical framing of settler colonialism, I strove to deconstruct the teacher's perceptions of nature, their own personal journey, and their role in an outdoor classroom.

When researchers deconstruct, they aim to "break apart assumptions" and recognize that individuals are socially conditioned to perceive and interpret the world in particular ways (Bhattacharya, 2017, p. 20). While Western society in the United States has a long history rooted in objectivist ontology linked with empiricism, I am situating this study within settler colonial studies to explore a facet of settler colonialism concerning the separation of nature and culture. In doing so, I assume that individuals, particularly outdoor preschool teachers, are socially conditioned in their understanding of "nature" and in how they conceptualize nature-culture relationships. Since my primary objective is understanding, as per Bhattacharya (2017), it is appropriate to gather relevant information related to the focal experience. Accordingly, I have collected data on teachers' perceptions of nature, their own connection to

nature, and their role in a nature-based classroom through interviews, journal entries, and a cognitive mapping exercise.



### Setting and Participants

After securing Institutional Review Board ethical approval, I recruited participants in January 2022 via communication with school directors from two different outdoor preschools. School directors then sent my information to teachers for participation. The setting for this study consists of two nature-based preschools which operate completely outdoors. For the purposes of this research, the names of the school have been removed for privacy and referred to as school A and school B. School A is a large organization with eight locations throughout the WA Puget Sound region. Their programs operate completely outdoors on public land in partnerships with parks departments. The locations of their outdoor classrooms vary greatly from urban centers with a roving exploration model to secluded, forested spaces in a regional wildlife park. The school in which I was able to interview teachers is in a densely populated urban area of the city but the park itself is large and offers a variety of green spaces. School B is a single school model but functions within a larger public institution and in the setting of an expansive public park, surrounded by trees, shrubs, and wildlife. They have three large, dedicated spaces as outdoor classrooms which is the primary location of their activity. They also explore areas throughout the park including ponds, gardens, and wetlands.

Four teachers participated in this study, two from each of the above-described settings. To protect the privacy of each teacher, they are referred to throughout this study by pseudonyms as listed below. All participants identified as white, non-native settlers. Three participants identified as female and one as transgender/non-binary. The below chart sums up their background, experience, and role in the nature-based setting.

Participant	Setting	Current Role	Brief background
1 Joyce (she/her)	Preschool B	Lead teacher	Received elementary teaching degree but after graduation, decided not to pursue teaching career. Found way into teaching via the outdoor school model. Currently holds five years of experience working with children outdoors, most of it as a lead teacher in outdoor preschool.
2 Ely (she/her)	Preschool A	Lead teacher	Double majored in psychology and early childhood education (not a teaching track) with no original intent to work as a classroom teacher. Once she discovered outdoor school, felt teaching was a good fit. Currently holds 1.5 years of working in an outdoor preschool setting, the last 6 months as the lead teacher.
3 Catrina (she/her)	Preschool A	Assistant teacher	Holds BA degrees in Spanish and Justice & Peace studies. This is the participant's first year working in an outdoor preschool setting.
4 Layne (they/them)	Preschool B	Lead Teacher	Holds a degree in Sustainability and early childhood education. Had prior experience working in an indoor preschool. Separately, worked with preschool aged children outdoors in other settings (field trips, summer camp) and for an internship. Has held current position (lead outdoor preschool teacher) for 1.5 years at time of interview.

### Data Sources

To build understanding, interviews were the primary mode of inquiry in this research study. Because I am sought to deconstruct our conversations and “dig deep into one’s experiences” (Bhattacharya, 2017, p. 127), I employed the use of in-depth open-ended interviews in addition to journal entries and cognitive maps.

### Interviews

All participants engaged in two interviews, one short informal interview which ranged in length of 30-45 minutes, and one formal, semi-structured interview which ranged from 50-75 minutes. All interviews took place over the course of 4-6 weeks. The initial interview consisted of conversational questions to invite a participant-led flow and opportunities for the participants to ask questions, the intent being to build rapport (Bhattacharya, 2017). The later semi-structured interview consisted of 4 to 6 open-ended mostly, descriptive questions to generate authentic conversation around specific themes (Bhattacharya, 2017). In this interview my goal was to probe more deeply and raise some potentially challenging issues for the participants around their personal perception of and connection with nature as well as how they may reflect upon settler-colonialism in nature-based early childhood education. When possible, the interviews were conducted in the teacher’s outdoor classroom.

### Journals

After the first interview, I emailed each participant open-ended prompts which consisted of a variety of cues to choose how they would like to engage. (See appendix A for journal prompts.) I asked them to complete one journal entry based on the prompt before our second interview which was generally scheduled for 7-10 days after the first interview. The prompts invited them to reflect deeply (McClintic & Petty, 2015) about their feelings with/towards/about nature. By providing the prompts before the second interview, I hoped to spark some initial thoughts around nature-culture relations.

### ***Cognitive Mapping***

I sought to deconstruct the participants' perceptions of nature and visualize their relationship and journey with nature. Expanding beyond the written word, Futch and Fine (2014) have found cognitive maps to aid qualitative inquiry, negotiating ideology and relationships. Since I am concerned with teacher's perception of nature and how their personal relationship with nature developed, I chose to employ this method at the end of the second interview. To visually represent their nature-cultural relationships and journey, I prompted each participant to create a map of their journey with nature.

To move towards a decolonizing methodology (Tuhiwai Smith, 1999) my aim was to build a reciprocal reflective experience in which the participant-researcher roles felt equitable and respectful; one in which we were learning together. To support this, I also went through the journaling practice mentioned above. Additionally, I worked concurrently to create a cognitive map each time the participants went through the exercise of cognitive mapping.

Participants and I used our thoughts from the journals and our cognitive maps to engage in dialogue (Annamma, 2018) about nature-culture relations, our journeys into nature-based education, and how conceptions of and relationships with nature have developed over time. While these experiences (journaling and mapping) may have operated as a change process in which participants' ideas shifted after completing the exercise, the intent of the work was to elicit conversation about their current ideas regarding nature-culture relations and their role in a nature-based setting. It is beyond the scope of this paper to understand how these activities may have created changes in the participants' thoughts.

### **Data Generation and Analysis**

To adhere to the protocols of academic rigor through data triangulation (Falk & Blumenreich, 2005; Glesne, 1999), analysis from multiple data collection methods and sources were used. The purpose of data triangulation is not just to use multiple data sources but to relate the findings in the different kinds of data which in turn, increases credibility (Glesne, 1999). Data collection took place between January 26, 2022, and February 24, 2022. All initial interviews were conducted and recorded via the video conference platform, Zoom, and lasted between 30-45 minutes. Second round interviews were conducted in the outdoor classroom space when possible. Being in person in the outdoor classroom space allowed teachers to directly reference some areas and ideas important to the conversation. It was also helpful to collect additional relevant information pertaining to their perceptions of nature by looking directly at certain areas of the outdoor classroom. When in person, video was recorded via a camcorder and tripod device. When not possible to do an in-person interview (in the case of two participants), Zoom was used for the second interview. The second interviews lasted between 50-75 minutes.

All transcripts from the interviews were stored and organized in the web-based application Dedoose. After data collection, interviews were transcribed using a combination of the automatically generated transcripts via zoom and line-by-line editing by hand in Dedoose. As customary in qualitative research (Miles, Huberman, & Saldaña, 2014), I engaged in analysis process throughout data collection with the use of notes and jottings to record initial impressions and ideas. Memos were used in Dedoose during the transcription process (and later throughout the coding process) to build upon the original jottings.

After transcribing interviews, I used a flexible approach inspired by Saldaña (2013) to set the stage for analysis and conclusions (Miles, Huberman, & Saldaña, 2014). Following a trial run (Saldaña, 2013), I chose descriptive and in vivo coding for subsequent analysis.

The initial coding phase yielded 93 separate codes. Using code mapping, I reorganized these codes into themes by visually categorizing them. Code mapping, part of the auditing process, documents how codes are categorized and conceptualized throughout analysis (Saldaña, 2013). This process resulted in six central themes, three of which (settler-colonialism, teacher's roles, and teacher's perceptions) directly addressed the study's questions and theoretical framework. Three additional themes (responding to entanglements, personal encounters with nature, early childhood development) emerged from participant discussions. These six themes led to the creation of 18



separate codes, which were used in a second round of coding. A code manual was developed for these 18 codes, providing definitions and examples for clarity.

During the interview transcript coding process, cognitive maps and journals were referenced using the 18 codes to provide supporting evidence in relation to ideas found in interview transcripts. I organized evidence from journals and cognitive maps using color-coded highlighters and post-it notes.

In addition to the use of data triangulation, I employed several other strategies to support the validity and reliability of this research study. To address accountability to the interviewees, I have been in touch with them at various points in the research process to conduct internal validity member checks with participants. During the data collection and analysis process, I met with a peer group for peer debriefing in which I was able to hear multiple perspectives on issues relating to reliability and validity (Rose & Johnson, 2020). These meetings also allowed me to reflect upon power and positionality in my research process. Additionally, I explored my own positionality as a researcher, educator, and parent.

Using this process, I analyzed how a) teachers understood their own nature-connectedness, b) their unique role, and c) their perceptions about settler-colonialism and multispecies relations. Next, I describe the findings in detail and then discuss their importance to the early childhood environmental education and significance to scholarship.

## FINDINGS

When examining teacher's perception of nature and their role in nature, I am considering the way they interpret knowledge and truth. I believe, this interpretation of knowledge will fundamentally influence how they interpret nature and their role in a NBECE setting. I have brought with me my own personal beliefs, and experiences as a teacher, as a researcher, as a parent of three young children, as a former nature-loving child who sought reprieve outdoors, and as a human living among multiple species, races, cultures, and identities. Acknowledging a researcher's identity and positionality as central to the qualitative research process is necessary for the honesty, rigor, and clear intent of the work (Bhattacharya, 2017; Hampton & Reeping, 2019; Milner, 2007). Important to the work in this study, it must be made clear that I am a non-native settler, socialized into thousands of years of Western philosophy. I have attended 'traditional' public school education in the United States and was raised using mostly the conventional English language of the US. Within the confines of my positionality, my study seeks to understand others' perception of nature but interprets that only within my own perception, which is limited. However, very much acknowledged as a part of this study is that we must recognize this limitation and be open to further interpretations and expressions.

My story is intertwined with and cannot be separated from the story of the participant and is important to name these entanglements. These identities and experiences have shaped how I see the world and how I have interacted and continue to interact with the world, and to some extent, influence how I perceive this research. To attempt to find a balance, I have been reflective throughout the data collection process by maintaining a research journal and seeking peers' and participants' perspectives through member-checks and peer-debriefing sessions.

This research study provided the opportunity to hear how other humans, specifically nature-based early childhood teachers value and understand nature-connectedness, while learning about their journey in arriving at this understanding. I sought to learn about how nature-based preschool teachers may be challenging human exceptionalism and resisting a settler-colonialist narrative around humans and nature as separate which is so deeply woven into our society. What I have learned about their perceptions, their personal stories in building these perceptions, and their classroom practices is presented below. It has proved to be illuminating in understanding the perspective of nature-based teachers yet, it is only one small piece of the on-goings within the world of nature-based early childhood education (NBECE).

### **Understanding One's Nature-Connection**

While there were many commonalities among the four participants, each had their own personal journey in arriving in their NBECE role, developing their own nature-connectedness, and conceptualization of nature. In the following section, I capture three themes weaved throughout this journey and highlight the similarities and divergences.

### ***Finding Something That “Feels Right”***

All participants expressed an initial interest in education, but surprisingly, three of the four teachers did not begin their careers as educators. A common sentiment was an “unfit” feeling for traditional teaching. Joyce recalled that tension: *As I started taking more and more courses and getting closer to becoming a teacher, I was like, ‘this doesn't feel good.* Ely also considered various roles in education but said, *When I was thinking about being a classroom teacher it just didn't feel like me.* So, she began searching for other job opportunities. Catrina began in a college program in education, but with similar feelings, switched to peace studies. Eventually, all participants found their way to NBECE, which they unanimously described as joyful and offering a sense of fulfillment.

### ***Nature's Place in NBECE Teacher's Lives***

Nature's significance in the lives of the NBECE teachers extended far beyond their work environment. It provided them with affirmative and consoling experiences, acting as both a safe space *and* a catalyst for personal growth and resilience. The teachers described a profound sense of connection, both with nature and with themselves and others.

Layne expressed in their journal entry how being in nature feels like a sense of openness and acceptance. They elaborated on this idea of acceptance during our second interview, stating:

*as, like, a gender nonconforming person, a queer person, a disabled person, like there have been a lot of times in my life where I felt very limited by how people received me or judged me, you know? And so, it's, it's nice to be in a space where you're like, I don't have to think about that right now. Nature is not judging.*

Through their journal entry and interview, Layne demonstrated that they felt safe to be themselves in nature and experience a feeling of acceptance. Joyce described a similar sentiment:

*I spent the majority of my time outside. If I wasn't outside, I was thinking about being outside. Nature was my safe spot. School did not come easy for me. So, when I was feeling frustrated or angry or pretending like I was going to run away from my family, I found myself outside. Nature accepted me and it would calm me down... and I felt like I could be myself there, and I didn't feel like I could be myself in a lot of different places.*

This was confirmed in her cognitive map and description of it when she drew hands holding (nature holding her hand) and included the written words “my safe place.” (See exhibit A for Joyce's map). Ely expressed similar ideas to Layne and Joyce of comfort and safety especially during the COVID-19 isolation period describing one of the only places available for “good feelings.”

This comforting experience was evident in the participants' personal lives, but also in their teaching roles. Demonstrating a teaching example, Layne told a story of how the children were talking about an owl, so they took the children out on a walk to view the owl's sitting spot. The owl was present as well as an owl pellet. It had been a rough day, and Layne said they felt relief, stating: “realizing in this moment, all I have to think about, is looking at this amazing owl with my students ... You know, those are the moments that keep me going through all the [hard times] and bring me joy.”

There were plenty of comforting feelings as described above by participants, but they did not shy away from describing challenges. This included dealing with extreme weather, confronting death, being injured, and navigating personal health issues. Specifically, when working outdoors with preschoolers, there was the added challenge of

helping young children through similar hardships. Overcoming these challenges was viewed as a means of building resilience. Illustrated in a personal sense by Layne's statement:

*I really love the person I feel like I'm becoming through forest school. Yeah, I feel like I'm becoming more resilient. I'm becoming more flexible. Like, there are a lot of positives in my life right now that have come from this [being an outdoor preschool teacher].*

Joyce considered the resilience building opportunities for not only herself but for the preschool group. She described being in an outdoor classroom as helping children figure out what they need to regulate, conducting what she called "therapy sessions" during tough moments in the outdoor preschool classroom. Through these sessions, children were able to overcome challenges together. The experiences in these difficult moments also appeared to contribute to a sense of comradery and collective well-being among the group.

### ***Budding Connections Over a Lifetime***

Through the conversations and later analysis, it became evident that the participants' positive messages and connections with nature had developed over their lifetimes. Importantly, this connection was noted as starting in childhood. The reference to childhood specifically came up in two segments of the interviews: 1) when I asked about why they chose this specific profession and 2) to describe a time when they felt connected to nature.

When I asked Joyce to tell me about her decision to work in an NBECE field, she began with, *So I grew up and I was really fortunate enough to grow up with the backyard ... I spent the majority of my time outside.* Leading with this viewpoint signifies that the early connection she made with nature was influential throughout her life and in this instance, influenced her choice to work in NBECE. Ely opened her answer to this same question by quickly identifying that, *It reminded me of my childhood.* Separately, Ely and Layne directly referenced a childhood experience when I asked about a time that they felt connected to nature.

Whether it was in direct response to these questions or in other conversation throughout the interview, all four participants described in detail at least one memory of nature-connectedness from childhood or youth. An excerpt from Layne's journal entry illustrated how the special connections and their understandings of nature built during childhood have stayed with them and continue to influence how they think about and relate to the natural world. They wrote, "Did you know there are tiny mushrooms that only grow on pinecones? The fact that they exist, and I also exist makes me happy. Wonder is real. Magic is real. The books I read as a child maybe didn't have the facts right, but they had the feelings."

During the study, two of the participants mentioned the importance of solitary moments outdoors. However, notably, all the participants mentioned meaningful experiences with others mostly focused on siblings and peers. In addition to similar aged peers, Joyce and Catrina acknowledged the significant impact of having role models who encouraged their love for nature. Joyce's father served as her guiding presence, fostering her appreciation for the natural world and she spoke fondly of her father's guidance and love. For Catrina an important mentor teacher filled that role, and she recalled a transformative hike with this mentor who shared her feelings of nature. These influences are also illustrated in cognitive maps (Exhibits A and B) of both participants. The mentor's role is significant to note since each of these participants are now teachers with the potential to mentor and guide young children through nature experiences. In the next section, I examine participants' perceptions of their teaching roles and explore themes associated with guides or mentors.

### ***Teacher as Nature Guide***

Study participants shared common perceptions of their general roles as early childhood nature-based teachers. They highlighted responsibilities like curriculum planning, safety, observing children, and collaborating with families. However, the predominant theme was that of being a guide in their teaching approach. All four participants stressed the significance of guiding children in their educational journey. Additionally, Joyce, Layne, and Ely explicitly stated being *a nature-guide* when they were discussing their role.

During a discussion of her role, Ely highlighted her commitment to supporting children's understanding of humans' environmental impacts. She recounted leading student through an "environmental impact review" aimed at assessing environmental harm. She later expanded on this, stressing the obligation to illuminate humans' place within the broader context of their environment.

Joyce's perspective placed a strong emphasis on fostering children's presence and connections with the natural world rather than environmental impacts. When discussing her role as a nature-based teacher, she provided examples of how she facilitates meaningful experiences for children. Joyce recalled a moment when she and a child were near small rocks, in which she silently demonstrated rearranging the rocks and soon the child joined in. She highlighted these moments of connection with nature, emphasizing the value of outdoor exploration and loose parts for children. Before discussing her role, Joyce described times when she modeled a deep appreciation for nature, such as lying down in the forest, encouraging the children to observe the trees, and sparking conversations about their observations.

Layne shared instances from their day in the forest where the children actively engaged with nature, and Layne, as the teacher, played a guiding role in facilitating these experiences. They recounted a scenario where the children observed a chipmunk, tracking its movements with curiosity. Layne described their responsibility as teacher to ensure children's safety, while encouraging their chipmunk interest. The owl encounter, previously mentioned, provided children another opportunity to connect with nature. Layne, in this instance, modeled a sense of wonder by exploring owl pellets with the children, and emphasizing observation and inquiry.

With such interactions between children and more-than-human others in the outdoor preschool environment, NB teachers continuously navigate with children through the movement of multispecies entanglements. Ongoing encounters provide unique spaces to question human exceptionalism and resist a human-nature divide. These valuable opportunities, which are less accessible in indoor classrooms, make NBE spaces a crucial setting for exploring the concept of human exceptionalism. I was eager to learn how these teachers were challenging the prevailing settler-colonial views of human exceptionalism and the separation between humans and nature, while also similarly guiding children. What I learned is presented next.

### ***Relating to Lifeworlds: Resisting the Human-Nature Divide***

Interviews with the four teachers revealed that outdoor preschool experiences offered children ample opportunities to engage with nature, as seen in examples above. These examples illustrate the unique role of outdoor preschools in facilitating meaningful interactions between children and nature. While these interactions indeed can hold meaning, Pacini-Ketchabaw (2013) emphasizes that mere exposure to nature is insufficient. It is when children recognize what she calls "frictions in the forest," and are pushed to think critically that they can contemplate its intricate histories and entanglements. I reviewed the participant data to determine how they may (or may not) have found that friction in the forest.

Ely contemplated the nature-culture divide with her preschoolers, "because our classrooms exist in such a diverse array of natural settings and sort of like I'm always like interrogating that question of like what is nature.... So that's something that like we definitely talk about with our kids." She lightly suggested a challenge to human-nature divide, acknowledging frictions and uncomfortable realities of settler-colonialism. However, at times, she suggested a contrary mindset, such as designating certain areas as off limits and upholding strict guidelines about human's place within nature, emphasizing human harm to the environment while neglecting reciprocal aspects.

Joyce, on the other hand, directly discussed the connection and reciprocal-relational aspects of humans and nature. The deep connections and nature-awareness suggested that she may resist the idea of the human-nature divide, but her descriptions fell short of explicitly addressing the issue of human exceptionalism or settler-colonialism. She mentioned that living in a city can create a perceived disconnect from nature, signaling that Joyce perceived a tension or friction, but she attributed it to city life without exploring the deep-rooted settler-colonialist paradigm.

Layne provided a strong example of a teacher who addressed settler-colonial constructs, including human-exceptionalism while mindfully reflecting on the interconnections among children, teachers, and nature. Layne clearly articulated a friction in the presence of human exceptionalism: “Lots of times people view nature as like the resources we can get from it, like what commodities we can make from it. Even sometimes with education, people view nature as like the next curriculum set, you know, the next thing we have to teach about.” To illustrate their point, Layne shared an example of a college experience where a friend’s thesis on an endangered plant was devalued due to its perceived lack of human utility. Layne clearly saw this tension of human exceptionalism stating: “but it’s a living thing. It has a use to its ecosystem and beyond that, does it need a use to exist?” They then linked this perspective directly to settler-colonialism:

*I mean, honestly, I think a lot of it stems from colonialism. And just this idea that like, we can possess the space that we’re in and all of that, those things that are there, like if we show up, we can just take them. I think it’s pretty sad. But yeah, I think just the impact of colonialism on our view of nature, I think are expensive and pretty heavy.*

Layne also said they discuss the history of the land, connect experiences to Indigenous practices and highlight the effects of settler-colonialism with the children. Layne’s example illustrated how a teacher resists the human-nature divide and directly addresses settler-colonialism’s impacts exposing the “friction in the forest” while fostering a child-nature connection. I now delve into a discussion and consider scholarly implications of this study.

## DISCUSSION AND SCHOLARLY SIGNIFICANCE

This study explored how outdoor preschool teachers perceived nature and showed resistance to the nature-culture divide prescribed by settler-colonialism. Findings revealed deep journeys and strong bonds with nature, influencing participants’ nature-culture relations and pedagogies, which is significant for both practice and research in the field of early childhood environmental education.

### A Teacher’s Journey

Teachers’ journeys with nature and their work in NBECE were tied to their own experiences in nature, with an emphasis in childhood. This confirms findings from earlier research about the influence of children’s outdoor experiences on nature-connectedness leading to their relationship with nature (Chawla, 1999; Barrable & Booth, 2020; Yilmaz-Uysal, et al., 2020), stewardship (Bailie, 2012), and involvement in environmental fields (Chawla, 1999; Palmer & Suggate, 1998). In addition to general outdoor experiences, some research (Chawla, 2007; Sobel, 2008) indicates having a role model during nature engagement can develop and maintain a healthy child-nature relationship. This was demonstrated by Joyce when she talked about her father as her nature guide and by Catrina when she reflected on meaningful experiences with her mentor. For both participants, it seemed to have had a big impact on why they chose to be an outdoor preschool teacher and their journey.

These conclusions are significant since research on NBECE career motivations is lacking. Given that this is a new field, it not surprising that I was unable to locate research on the career motivations of NBECE teachers specifically. However, the findings of this study align with broader insights into educators’ career choices. Manuel and Hughes (2006) identified three primary factors motivating teachers’ career choices: a personal desire to work with children or youth, engagement with the subject matter, and a sense of fulfilment in doing meaningful work. The participants in this study demonstrated a strong affinity for the outdoors and a deep appreciation for nature, drawing them to nature-based education. These findings also indicated that the participants sought meaningful engagement with the subject (nature) as a key aspect of their career motivation. Additionally, their commitment to both children and nature aligns with Manuel and Hughes’ (2006) concept of doing work they genuinely care about.

Another significant factor in these teachers’ journeys towards becoming NBECE teachers was their recognition of the benefits of outdoor experiences. All participants highlighted the advantages of outdoor activities both for themselves and the children with whom they worked, including slowing down, being present and connected, building resilience, problem-solving skills, emotional regulation, and learning about nature. This resonates with

established research on the benefits of outdoor and nature experiences for adults (Bowler et al., 2010; Bratman et al., 2015; Schertz & Berman, 2019) and children (Blackwell, 2020; Chawla, 2015; Chawla et al., 2014; Carr et al., 2017; Triguero-Mas et al., 2015). Notably, my present study revealed that these benefits played a pivotal role in motivating the teachers to pursue a career in nature-based education. Acknowledging and deliberately integrating these nature-related benefits into the recruitment, training, and ongoing support of NBECE educators could prove valuable for their professional development, job satisfaction, and teacher retention, potentially benefiting the overall nature-based preschool learning environments.

### **The Unique Role of NBECE Teachers**

While the field of NBECE is growing significantly, working with preschool children in nature-based and outdoor settings is still a unique position which comes with unique challenges, such as defining roles and responsibilities. The still-emerging definition was evident in this study. While some common responsibilities align with general preschool teaching, such as curriculum planning and safety monitoring, this research explored how these teachers perceive their roles in connection with nature. To think more specifically about how the teachers are fulfilling the role of nature-based teacher, my study paired a teacher's understanding of their role in conjunction with their perception of nature. This pairing is important because, as found by Clark and Peterson (1986) and Spodek (1988), teachers' beliefs will influence their decisions around curriculum and planning. In line with that research, I found that the participating teachers expressed beliefs about the importance of children's connection with nature and therefore it was a critical part of their described pedagogy.

A unifying theme was the role of being a guide, which all participants emphasized. Commonly, preschool teachers acknowledge themselves as guides for things such as conflict management and social-emotional development (Gartrell, 2017; Sanchez, Steece-Doran & Jablon, 2013) and the participants reconfirmed this. However, a significant novel theme emerged in this research: *teachers as facilitators of children's nature connection*. This approach is unique to NBE settings, where teachers scaffold children's understandings of the broader narrative about their natural surroundings, model appreciation, guide critical thinking through nature experiences while fostering wonder, curiosity, and notions of entanglement. As one participant described, it is about "wanting children to understand the bigger narrative of the space we are in," which include the interconnection of multispecies and natural systems, acknowledging the impact of settler-colonialism on the land and human relationships, and appreciating the history of the land itself. These findings extend the discourse on what it means to have a guide or role model facilitating nature experiences during early childhood and what that could look like in an outdoor preschool setting.

Catrina's was the only participant who did not emphasize the role of nature-guide or facilitating nature-connections. This was unexpected given her own reflections on the significance of nature and mentorship in her life. Research suggests that such personal experiences typically contribute to a sense of nature-connectedness and beliefs about nature-based experiences (Barrable & Booth, 2020; Pruneau, et al., 1999; Robson & Rowe, 2012). Considering that teachers' thoughts and beliefs are known to influence their teaching (Clark & Peterson, 1986; Spodek, 1988) and pedagogy (Fang, 1996), it could be expected Catrina would extend her beliefs to her teaching practice. Catrina's status as an assistant teacher in her first year in an outdoor setting, compared to the other participants who were experienced lead teachers, may in part explain this difference. It's possible that her limited experience and the learning curve associated with novice teaching led her to focus on more immediate needs such as safety (Feiman-Nemser, 2003) which she did emphasize as important in her outdoor teaching role. McClintic and Petty's (2015) research provides another lens, as they found that a teacher's outdoor experience influences the value they place on outdoor engagement, *but* their desire to reduce safety risks and lack of experience can create a philosophy-reality conflict in which they hold one theoretical grounding but enact a different reality. This suggests the potential for a transformative shift in perspective as Catarina gains more experience and confidence in her nature-based setting.

### **Resisting a Settler-Colonial Narrative**

In the analysis of this research, I explored participants settler-colonial perspectives. I was inspired by scholars like Bang and Marin's (2014), Kyle Whyte (2018), and Tuck and Yang (2012), who explored how settler-colonialism perpetuates environmental injustices, namely by separating human relationships from the environment.

Demonstrating an awareness of Whyte's (2018) argument that colonialism has fundamentally altered the way humans perceive and interact with nature, the participant, Layne thoroughly acknowledged the destructive impacts of colonialism on nature as discussed above.

Whyte (2018) elaborates on how the violent disruption takes place by working “strategically to undermine Indigenous peoples’ social resilience as self-determining collectives... [and] disrupting eco-social relationships” (p. 125). Teacher Ely demonstrated that she was thinking about similar issues in explaining her antiracist curriculum, including contributions from local Indigenous peoples and the history of the land. Specifically, she noted using the Since Time Immemorial curriculum (OSPI, n.d.) to facilitate a discussion of about how a local river had changed over time and in turn shifted relationships between people and land. She also discussed with children language loss among the local Indigenous communities while teaching words in Indigenous languages. Working with her preschoolers through the Antibias education (Derman-Sparks & Edwards, 2019) and Since Time Immemorial curricula(OSPI, n.d.) required consideration of Indigenous peoples’ social resilience and self-determination, alongside conversations about ecological (in)justices.

Tuck and Yang (2012) note specifically “how settler colonialism has shaped schooling and educational research in the United States and other settler colonial nation-states” (p3). Bang and Marin’s (2014) findings of a notable separation between humans and nature in science curricula concurs with that notion. Given that formal schooling systems often demonstrate these dominant settler-colonial narratives of nature and humans as separate, hearing how some of the participants in this study were confronting and resisting settler colonialism and human exceptionalism adds a valuable dimension to what Bang and Marin (2014) describe as “desettling” normative time-space and nature–culture relations in schooling.

By examining NBECE teacher’s perception of nature and perceived classroom role, this study has shed light on how some educators are resisting settler-colonialism and its separation of humans from nature, offering insights into the broader discourse on these issues in early childhood environmental education. Given that only two of the four teachers directly confronted settler-colonialism, the findings also suggest the need for additional training in NBECE to directly address settler-colonialism and contemplate human exceptionalism.

### **LIMITATIONS AND FUTURE DIRECTIONS**

This study, while offering promising insights into how nature-based preschool teachers connect with nature and address settler-colonialism, should not be over-generalized. The data heavily relies on self-reported information from teachers. The inability to conduct on-site observations due to strict visitor COVID-19 protocols hindered my knowledge of how these ideas manifested in practice.

Beyond the scope of this article is how teachers define 'nature' and what this definition means in the context of modern life and associated stressors or feelings of alienation. Some teachers in this study described nature as a “safe space” and a place to “be myself,” but these statements lack context. Future investigation of “safe space” could yield insights into the relationship between personal definitions of nature and broader societal experiences.

Another valuable research avenue involves direct observations of teachers and children in outdoor preschool settings, offering a more comprehensive understanding of how teachers' understandings regarding nature influence their pedagogical practices and the daily experiences with children in these environments.

### **CONCLUSION**

In conclusion, this research delves into the perceptions of teachers within the emerging field of nature-based outdoor preschools, examining their views on nature and their roles in outdoor classrooms. The study revealed how some teachers recognize the influence of settler-colonialism on human-nature perceptions. Additionally, it reaffirmed previous research findings regarding the formative impact of childhood experiences on environmental stewardship, nature appreciation, activism, and career choices.

One noteworthy aspect arising from this study revolves around the role of an outdoor nature-based teacher, specifically their role in facilitating children's interactions, critical perspectives, and connections with nature. Inconsistencies emerged among participants, particularly regarding their roles as nature guides. These inconsistencies suggest a need to further define teacher expectations and enhance training in this evolving profession. Beyond that, supporting NBECE teachers to contemplate the influence of settler-colonialism and human exceptionalism would aid in growth and cohesion across various nature-based practices, research, and teacher preparation. Overall, this study offers valuable insights into nature-based preschool teachers' perceptions on nature-culture relations and their own nature-connectedness while reinforcing the need to continue investigation supporting this growing field.

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## **Factors associated with nature connection in children: A review, synthesis, and implications for practice within environmental education and beyond**

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### **ABSTRACT**

Nature connection has been found in previous research to be a predictor of pro-environmental attitudes and behaviours. For this reason, efforts to build children's nature connection through a variety of avenues, including environmental education, have been explored by practitioners and researchers alike. In this paper we undertook a purposive literature search of research looking at factors associated with children's nature connection. The resulting synthesis of 28 studies found demographic, dispositional, affective, familial, environmental, and experiential factors that are associated with children's nature connection that will be of interest to educators, parents, researchers, and policy makers. Recommendations are made for the implementation in environmental education programmes and beyond, in order effectively mobilise an integrated response that will foster a sustained connection to the natural world.

**Keywords:** children, childhood, connection to nature, ecopsychology, environmental education, environmental identity

Nature connection can be defined as the part of the self-concept that identifies with the nonhuman natural environment and its elements, as well as the individual's subjective evaluation of that relationship (Clayton, 2003; Restall & Conrad, 2015). Research on nature connection suggests that it is a multidimensional and stable trait, though subject to change through experience (Mayer & Frantz, 2004; Nisbet, Zelenski & Murphy, 2009). The term encompasses several broader constructs including an emotional affinity to nature, the inclusion of nature in the self, and connectedness with nature; as well as the extent to which people feel they are part of nature (Tam, 2013).

Research on nature connection has consistently shown that the its promotion leads to an increase in pro-environmental behaviours, including environmentally protective and self-sacrificing behaviour (Duron-Ramos, Collado, García-Vázquez, & Bello-Echeverria, , 2020; Frantz & Mayer, 2014; Mayer & Frantz, 2004; Salazar. Monroe, Jordan, C., Ardoin & Beery, , 2021; Schultz, 2011; Whitburn, Linklater & Abrahamse, , 2020), in addition to its benefits on wellbeing (Capaldi, Dopko & Zelenski, 2014; Pritchard, Richardson, Sheffield & McEwan, 2020). Individuals with a stronger nature connection are more likely to engage with conservation of energy and water, reduced consumption political activism, or financial donations to environmental organisations (Whitburn et al., 2020).

It has been widely suggested that a globally greater emotional bond with nature would therefore be instrumental for environmental catastrophe mitigation and nature conservation (Barrable, 2019; Ives et al, 2018; Richardson et al., 2020). Environmental education has a key role to play in this and should focus on efforts to mobilise the most effective tools for fostering an emotional bond with nature (Frantz & Mayer, 2014; Whitburn et al., 2020). Though it

is necessary to educate the whole population, there is reason to purport that children's education should be regarded as a priority, based on practical, prospective as well as ethical grounds. The negative effects of children's greater disconnection with nature have been thoroughly documented (Edwards & Larson, 2020; Hughes, Richardson & Lumber., 2018; Larson et al., 2019; Soga et al., 2020), while efforts to reconnect children with nature have yielded positive outcomes (Barrable & Booth, 2020a; Cheng & Monroe, 2012; Frantz & Mayer, 2014; Pyle, 2002). Efforts for early nature connection seem to be more potent and long-lasting than in adults, and predict later higher nature connection levels as well as pro-environmental behaviour (Chawla & Cushing, 2007; Evans, Otto & Kaiser, 2018; Lieflander & Bogner, 2014; Lieflander et al., 2013).

Nature connection has been identified as having a distinct role in happiness and wellbeing (Zelenski & Nisbet, 2014), while other researchers have proposed that a positive relationship with the natural world is a basic psychological need for humans (Hurly & Walker, 2019). Moreover, several systematic reviews and meta-analyses have shown a robust and positive association between nature connection and wellbeing in adults (Capaldi, Dopko & Zelenski, 2014; Pritchard, Richardson, Sheffield & McEwan, 2020) and in children (Arola, Aulake, Ott, Lindholm, Kouvonen, Virtanen & Paloniemi, 2023). These, as well as the afore-mentioned associations with pro-environmental behaviours have proposed it as a key goal for education (Barrable, 2019).

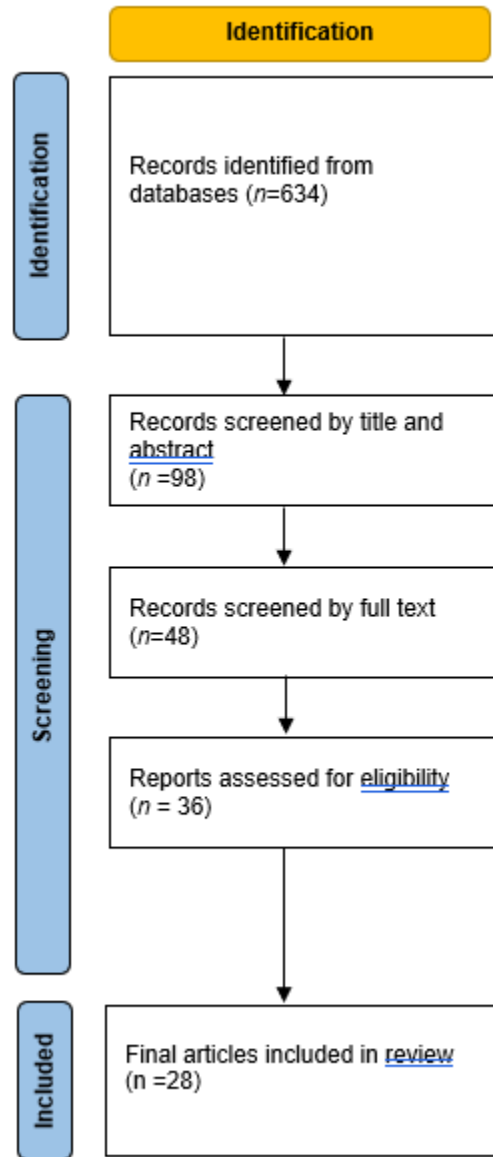
Some previous reviews have looked at nature connection in children, including Chawla (2020) and Barrable & Booth (2020). The two reviews had expressly different areas of focus and aims: the first one (Chawla, 2020) aimed at 'breadth of coverage' (Chawla, 2020; p. 620) and therefore giving a real overview, while the second one (Barrable & Booth, 2020) had a tighter focus only on interventions. This review has a different aim and focus, in that it looks to identify the *factors* that are associated with nature connection, and how those can inform ongoing efforts to improve nature connection in children.

## METHOD

An initial systematic search of the literature was undertaken through the databases Web of Science and PsycINFO (Beller et al., 2013). Key search terms were: (connection to nature OR biophilia OR environmental identity OR inclusion of nature in self OR love and care for nature OR nature relatedness OR inclusion of nature in self) AND (children OR childhood). No date limits were imposed. The articles found were scanned through title and abstract for relevance, and a further purposive sampling was undertaken in order to find the most effective educational tools for fostering an emotional connection to nature in children (Ames et al., 2019). A flowchart of the process is presented in Figure 1.

To sufficiently focus the search and find the most effective educational tools for fostering an emotional nature connection in children, only quantitative studies containing previously validated measures were considered. Articles were included if the following inclusion criteria were fulfilled: 1. was a full report published in a peer-reviewed journal; 2. used a validated measure ; 3. was published in English; 4. included children, defined as humans of 18 years of age or younger in its sample. A total of 28 articles fit the inclusion criteria and were chosen to be included in the synthesis; the summary of which can be found in Appendix A. The focus of the purposive sampling, using the above criteria was to "achieve conceptual and not statistical generalizability" (Ames, et al., 2019, p. 3) This means that although the initial methodology used was exhaustive and systematic, the final selection for inclusion into the synthesis was purposive, in order to meet the aims of usability and conceptual generalisability.

For the final synthesis, the articles were read and notes were made on the key factors that were reported on by the first author and their association (positive, negative or null) with nature connection in children. These were then synthesised into descriptive categories, or themes, using techniques of thematic synthesis created for use in reviews (Thomas & Harden, 2008). This process was undertaken by the first author initially, and then discussed and re-shaped through discussion with the second author, who also read the relevant full-texts. No specialist software was used for the analysis or synthesis processes. As described in Thomas and Harden (2008) the steps of the process were the generation of initial coding, the development of descriptive themes and finally the development of more analytic themes, through grouping together codes according to similarities or differences These are presented and explained fully in the results.

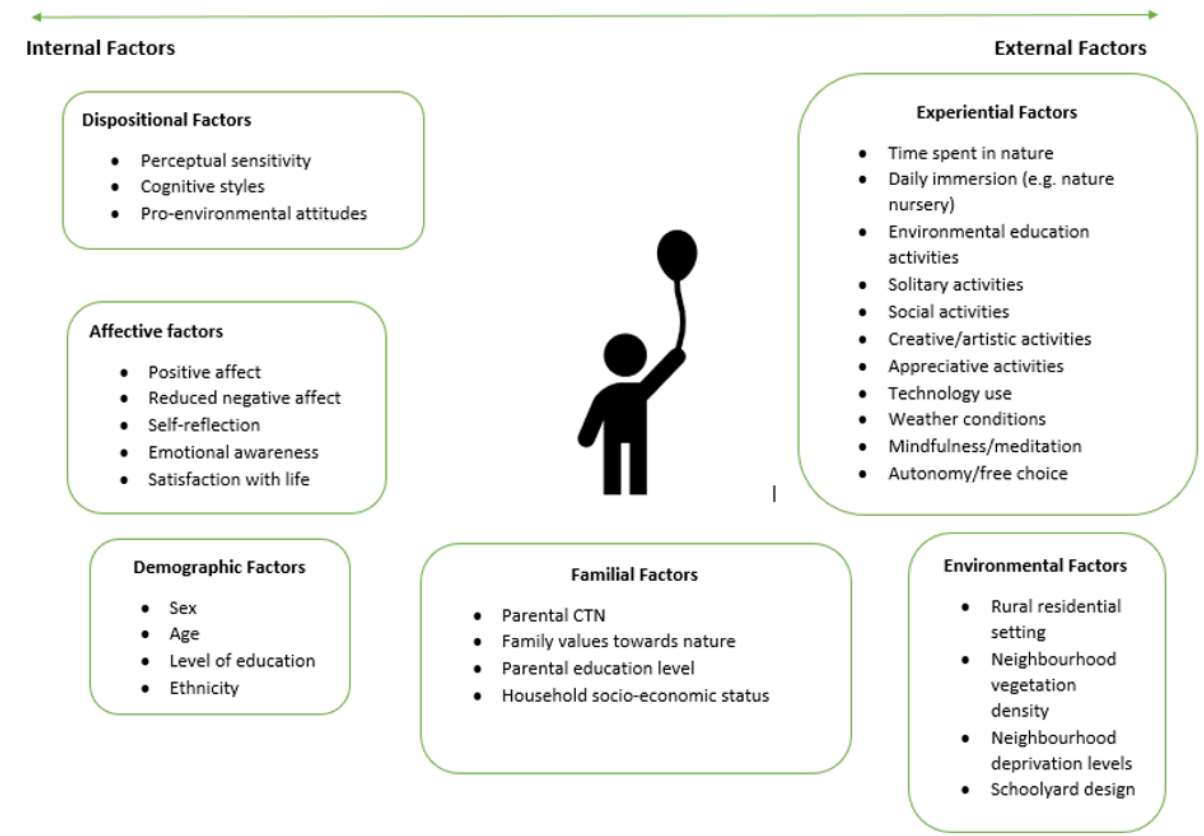
**Figure 1:** Flowchart of search, screening and inclusion

The two overarching labels of external and internal were chosen by the second author, not with the aim to separate two categories of factors, but to elucidate the potential interaction between the two. The terms internal and external were 'borrowed' from the language development literature (e.g. Kuvač-Kraljević, Blaži, Schults, Tulviste & Stolt, 2021; Sun, Steinkrauss, Tendeiro & De Bot, 2016). Internal factors refer to those coming from *within* the person, including motivations and dispositions, demographics and biological/genetic factors, while external are from *outwith* the person, mainly environmental and experiential factors. The categories are not precise but stand on a continuum, and are offered as suggestions and are intended to highlight the fact that factors that influence nature connection in children are not always simply environmental/experiential, and that there is a level of interaction between the internal and external factors.

## RESULTS

Overall, a variety of factors were found to be associated with nature connection in children. Initial 'descriptive themes' can be seen in Figure 2. Six main themes were identified, and these will be looked at into detail in this section. It should be noted that there is some overlap between the groups, although some of the general themes are often correlated themselves, for example parental education and child education, or parental income and place of residence. There is also a possibility of other confounding factors not mentioned here, as well as interactions between these factors as seen here that are hard to untangle.

**Figure 2.** Internal and external factors that are associated with nature connection in children.



### Demographic factors

Children's demographics have consistently been identified as predicting their development of a nature connection. Age, for example, was found to be inversely correlated with nature connection by Passmore et al. (2020). Age has also been identified as a factor affecting children's receptiveness to nature connection interventions (Larson et al., 2019; Lieflander et al., 2013) with younger children being more receptive or the changes being more long-lasting.

Two other demographic factors identified were children's ethnic background and sex (Larson et al., 2019). In this particular study they found that African American children had lower levels of nature connection to the other groups included in the study, namely Hispanic/Latino and other. . Several studies identified girls as having higher CTN than boys (Barrable & Booth, 2020b; Duron-Ramos et al.2020; Giusti,2019; Passmore et al., 2020) also found girls to have higher nature connection levels than boys, with various reasons hypothesised as responsible for this, including socialisation towards more empathetic and altruistic behaviours. Studies in adults have also suggested that men tend to have lower levels of connection than women (e.g. Barrable & Booth, 2022). It should be noted, however,

that other studies, such as Szczytko et al., (2019) did not find a significant difference between the sexes, nor between different ethnicities.

### **Dispositional factors**

Considering nature connection lies at the crossroad between cognitive and affective domains of the self, other defining personal traits need to be considered when designing environmental education focused on developing this relationship to nature. For example, perceptual sensitivity was found by Bakir-Demir et al., (2019) to be a significant predictor of nature connection. Higher perceptual sensitivity was consistently, albeit weakly, linked to higher reported level of nature connection.

A correlation between cognitive styles and nature connection was reported in a study by Leong et al., (2014). They found a strong association between nature connection and both innovative and holistic thinking. Innovative thinking is characterised by creativity and a tendency to break out of the norm, while those strongly connected to nature also show an openness to new experiences and ideas and enjoy finding new and creative ways to spend time in nature. Holistic thinkers are able to understand the interconnectedness of interactions, such as between objects and people, or the relationships within ecosystems. The mediating explanations between nature connection and innovative and holistic thinking are not causally confirmed.

Other dispositional factors were studied by Solano-Pinto et al. (2020), who found pro-environmental behaviour, satisfaction with life, knowledge of waste management and circular economy, and empowering beliefs on pro-environmental behaviour all to be positively associated with nature connection. Pro-environmental behaviour and beliefs seem to develop in parallel with nature connection, though how their development interacts needs to be further examined.

### **Familial Factors**

Although children spend a great deal of time in educational settings, which greatly influence their development, familial factors are clearly very salient. Barrable and Booth (2020b) found parental nature connection to be a predictor of the children's own connection over and above whether a child attended a nature preschool – although the two are probably highly correlated. This association of parental and child nature connection was also echoed in Passmore et al (2020). Cheng and Monroe (2012) report an association between family values towards nature and children's nature connection. There does seem to be a robust positive association between parental values/ nature connection and the child's connection, though the correlational nature of these studies does not allow us to draw causal conclusions. Other confounding variables could also be at play: parental nature connection and values may be influencing other variables, such as their choice of residential area, the child's outdoor behaviours, or the choice of school.

It could also be that parental demographic variables such as educational level and income may be influencing the child's development. Ahmetoglu (2019) found effects of parental educational background and household socio-economic status (SES) on the nature connection of a sample of Turkish children. The study found that low SES/household income was negatively associated with nature connection. Though requiring further investigation, the children of parents with high school degrees scored lower on measures of nature connection than the children of parents with college degrees.

### **Environmental factors**

A variety of residential settings have been positively correlated with increased levels of nature connection. Research has identified higher levels of neighbourhood vegetation density or living in a rural areas were positively associated with higher levels of children's connection (Bakir-Demir et al., 2019; Cheng& Monroe, 2012; Duron-Ramos et al., 2020).

Other studies (e.g. Passmore et al., 2020) have not found the same effect, with neighbourhood green space reported as negatively associated with children's nature connection. Interestingly, in the same study deprivation levels were found to be positively associated with children's nature connection. Sedawi et al., (2020) present a much more complex picture, outlining how cultural and other elements may be stronger predictors of connection or disconnection from the natural world, rather than simply contact with nature through the living environment.

Schoolyard design, which directly predicts the amount of time children spend in contact with nature while at school, is another factor positively associated with higher nature connection. A study by Luis et al., (2020) compared the effects of three different types of schoolyards; one school had a central playing field with some surrounding trees on the perimeter, another had green areas in addition to a playing field, and the last had earthen areas, a vegetable garden, and three playing fields. The greener the schoolyard, the greater the resulting levels of connection. The highest levels of connection were observed in the greenest schoolyard, interpreted as a consequence of not only increased levels of vegetation, but also greater exposure to biodiversity from the vegetable garden. A variable not accounted for was the difference in school curricula; the greenest school also included a garden-based learning program, making the effects from teaching and schoolyard greenery indistinguishable.

### **Experiential factors**

Time spent in nature, as well as visits to natural spaces is generally seen as, and often assumed to be, a predictive factor for nature connection in children. In a study by Larson et al., (2019) on children from rural South Carolina in the U.S. who were asked about the amount of time per day they spend outdoors, higher outdoor time was linked to a higher nature connection. When fully immersed into a green environment, as for example when attending a nature preschool, children showed a higher nature connection (Barrable & Booth, 2020b). On top of that, the more time spent in the attendance of the outdoor preschool, the stronger the children's nature connection. Because of the young age of the participants, the answers were obtained from their parents through an altered version of the original scale. The effect sizes found were quite small, and the correlational nature of the study could also have led to the conclusion that parents with high connection could have influenced the child's nature connection, instead of the nature preschool itself. This is also a plausible explanation, considering the association between parental and child nature connection discussed earlier.

The limitations of contact alone should be noted, as seen in the large sample from England studied by Passmore et al. (2020), which found that frequency of visits *did not* predict nature connection in children. Although surprising, the authors highlight the importance of quality above quantity. This is seen in studies such as Dopko et al. (2019), where the activities and quality of time spent in the forest seemed to have a positive effect on nature connection.

Looking more closely at the activities themselves, and comparing social versus solitary outdoor activities, Szczytko et al. (2020) found that both foster nature connection, though solitary activities are the stronger predictors. Activities such as hunting, fishing, or meditation seem to be more beneficial than social activities like sports or camping. Solitary activities allow more space for attention towards the natural environment, even when accompanied by an adult. Creativity and the chance to feel an emotional connection through art may play a role in developing a positive relationship with the natural world (Gray & Birrell, 2015).

Hoover et al. (2020) distinguished between groups of outdoor activities differently - they proposed the distinction between appreciative, consumptive, and abusive activities - appreciative activities encompassed enjoying nature without alternation, such as hiking or rock climbing, consumptive activities included anything where one consumes from nature, such as hunting or fishing, and abusive activities included activities of degradation, such as snowmobiling or off-road driving. Adult participants were asked to retrospectively recall the outdoor activities they participated in as children. Only appreciative activities were found to be strong predictors. A limitation of the study is the retrospective nature of the data gathered; it is possible the participants did not accurately recall their childhood activities.

Crawford et al. (2017) investigated the role that technology could play when engaged in outdoor activities. Children participated in chaperoned tours through natural parks either with a mobile application, a paper map, or an



environmental educator. The app was designed to engage children with their surroundings, providing stimulating challenges such as “What does a spruce tree’s bark look like?”. All methods were found to be equally effective in fostering nature connection. In a similar study in young adults, using technology was not found to hinder nature connection (Barrable & Booth, 2019).

Environmental education (EE) programmes are often seen as an effective way of fostering nature connection (Ernst & Theimer, 2011; Lieflander et al., 2013; Mullenbach et al., 2019). In all these studies different EE were examined with most having been found to have a positive effect on children’s connection. Limitations in measurement, such as a ceiling effect, could be responsible for no positive results in some. The complexity of these make it difficult to identify which specific factors have a positive effect on nature connection, but on the whole longer programmes, such as the four-day water focused EE programme investigated by Lieflander et al. (2013) and a four-day camping programme investigated by Mullenbach et al. (2019) had a larger effect.

A sense of autonomy and agency may positively contribute to the building of the nature connection. A study by McCree et al., (2018) took a group of socially disadvantaged children with special educational needs into the local woodland each week for three years. Through this time, there were no fixed activities. Children were allowed to choose from a variety of activities each week; scavenger hunts, creative crafts, shelter building, tree climbing, running around, or any other activity they could think of. Their connection levels increased after participation, though the generalizability of the results is limited due to a low sample size.

Mindfulness and meditation have been associated with an increase in nature connection in three separate studies on children. In Kossack and Bogner’s (2012) programme children simply sat in a five-minute-long silence at the end of their one-day field trip, which may have contributed to the positive results. Szczytko et al. (2020) observed meditation was also positively associated with increased levels of nature connection in children, while Author et al (2021) present the positive effect of mindfulness exercises and mindful natural play.

Conditions within the environment may also play a role in nature connection development. In one particular study which looked at that during a four-day field program containing a multitude of activities different groups of children had varying experiences with the field trip, due to differing weather conditions (Talebpour et al., 2020). One group had to be evacuated a day early because of extremely heavy rainfall and imminent flooding, and another was not able to participate in some activities because of rainfall. The last group was fortunate enough to only experience intermittent periods of rain, enjoying mostly dry weather and clear skies. The group experiencing extremely disruptive weather conditions reported significantly lower levels of nature connection following the program. Mild weather did not significantly affect nature connection levels in any way, and the group experiencing positive weather conditions had higher levels of nature connection post-program. Supported by Sedawi et al. (2020), the affinity towards nature of indigenous children from the Negev desert was also strongly influenced by the weather conditions. Other studies (Barrable et al., 2021; Dopko et al., 2019) have also hypothesised that weather could have played a role in the development of nature connection. More specifically, Barrable et al., 2021 had three groups attend a nature reserve and undertake the same activities; the group which experienced wet and windy weather had no increase in nature connection, while the two groups that visited on a sunny day had a significant positive change.

Notably some EE programmes have also been reported to have non-significant effects on children’s nature connection (Giusti, 2019, Hammond, 2020 & Harvey et al., 2020). Giusti (2019) examined the Salamander Project, a voluntary nature conservation program where children interacted with two endangered species of local Swedish salamanders. First, the children were asked to localise them, then document their characteristics, and release them back into the wild every day throughout a 2-month period. No difference in nature connection was found between children who took part in the Salamander Project and those who did not. Hammond (2020) investigated the effect of bird feeders in a classroom setting over one month, and also found no difference in nature connection between groups of students who had a bird feeder present in class, and those who did not. It was proposed the presence of a bird feeder was not a strong enough intervention to influence sixth-grade students. Finally, Harvey et al., (2020) looked at the effect of a biodiversity-focused outdoor learning program. It continued over one school year and included both short lectures on birds, amphibians, insects, and trees as well as hands-on activities such as building

bird boxes or monitoring species. No significant effect on nature connection was observed on post-test measures. It is possible the results of these studies could all be attributed to the ceiling effect.

### **Affective factors**

Affective elements of the experience, as well as internal affective characteristics may have a positive effect on nature connection in children. Pirchio et al. (2021) conducted four visits to a natural reserve with a group of children. The visits not only included multi-sensory, experiential activities such as searching for wild animal traces, listening to, and identifying sounds, but the program also incorporated an affective component. Along the walk, at each place, the children were asked how they were feeling. They were asked to map the emotions they were experiencing at that moment. After returning to class, they were then guided in sharing their emotions through drawings or other forms of artistic expression. The hands-on activities in combination with the reflection exercises resulted in significantly increased levels of nature connection.

Two studies have found an association between affective wellbeing and nature connection, namely increased levels of connection correlate with higher positive affect and lower negative affect (Barrable et al., 2021; Dopko et al., 2019). Moreover, a general sense of wellbeing, as in the case of life satisfaction has been associated with increased nature connection in some studies (Sedawi et al., 2020; Solano-Pinto et al. 2020). Satisfaction with life, or general wellbeing, is further confirmed by the findings of Sedawi et al. (2020), that only in stable political, social, and residential environments is there the necessary basis for developing a positive relationship to nature. The causality between nature connection and affective wellbeing, as well as life satisfaction is not causal, although in Barrable et al. (2021) we do see a pre- and post-measures and an increase in both. More research is needed to further elucidate the direction of this relationship.

## **DISCUSSION**

The review found a multitude of tools, programmes, and other variables positively and negatively associated with children's nature connection. In general, nature connection is positively influenced by time spent in safe natural surroundings and performing enjoyable and expressive outdoor activities. More complex EE programs may also foster this connection. In both the school and household context, personal demographics as well as cognitive characteristics need to be considered before embarking on programmes and promoting activities that will foster a child's emotional nature connection

Crucially parental values and behaviour as well as the greater household environment seem to be critical players in the facilitation or disruption of a child's relationship with nature. As such, policymakers and programme designers should focus on ensuring that parental involvement can be facilitated, and programmes can look at the child within their family and social context. As such, looking at family-unit level interventions, rather than at the level of a single child may prove to be very impactful.

### **Recommendations for practice:**

It is true that internal factors are often immutable (e.g. sex, race, family education levels) but there are several external factors that are easier to manipulate when planning and executing programmes designed to increase children's nature connection. Drawing conclusions from the above review, and acknowledging its limitations, we feel that the following recommendations could be made to support the growth of the field:

- 1) Consider family level interventions that can support the growth of nature connection of both parent/guardian and child. This may lead to longer-lasting changes and a potentially virtuous cycle of nature connection growth within the family.
- 2) Consider weather conditions as a factor that may play a role as to whether an intervention or programme will be successful. While the evidence is limited, there is some support to the idea that inclement weather may reduce the impact of a programme or experience on children's nature

connection. Consideration to appropriate shelter and clothing could be important in ensuring maximum impact.

- 3) Consider the potential of focusing programmes on those who may benefit the most or shape programmes with specific groups in mind (boys, older children etc). This is also a call to researchers to ensure that research activity is not focused on certain types of groups only.
- 4) Consider activities that may promote positive affect and enjoyment. Challenges and tensions arise here, as identified by Chawla (2020) in her review, of the ongoing environmental degradation and the need for education on the climate crisis on the one hand, and the important task of ensuring children build a lasting nature connection.

### **Limitations**

There are several limitations of this review that need to be taken into account. In the first instance, the search terms could have been more inclusive, using for example the term 'adolescent' or 'young people'. While this was not done in the search we undertook, several studies with adolescent participants were included. Moreover, and by design, only quantitative research that used validated measurement tools was included in this review which potentially limits its scope. Qualitative methods, such as the use of interviews may be more sensitive and appropriate to measure nature connection, especially in younger children. Related to this, there is also a call for the development of more instruments of measurement, as well as further evaluation of the existing tools, especially those attempting to measure the nature connection of very young children (Salazar et al., 2021). It is also necessary to develop more culturally inclusive and fluid tools, applicable to a variety of social and cultural settings.

There is also the question of whether it is even possible to measure a connection, a feeling. A great challenge in this field may be the proper operationalization of the extent to which nature is embedded in the self and the strength of the human-nature relationship. It is necessary to further theoretically scrutinise the meaning of the self, nature, and the relationship between the two (Beery & Wolf-Watz, 2014). It is possible that the empirical research thus far has not questioned the framing of these concepts sufficiently enough, and perhaps a complete post-humanistically oriented change in the conceptualization of the self and its relations to the world is needed (Fletcher, 2017; Rautio et al., 2017).

Considering the high degree of heterogeneity among the types of environments used in the studies, as well as the often observational rather than experimental nature of the methodologies use it is difficult to draw generally applicable conclusions on causality, or of the impact of specific environments and activities of children's nature connection. However, we feel that the general recommendations measured above may provide an opportunity to focus practice on some areas that have shown promise.

Finally, this was not an exhaustive review of all the literature but was purposive in its scope and search methodology. As such, not all relevant studies may have been included.

### **CONCLUSION**

Building a connection to nature in children seems to involve many factors, often interconnected and in interplay with each other. This paper proposes two overarching themes of internal and external factors, and wants to highlight that it is the interaction or interplay of the two that ultimately impacts nature connection in children.

As such, we propose a set of recommendations for practice, through EE programmes as well as less formal avenues. Moreover, we wish to highlight the role of parents, the bigger family unit and the community is key in achieving lasting positive changes in children's nature connection. For that to be achieved, sustained cooperation and communication of teachers, policymakers, and parents is needed in order to ensure the implementation of as many of the strategies as possible within their abilities and resources. Moreover, we propose that there EE should focus on equity of access to ensure all children, regardless of background have access to high quality nature experiences.

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**Appendix A**  
Overview of Articles Included in the Review

	Article	Participant age range	Number of participants	Variables studied	Type of nature setting	Instrument used
1	Ahmetoglu (2019)	4-6	238	Socio-economic status, perceived importance of nature activity	Outdoor recreation, Turkey	BI
2	Bakir-Demir et al., (2019)	8-11	299	Perceptual sensitivity, amount of neighbourhood greenery	Residential area nature, Turkey	CNI, INS, NR
3	Barrable & Booth (2020b)	1-8	216	Parental nature connection, time spent in nature preschool	Nature preschool, Scotland	CNI-PPC (adjusted CNI)
4	Barrable et al., (2021)	9-10	74	Mindful engagement with nature	Nature reserve, Wales	NCI, INS
5	Cheng & Monroe (2012)	9-10	5 500	Family values, previous experiences, and knowledge about nature, nature near the home	EE program, USA	CNI
6	Cho & Lee (2018)	8-9	104	Knowledge and experience with nature	EE program, South Korea	INS, CNS
7	Crawford et al., (2017)	9-14	747	Knowledge and experience with nature	Park tour, Canada	INS
8	Dopko et al., (2019)	Unknown	80	Time spent in nature	Field trip to nature school, Canada	LCNS
9	Duron-Ramos et al., (2020)	9-12	400	Place of residence, gender	Neighborhood nature, Mexico	CNI
10	Ernst & Theimer. (2011)	8-13	385	Components of EE programs	EE programs, USA	CNI
11	Giusti (2019)	10	158	Experience with nature, gender	Salamander project, Sweden	CNI, INS
12	Gray & Birrell (2015)	12-14	19	Experience with nature combined with artistic expression	Art-focused EE program, Australia	NR

	Article	Participant age range	Number of participants	Variables studied	Type of nature setting	Instrument used
13	Hammond (2020)	11-12	148	Experience with nature	Classroom bird feeders, USA	NR
14	Harvey et al., (2020)	8-11	549	Knowledge and experience with nature	EE program, UK	CNI
15	Hoover (2020)	16-19	140	Appreciative experiences with nature	Outdoor experiences, USA	CNS
16	Kossack & Bogner (2012)	11-12	123	Knowledge and experience with nature, initial NATURE CONNECTION	Forest trip, Germany	INS
17	Larson et al., (2019)	11-14	543	Screen time, gender, ethnic background, age	Outdoor recreation, USA	NR, INS
18	Leong et al., (2014)	13-17	138	Cognitive styles	Unknown, Singapore	CNS, NR
19	Lieflander et al., (2013)	9-13	N1 = 304 N2 = 264	Age, educational track (Study 1), knowledge and experience with nature (Study 2)	Water-focused EE program, Germany	INS
20	Luis et al., (2020)	8-14	132	Experience with nature	Schoolyard greenery, Portugal	CNI
21	McCree et al., (2018)	5-10	11	Knowledge and experience with nature, autonomy	Forest school project, UK	CNI
22	Mullenbach et al., (2019)	10-11	163	Knowledge and experience with nature	Residential outdoor EE program, USA	C(C)NS (adjusted CNS)
23	Passmore et al., (2021)		209	Age, neighbourhood deprivation levels, parental NATURE CONNECTION		
24	Pirchio et al., (2021)	9-11	N1 = 154, N2 = 170	Knowledge and experience with nature (Study 1), emotional self-awareness (Study 2)	Field trip programs, Italy	CNS

	Article	Participant age range	Number of participants	Variables studied	Type of nature setting	Instrument used
25	Sedawi et al., (2020)	10-12	294	SES, time spent in nature, place of residence	Indigenous settlement, Israel	CNI
26	Solano-Pinto et al., (2020)	10-19	120	Pro-environmental behavior and beliefs, satisfaction with life, environmental knowledge	Rural residency, Spain	CNS
27	Szczytko et al., (2020)	9-12	1 285	Type of outdoor activity, <b>gender</b> , <b>ethnicity</b>	Outdoor activities, USA	CNI
28	Talebpour et al., (2020)	10-11	317	Knowledge and experience with nature, weather	Residential field program, USA	CNI

*Note.* Biophilia interview = BI (Rice & Torquati, 2013), Connectedness to nature scale = CNS (Mayer & McPherson Frantz, 2004), Connection to nature index = CNI (Cheng & Monroe, 2012), Nature Connection Index = NCI (Richardson et al., 2019), Inclusion of nature in self scale = INS (Schultz 2002), Love and care for nature scale = LCNS (Perkins, 2010), Nature relatedness scale = NR (Nisbet, Zelenski & Murphy, 2009), EE = environmental education. Variables coloured in red were not positively correlated with nature connection.

## Three- to Six-Year-Olds Demonstration of Connection to Nature at a Montessori School in the Upper Midwest

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### ABSTRACT

Children are born into a world today with a drastically changing environmental climate. When young people develop an emotional attachment and sense of identity with nature, they may be more likely to behave in less destructive ways toward the planet and possibly live with a sense of responsibility and respect for nature. This mixed method study aimed to measure to what extent 3- to 6-year-olds demonstrated environmental sensitivity, awareness, and preferences at a nature-based Montessori school in the upper Midwest of the United States and asked if age was an influencing variable. Young children's connection to nature in these categories was determined using a modified age-appropriate psychological games testing tool, field observations of the types of nature features and activities the children experienced indoors and outdoors, and interviews with the two lead teachers. Results indicated that this cohort of children demonstrated a moderate to strong connection to nature in all three categories. Age was an influencing variable measuring environmental sensitivity and some aspects of environmental awareness, but not environmental preferences regarding where to play. This study adds to the body of work conducted in early childhood education, environmental education, early childhood environmental education for sustainability, and Montessori education.

**Keywords:** early childhood environmental education, early childhood education, environmental education, connection to nature, nature-based education, Montessori, biophilia, games testing

Children born in the 21st century come into a world with a drastically changing environmental climate (Bjornerud, 2005; Francis, 2015; IPCC, 2021; Klein, 2014; Wilson, 2021). Many people view global climates as static or just how it always has been and will be. People can experience a beautiful park with some trees, animals, and grass but do not have the memory or knowledge of the dense oak savanna that previously existed. Kahn (2002) labeled this *environmental generational amnesia*, stating, "We all take the natural environment we encounter during childhood as the norm against which we measure environmental degradation later in our lives" (p. 106). He further explained, "With each ensuing generation, the amount of environmental degradation increases, but each generation in its youth takes that degraded condition as the non-degraded condition—as the normal experience" (Kahn, 2002, p. 106). It follows that present generations do not understand the environment as it was in the past as they view the level of environmental degradation in the present; consequently, they can miss the magnitude of the environmental deterioration.

What is needed for people to find it important to protect and preserve the ecosphere? A literature review revealed that an answer lies in developing a connection to nature during childhood. To combat climate change as a species, we must be connected to nature to adopt and promote sustainable lifestyles (Chawla, 2020; Gould, 1993; Rosa et al., 2018; Wilson, 2016). However, children spend less time playing outdoors, therefore, less time experiencing, wondering, wandering, and learning from nature as children did in the past. Beery and Jørgensen (2018) referred to this as an *"extinction of experience"* (p. 21). Compared to previous generations, children are spending more and more time indoors (Burgess & Ernst, 2020; Cordiano et al., 2019) and on screens (Chawla, 2020; Crandell, 2019;

Ginsberg & Audley, 2020; Sobel, 2016; Wilson, 2016), resulting in their spending less time outdoors; scholars have suggested that this is evidence of a disconnection from nature compared to children of the past (Beery & Jørgensen, 2018; Louv, 2008). Connection to nature, not disconnection, is needed to preserve the biosphere, and the opportunity to connect can occur at a very young age.

Early childhood environmental education (ECEE) pedagogy can encourage a child's natural curiosity and wonder about the ecosphere they are members of. When children develop a connection to nature, they are more likely to exhibit pro-environmental behavior as they age (Barrable & Booth, 2020; Chawla, 2020; Duhn et al., 2017; Kollmuss & Agyeman, 2002; Nxumalo & Berg, 2020; Rosa et al., 2018). An environmental mindset, or as Leopold (1949) referred to, an *ecological conscience*, is an awareness of the human impact on nature and having the reflective and even spiritual ethic to change our human impact on Earth's natural environments. For children to develop an ecological conscience they need more than to simply play in nature but to engage in play-based, child-focused learning with the help of their teachers. As Carson (1956) pointed out, "If a child is to keep alive [their] inborn sense of wonder . . . [they] need the companionship of at least one adult who can share it, rediscovering with [them] the joy, excitement, and mystery of the world we live in" (pp. 44-49). In other words, when young people develop an emotional attachment and sense of identity with nature, they are more likely to behave in ways that are less destructive towards the planet. They will live with a sense of responsibility and respect for nature and attitudes that continue into adulthood.

This study focused on the following questions: To what extent do 3- to 6-year-olds demonstrate connection to nature at a Montessori school in the upper Midwest? A secondary question asked if age was an influencing variable. An opportunity to bond with nature can occur in formal early childhood education (ECE) through routine outdoor exposure with encouragement to explore and wonder. Connection to nature for young children is multi-dimensional and includes emotional responses, cognitive interests, physical interaction, and multisensory experiences. For these characteristics to form, "connection to nature in two-to five-year-olds involves freely chosen personal elections to interact with nature. This interaction may take many forms, including bodily movement in nature, the investigation of nature phenomena, place exploration, and free play" (Beery et al., 2020 p. 16). Montessori ECE can be a formal setting that allows for these connections to develop.

## METHOD

### Mixed Methodology

A mixed method study is one where the researcher collects both qualitative and quantitative data to investigate problems or answer research questions. As Creswell (2015) explained, in a mixed method approach, the "assumption of this approach is that when an investigator combines statistical trends (quantitative data) with stories and personal experiences (qualitative data), this collective strength provides a better understanding of the research problem than either form of data alone" (p. 2). Creswell and Plano Clark (2018) pointed out in a convergent mixed methods design merges them to compare and combine to interpret together. A convergent mixed method approach was suitable to answer the research questions for this study.

The following variables—environmental sensitivity, awareness, and preferences—were measured to represent the concept of children's connection to nature. Two indicators of environmental sensitivity to nature were if a child demonstrated empathy towards living beings' ability to get hurt or feel pain and that human created structures do not. The second is if the child responded positively to positive images of activities in nature and negatively to destructive activities in nature. Two indicators of environmental awareness include the child's ability to match products humans use to where they come from in nature and recognition that pollution harms the biosphere. Two indicators of environmental preferences were determined based on what environments the child preferred or did not prefer to play.

To determine if the children demonstrated connection to nature, triangulation of observations of nature experiences, children's games data, and teacher interviews were used to give a more complete result.

## Site and Participants

This mixed method study occurred at a Montessori charter school in a rural area of the upper Midwest of the United States. This school was intentionally chosen as a site to assess if 3- to-6-year-olds demonstrated connection to nature because the campus had created and incorporated the surrounding natural environments within their pedagogy. Traditionally, Montessori philosophy embraces purposeful nature-related experiences for children, allowing them the opportunity for regular nature exposure. This Montessori school served approximately 90 students from ages three- to twelve-years-old. The ECE program included a few students who began the year as two-year-olds but turned three during the fall. This ECE program was divided into two Children's Houses (ages 3-6) or classes. 100% of these students were the participants in this study, N=34, as were the two classroom teachers. Teacher one (T1), was Montessori trained and on the faculty for several years at this site, and teacher two (T2), was new to the school but had over a decade of public-school teaching experience with this age group.

This school consisted of several connecting cottages divided into indoor classrooms and office spaces. The campus included a playground on a large grassy area with many trees, ample space for running, and a small wooded area. Additionally, during the 2020-2021 academic year, classes were conducted outdoors all day, every day, temporarily adopting a forest kindergarten philosophy to continue safely providing in-person education during the COVID-19 pandemic (personal communication, August 27, 2022). Larimore (2016) explained, "Forest kindergartens have been defined as educational programs which provide daily outdoor experiences for children 3-6 years old . . . tend to spend 70-100% of their time outdoors, in nature immersion experience" (p. 34). Thus, this school followed a nature-based pedagogy.

## Procedure and Data Collection

I was intrigued by Giusti et al. (2014) research instrument called "Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere," which used interviews with image-based games to assess what they referred to as preschoolers' emotional, cognitive, and attitudinal affinity to nature. Their findings indicated that "long-lasting exposure to natural environments, even in an urban context, is closely related to the development of a conscious and unconscious affinity with the biosphere and its dynamics" (Giusti et al., 2014 p. 33). I was captivated by the age-appropriate games aspect of the data collection tool.

I became familiar with the psychological game-based testing (GT) tool developed by Giusti (2012) after hearing a presentation by MacKeen and Wright (2020) at the 2021 Natural Start Alliance Virtual Conference held by the North American Association for Environmental Education (NAAEE). MacKeen and Wright (2020) discussed updating Giusti et al. (2014) data collection methods to fit participants' geographic and cultural realities in different locations. I decided to adapt the GT technique of Giusti et al. (2014) to measure preschoolers' connection to nature using MacKeen and Wright's (2020) suggestion to change the images to align with the geographic and cultural realities of the research site. For example, Giusti's original game included an image of a reindeer which are not indigenous to this study's site's geographic region. Therefore, it is implausible that a child in the area would have encountered a live reindeer in the wild. Instead, I used an image of a white-tailed deer, which is commonly seen in and around the town where the Montessori school is located. I applied this logic to the choice of other images in the games. The categories of the pictures, living and nonliving, remained the same, but the pictures were changed to align the original tool with the present context.

The children's daily routine consisted of attending workspaces, so I established a GT workspace in each classroom. The children completed the games with me individually. The choice to use this research technique was that the games used a mixed method approach and allowed the children's voices to be heard in the study.

The modified GT tool consisted of six games. Games 1A and 1B measured if children demonstrated environmental sensitivity (ES), games 2A and 2B measured environmental awareness (EA), and games 3A and 3B measured environmental preferences (EP) for nature. This study defines *environmental sensitivity* as "a conjunction of empathy and concern, as caring for a person implies also being concerned about [their] health" (Giusti, 2012, p. 23). *Environmental awareness* is the understanding that humans are members of the biosphere and that human behavior

impacts the ecosphere (Giusti, 2012). Children's *environmental preferences* related to places they prefer or do not prefer to play in are referred to as attitudes in Giusti et al. (2014). Each participant was assigned a code of letters and numbers to conceal and protect their identities.

Along with the GT data collection, I compiled a list of indoor and outdoor nature features and activities observed to determine what nature exposure the school environment provided for the children. Teacher interviews took place after conducting the inventory of indoor and outdoor features and activities and collecting the GT tool data. Individually, each teacher interview occurred after school in their classroom. This interviewer took the approach of a traveler, as described by Brinkmann and Kvale (2015), to converse with the teachers to wander through their experienced journey with the children's nature interactions. With permission from the interviewees, the Rev app on my iPhone recorded the interviews. The Rev app transcriptions were later transferred to a Google Doc and edited for accuracy.

### Nature Related Activities and Features

The 3- to 6-year-olds at this site had access to nature features and activities indoors and outdoors daily. The researcher accompanied the children during their structured indoor and unstructured outdoor playtime. Indoor exposure to nature-based features and activities were inventoried and recorded. Table 2 shows indoor nature-related classroom features. Criteria for feature inclusion are based on Kellert et al. (2008) definitions of indoor environmental features.

**Table 2.** Indoor Nature Related Features with the Analytic Framework Used for Inventory

Nature-Related Features in the Classrooms		
FEATURE	DEFINITION	OBSERVED FEATURES
<b>Fresh Air</b>	Well-ventilated, non-stagnant, visually clear air	Well-ventilated and multi-door access to rooms from the outside. A main door from the parking area to a space to take off boots, coats, and mittens. To the left was one classroom, and to the right was the other classroom, with no doors, just open to the rooms.
<b>Water</b>	Water as a design feature within a built space	Children had access to an open kitchenette in one classroom with a child-height sink for the food workstation. The other classroom had a glass canister with access to fresh water for drinking or washing. Children could fill water pitchers for plants from these features and wash and clean for food preparation or cleaning up.
<b>Natural Sunlight</b>	Use of natural over artificial light	Large picture windows across three of the four classroom walls allowed sunlight to pour inside. The classrooms also used track lighting and lamps instead of fluorescent ceiling lights.
<b>Views of Nature</b>	Views from inside of outside natural features, vistas, or vegetation	In each classroom, children could look up from their workspaces, from any part of the room, and easily see nature outside. There were also workspaces or a desk where the chair faced a window.
<b>Plants</b>	Plants inside a built space	Living plants were in each classroom for children to be with and care for. Manipulatives in activities or art use plant patterns, shapes, or vegetative matter such as leaves, beans, acorns, and other seeds.

<b>Natural Materials</b>	Natural (wood, rocks, items from nature) instead of artificial materials (plastics)	Examples of materials from nature included acorns, twigs, stones, a nest, pinecones, feathers, and shells to use as manipulatives. Most of the furniture was made of wood instead of plastic. There were a few child-sized metal folding chairs. The few pieces of plastic furniture were in the process of being replaced with wood.
<b>Natural Colors</b>	Colors considered earth tones or shades of colors found in nature	The walls were white. The furniture was tan or light brown. The wall-to-wall carpet was the color of the ground, different browns and area rugs were more colorful but still nature colors, such as a gray and white geometric patterned area rug, a light blue and white cotton rug to sit on the floor, and learning containers are muted tones, not electric or bright.

The researcher conducted observations of the children outdoors during recess when the temperatures were consistently below freezing (32°F/0°C), and snow covered the ground. The teachers explained activities conducted outdoors when the weather was warmer. The Observed Nature Related Activities Outdoors section of Table 3 illustrates the children demonstrating curiosity, creativity, innovation, and awareness of themselves in relation to each other and the natural environment through the various outdoor activities listed below.

**Table 3.** Indoor and Outdoor Nature Related Activities

<b>Observed Nature Related Activities in the Classrooms</b>	
<b>TYPE of ACTIVITY</b>	<b>OBSERVED EXAMPLES</b>
<b>Experiment Investigations</b>	Pumpkins in different stages of decomposition on a countertop available for children to observe from day to day.
<b>Nature Art</b>	Workspace to trace leaves and make leaf rubbings. Cards of animals with small leaves and seeds to recreate animal depictions on colored construction paper with glue.
<b>Workspace Activities</b>	Topics such as a study of animal tracks using nomenclature cards to match the animal with the tracks. Using 3-part nomenclature cards to learn an item with its name and then match the name with the item.  Color pages with coded coloring of animals using geometric shapes to create the animal. Color pages used to learn the parts of animals and life cycles.
<b>Book Choices</b>	Children had access to many books on animals, nature features and functions, and seasons in each classroom library, on shelves the height of which was easy for them to reach.  Books on the theme of a workspace, such as in the space learning animal tracks using the cards, there were also books on the subject.
<b>Observed Nature Related Activities Outdoors</b>	
<b>ACTIVITY</b>	<b>EXAMPLE</b>



<b>Experiments</b>	<b>Icicle Demolition:</b> Four children threw different loose parts at hanging icicles to observe first if they could make contact with the icicles and second, if so, their impact on the icicles.
	<b>Water Flow:</b> Six children inferred and observed how different objects or ramp angles impacted water flow in a downspout ramp. They excitedly yelled out ideas to try and negotiate what they would do next.
<b>Creating Sculptures</b>	Creating snow people using snow and loose parts.
<b>Fort Building</b>	Building a fort using a picnic bench with a blanket hanging over the sides, held down using large rocks.
	Building a fort within the fenced area using fallen branches to add a ceiling to the fort.
<b>Simulated Cooking</b>	Children used tree stumps as tables and stovetops, using a stirring stick to make soup in toy pots with loose parts such as pinecones, twigs, and leaves.
<b>Running</b>	Chasing each other or participating in snowball fights.
<b>Sitting Alone</b>	Children would sit alone under the playground equipment or, at a picnic bench, or in the snow away from others, appearing to peacefully contemplate.
<b>Sitting with Others</b>	Groups of students in pairs, triads, and foursomes would spend time sitting on the playground floor or out on the snow by the border fence or in large truck tires (there as loose parts).
<b>Playground Equipment</b>	While outside, the children rarely played on the playground equipment
<b>Outdoor Activities Described as Typical but Not Observed</b>	
<b>Physical Education</b>	Taught outside in the play area by a specialist.
<b>General Nature Hikes</b>	Along sections of the campus beyond the recess area along the boundary to the adjacent farm and the drainage ditch by the road, and the woods.
<b>Targeted Nature Hikes</b>	Hikes to identify insects, trees, or specific plants in various areas of campus during different seasons.
<b>Content Teaching</b>	Academics taught outside instead of inside. Reading picture books outdoors. Music lessons taught outside.
<b>Lunch</b>	Outside instead of inside, depending on the weather.

### Data Analysis

Quantitative data was analyzed using descriptive and inferential statistics. Descriptive statistics, specifically mean ( $\bar{X}$ ) and standard deviation ( $\sigma$ ), were used to measure the strength of the cohort's demonstrated connection to nature (C2N).

**Table 1.** The Strength of Connection to Nature for Games 1A, 1B, (ES), and 2B (EA)

C2N	Strong	Moderate	Weak	Lacking
Mean	$\bar{X} \geq 0.75$	$\bar{X} = 0.74-0.61$	$\bar{X} = 0.60-0.51$	$\bar{X} \leq 0.50$

Game 2A (EA) C2N strength was based on the number of correct EA scores (depicted in Figure 6). Games 3A and 3B (EP) did not have a 50% random correct possibility. The strength of cohort connection to nature for EP weighed heavier on the qualitative data to evaluate the quantitative results. Inferential statistics, specifically regression lines, were used to determine the correlation between the independent variable (children) and dependent variable (connection to nature). Analyses of variance (ANOVA) were run to determine if the null hypothesis could be rejected, in other words, to determine if age was an influencing variable.

The GT technique included qualitative interview response data of children's rationalized choices of their quantitative answers. Encouraging children's own words as data allowed the researcher to recognize each child's reasoning and avoid making assumptions as to their motivations. One participant's quantitative desire to play on a farm may differ from another child's reason to want to play on a farm.

To analyze the qualitative teacher interviews, interpretation of the participant's own words was used to create in vivo coding to discover any recognizable *a posteriori* themes that surfaced from the interviews. Expanding on these identified themes, "The analysis of an interview is interspersed between the initial story told by the interviewee to the researcher and the final story told by the research to the audience" (Brinkmann & Kvale, 2015, p. 219). The objective of the teacher interviews was to gather their insight and interpretation of the children's connection to nature. The teachers' perceptions of children's connection to nature allowed for the "identification, description, and interpretation" (Creswell & Plano Clark, 2018, p. 116) using both qualitative and quantitative data.

The triangulation of the qualitative data from observations of nature experiences, the teacher interviews, and the children's verbal responses in the games contributed to explaining and interpreting the quantitative data to develop conclusions about the children.

## FINDINGS AND DISCUSSION

The daily allocation of unstructured play is essential. As many scholars have pointed out, unstructured play in nature promotes healthy early childhood development (Larimore, 2019; NAAEE, 2016; Schirp & Vollmar, 2013). Nature-play allows children to engage their curiosity, which leads to exploration, creativity, and innovation (Ernst & Burcak, 2019). Table 3 illustrates that the children in this study demonstrated these skills through unstructured play during daily recess.

While outside, the children did not spend much time on the playground equipment, which corresponds with Zamani's (2016) conclusion that given a choice in a setting with playground equipment and ample other nature, children gravitate toward natural spaces to play, innovate, and create games and activities of their own. In this study, children played in the open spaces, used tree stumps as tables and stovetops, branches, and picnic tables to create forts, and conducted experimental investigations using loose parts found in the area. Zamani's (2016) results indicated "that the natural and mixed zones [playground equipment with natural areas] offered a diverse spectrum of cognitive play, were supportive of different learning styles and expanded their understanding about the world" (p. 172). As demonstrated in this study and listed on Table 3, children chose nature-play at playgrounds instead of playing on playground equipment.

### Measuring Environmental Knowledge and Connection to Nature: A Games Testing Tool

The following are the results from this investigation's modified version of the GT tool.

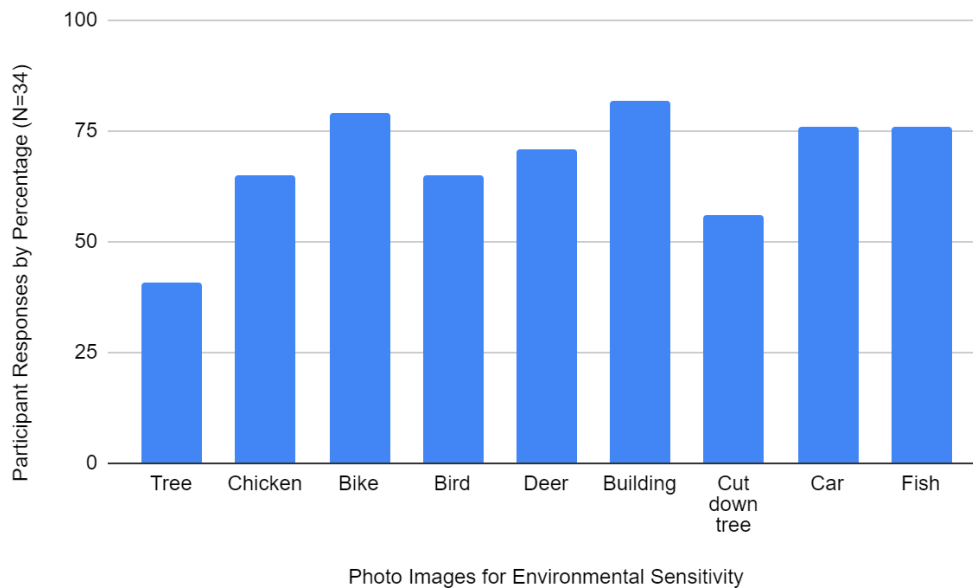
### Game 1A: Environmental Sensitivity (Feelings)

Game 1A was designed to assess children's environmental sensitivity (ES) towards nature. The participants (N=34) answered "yes" or "no" to the question, "Can the image in the picture feel an owie or get hurt like you or another human can?" As Giusti et al. (2014) explained, "Children's emotional affinity with the biosphere is here quantified by the capacity for emotional perspective-taking . . . the child's empathetic capacity to experience pain for living beings (e.g., marine life, birds, plants, animals) in comparison to empathy for damages to manufactured objects (e.g., vehicles)" (p. 21).

Children's response of "yes" to living images: tree, chicken, bird, deer, fish, and "no" to non-living images: bike, building, cut down tree, car, to the question "Can the image feel an owie or get hurt like you or another human?" demonstrated sensitivity or empathy towards nature. While opposite answers were considered a lack of sensitivity to nature.

**Results.** The cohort's mean ( $\bar{X}$ ) responses indicated they did demonstrate ES for living beings and an understanding that the nonliving do not experience pain like humans. For example, the majority of the children (24/34) acknowledged that deer could get hurt like humans and understood (28/34) that buildings cannot. However, fewer children answered with a yes score for the living tree (14/34) or a no score for the cut-down tree (19/34), indicating a lack of ES for plants.

**Figure 1.** Game 1A: Percentage Demonstrating Environmental Sensitivity

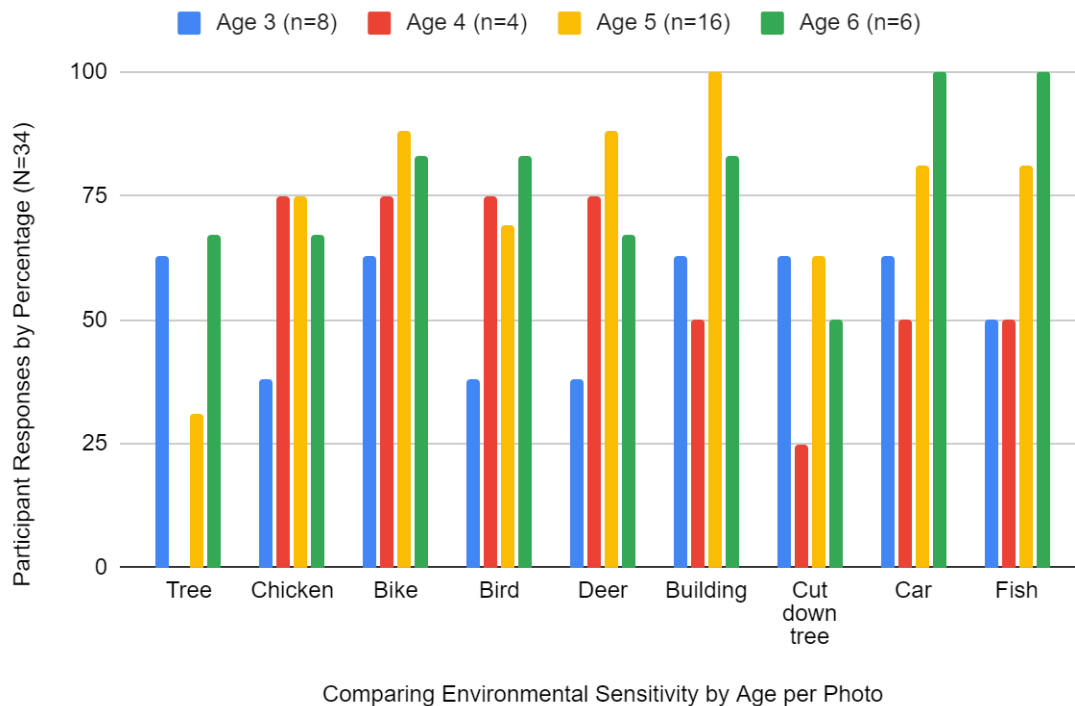


As the answers for Games 1A were yes/no, there is a possible random correct answer of 0.50 or 50%. To understand whether or not the cohort responses demonstrated a statistically significant positive correlation of correct answers to indicate connection to nature, an ANOVA was calculated, and the p-values determined if there was a statistical deviation from random correct answers. If the value is  $< 0.05$ , the data would be deemed statistically significant. If the p-value is  $> 0.05$ , randomness cannot be ruled out. A p-value is used to reject the null hypothesis. In this case, the null hypothesis was that 3- to 6-year-olds at this site do not demonstrate ES to nature. For Game 1A, the ANOVA run for the cohort gave an average of 69% correct answers (50% would be random guessing) with a p-value =  $1.86 \times 10^{-7}$ , indicating statistically significant results; thus, the children exhibited ES or connection to nature. The average correct answer of 69% indicated a moderate strength ( $\bar{X} = 0.74-0.61$ ) of connection to nature.

Using Excel, the researcher conducted a regression analysis to indicate if age, the independent variable, influenced the game score or the dependent variable. The regression analysis also generated the average correct answers for

the group and a p-value to determine if the values were statistically significant. The analysis coefficient calculated a predicted percent increase in correct answers per age if age was an influential variable. The regression analysis with such a small p-value of 0.000923 indicated that one can reject the null hypothesis; thus, age was an influential variable. The coefficient of age indicated that the percent of correct scores for a child would predictably go up by 9.7% per age for this game with this cohort.

**Figure 2.** Game 1A: Comparing Environmental Sensitivity Between Age Groups



Game 1A responses had a 50% random possible correct rate; a result of 69% was a statistically significant response rate, indicating a moderate ES. There was a clear understanding ( $\bar{X} \geq 0.75$ ) by the cohort that non-living objects (bikes, buildings, and cars) do not hurt as humans do, qualitative data included, “The wheels can pop, but it doesn’t hurt” (IHM4), “[a bike] can get scratched but not hurt” (DHF5).

Participants indicated an understanding that animals do feel pain or can be harmed like humans can. Nevertheless, more children responded that fish (26/34) and deer (24/34) could feel pain than chickens or red-winged blackbirds (22/34). The qualitative data indicated that results could have been influenced by understanding more concretely how animals get hurt versus the abstract that they can. For example, more than one participant said, “If a fish is caught, it would hurt” (NHM5, FKM5, JHM6). Others explained, “deer can bleed” (GHF2) and “deer can get shot and die” (NHM5). In the meantime, only 14/34 respondents indicated that plants (live trees) could also experience harm as other living beings, and 19/34 understood that a cut-down tree (non-living being) could not. The underlying intent of the question is to determine if children understand that living beings can be harmed as humans can. However, in a child’s experience, the damage a tree might experience would not be expressed in a way that an animal presents pain. The results of this study showed that this cohort understood that animals feel pain or can be harmed like humans.

**Discussion.** Disaggregating the data by age revealed that the five and 6-year-olds demonstrated a clearer understanding that non-living things could not feel pain than the three and 4-year-olds. The 3-year-olds demonstrated the least clarity in understanding that animals could feel pain compared to older children. As

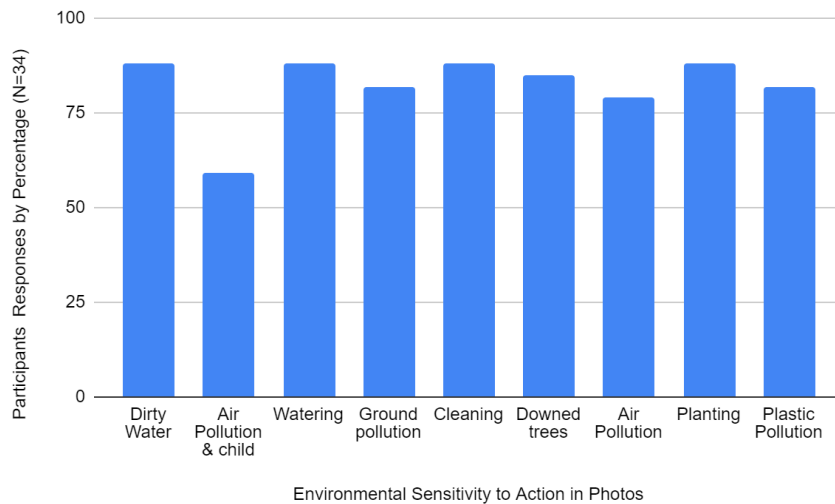
Klingensmith (1953) and Zaitchik et al. (2014) pointed out, the Piagetian concept of animism explained that a young child’s knowledge of ‘alive’ can refer to anything that can move or demonstrate activity. With this logic, cars and bicycles could be interpreted as alive as they move, and trees as not alive, as they do not appear to move. So, it is not surprising that so many four and 5-year-olds did not perceive trees as beings that could feel pain like people do or that they are alive like humans. What was surprising was that 5/8 of the 3-year-olds did. This cohort demonstrated a moderate ES or connection to nature; age was a contributing variable.

**Game 1B: Environmental Sensitivity (Action)**

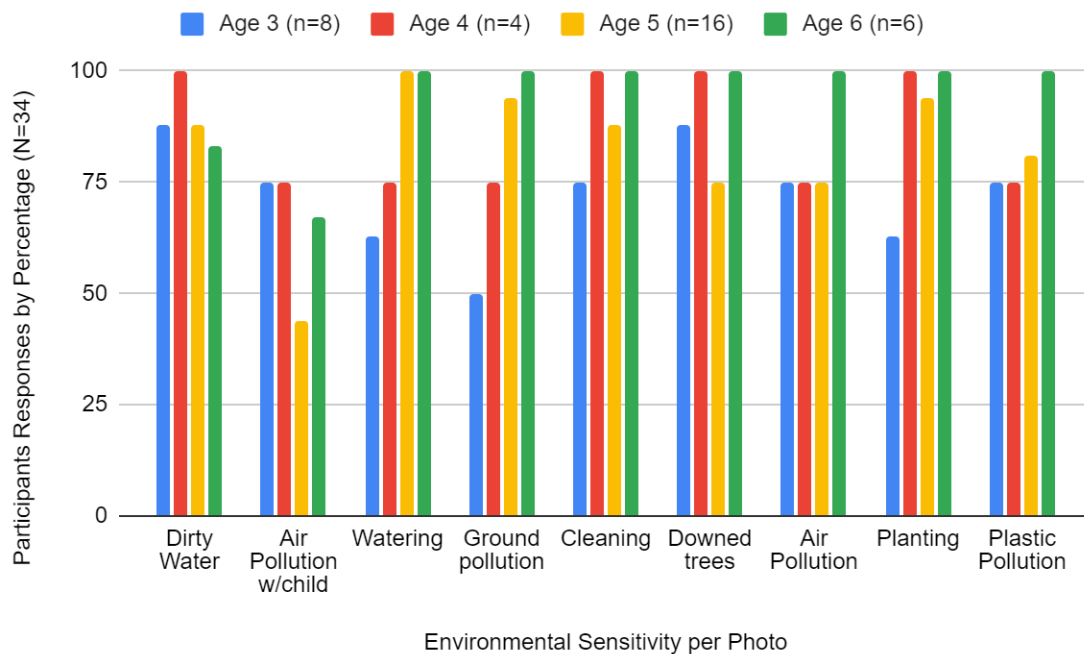
Game 1B asked participants (N=34) to indicate a sad or happy face or emotional response to images of activities in nature. Children’s response of a happy face to watering plants, cleaning up the ground pollution, and planting a tree, and a sad face to dirty water, dirty or smoky air, garbage on the ground, the sight of cut-down trees, and plastic pollution indicates ES. At the same time, opposite answers are considered to demonstrate a lack of sensitivity to nature.

**Results.** Children's ES responses were (30/34) for watering plants, cleaning up the ground, and planting a tree, dirty water, and cut-down trees, and (28/34) for garbage on the ground and plastic pollution, indicating a strong ES. The exception was the photo of air pollution from smokestacks across a river with a woman and child on the opposite side of a river (20/34). Although the lowest score, the  $\bar{X}$  was still 0.59, or over the possible random 50% score, indicating weak ES for that image. Overall, in 8/9 photos, results showed that the cohort had a strong ES ( $\bar{X} > 0.75$ ) to the environmental action indicated in the photos.

**Figure 3.** Game 1B: Environmental Sensitivity to Images in Photos



For Game 1B, the ANOVA run for the cohort gave an average of 81% correct answers (50% would be random guessing) with a p-value =  $4.9 \times 10^{-18}$ , indicating statistically significant results; thus, the cohort exhibited ES or connection to nature. The average correct answers of 81% ( $\bar{X} \geq 0.75$ ) indicated a high strength of connection to nature. Furthermore, the regression analysis with a p-value of 0.000688 indicated that one can again reject the null hypothesis; thus, age is an influential variable. The coefficient of age indicates that the percent of correct scores for a child would predictably go up by 8.1% per age for this game with this cohort.

**Figure 4.** Game 1B: Environmental Sensitivity to Images in Photos by Age

**Discussion.** The cohort's high ES response rate for the majority of the photos, with an average score of 81% and extremely low p-value, indicate statistically significant results. The anomaly was the photo of air pollution from smokestacks; only 20/34 placed a sad face on the image. This photo was very busy, a female adult holding a child's hand looking across a river, where the smokestacks were giving off pollution. The participants may not have focused their attention on the air pollution. The cohort also had an 88% ES, or happy face, to positive environmental behaviors, watering plants, cleaning the grounds, and planting trees. These responses indicate a strong ES or connection to nature in this category. Game 1B results also indicate that age influenced ES or connection to nature.

#### **Game 2A: Environmental Awareness (Matching Game)**

Game 2A measured children's environmental awareness (EA). Participants were asked to match nine products humans derive from nine entities from nature. For example, if a child matches eggs with chicken; this is considered EA. If a participant incorrectly matches a product with a natural entity, such as ketchup to pigs, the answer demonstrates a lack of EA. Below are the results of EA from this study. The determination of the level of connection is modeled from Omidvar et al.'s (2019) example to define EA based on the number of correct EA answers individuals gave to the matching game.

**Results.** The child's EA was measured based on the number of correct matching pairs. A lack of cognitive coherence or understanding that the products come from natural resources can be measured using qualitative data or verbal comments and is also considered an incorrect answer. For example, if the participant matches that

- milk comes from cows = correct knowledge or demonstrating EA
- milk comes from a river = incorrect knowledge or a lack of demonstrating EA
- milk comes from the refrigerator = incorrect knowledge due to cognitive incoherence and lack of demonstrating EA

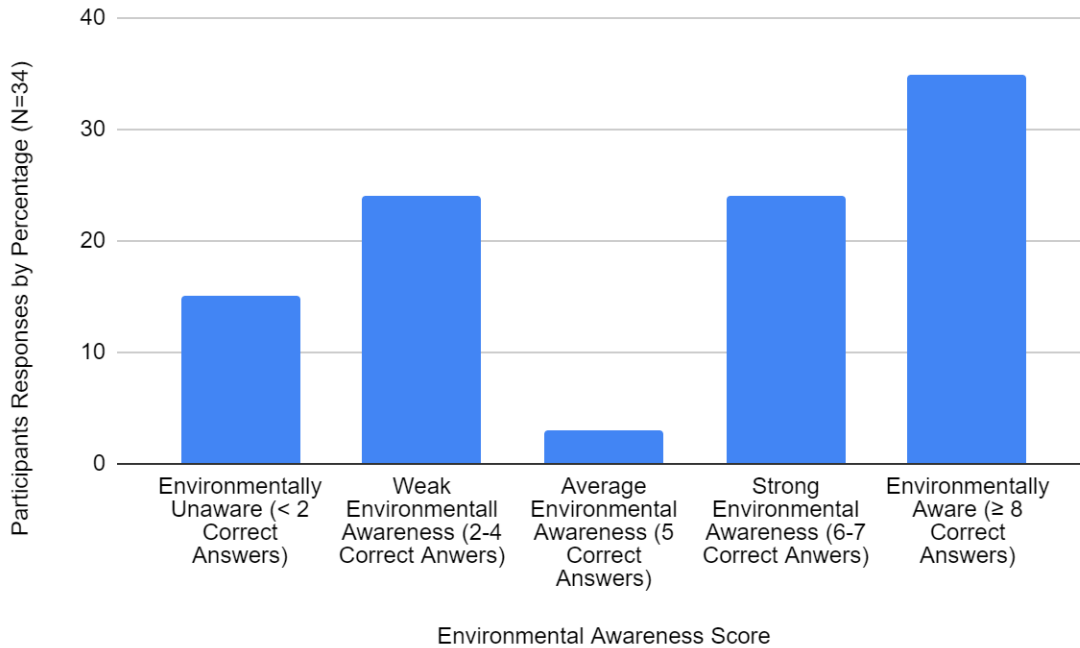
Examples given in this study of qualitative data indicating cognitive incoherence from participants included:

- Eggs come from the refrigerator
- Bacon comes from a frying pan

- Eggs come from Mom
- Ketchup comes from the store
- Paper comes from a drawer

Overall, this cohort demonstrated a stronger EA than a lack thereof in that 18/34 scored strong EA, while 16/34 scored moderate, weak, or lacking EA combined. As this is a small majority, the cohort was determined to have a moderate EA.

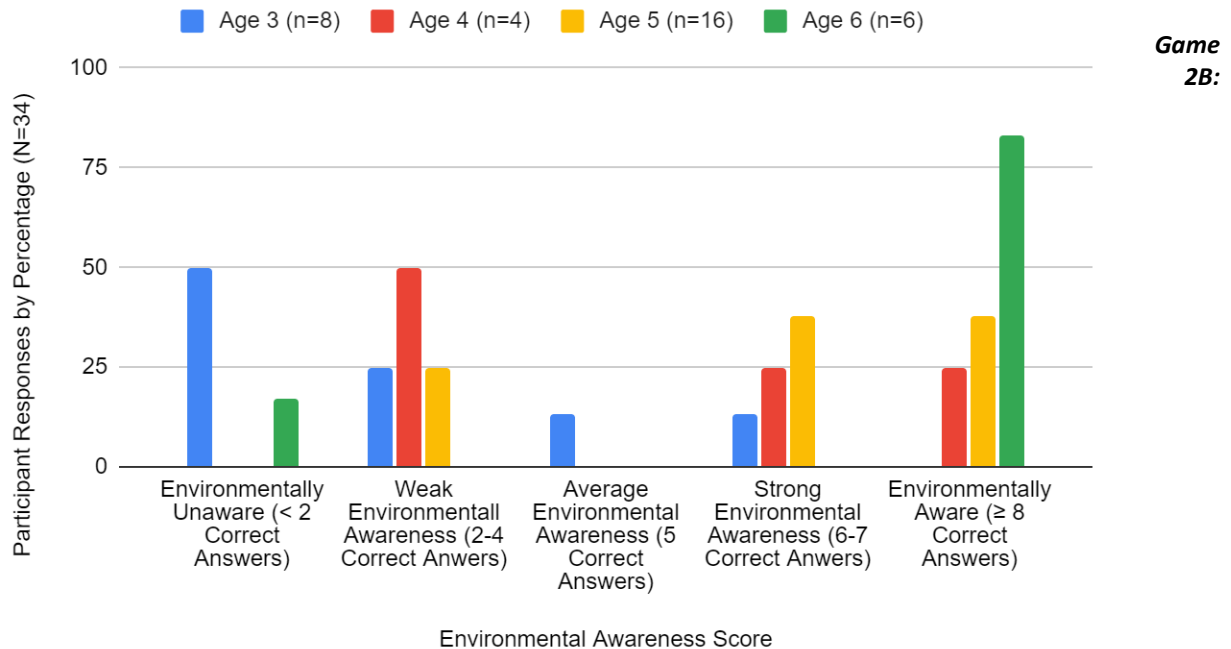
**Figure 5.** Game 2A: Percentage Demonstrating Environmental Awareness



Game 2A did not have a possible random score as it is a matching game; multiple matching answers could be given. There were a total of nine possible correct matches. The regression statistics indicated that age was a correlating variable to matching correct answers. However, calculating an ANOVA to determine a p-value does not apply here as it does not test people’s *awareness* of information. Descriptive statistics indicate that the demonstration of a moderate cohort connection to nature and EA rose with increased age. It was lowest for the 3-year-olds with a  $\bar{X}$ = 0.125, 4-year-olds with a  $\bar{X}$ = 0.25, 5-year-olds with a  $\bar{X}$ = 0.69, 6-year-olds with a  $\bar{X}$ = 0.83.

The majority of the children (18/34) exhibited a strong EA. Nevertheless, that majority was small compared to the combined population of participants scoring moderate, low, or lacking in EA. The overall EA for Game 2A was influenced by age, with the five and 6-year-olds exhibiting higher EA than three and 4-year-olds.

**Discussion.** The children who exhibited cognitive incoherence were 3-year-olds. This age discrepancy is not surprising as they have had less time on earth to learn that products humans use or consume are derived from nature entities. However, answers given that demonstrate cognitive incoherence were still logical. For example, eggs can come from the refrigerator; before that, they come from the store. The fact that eggs come from chickens is content information that those children have not learned. These answers are listed as incorrect matches, which they were, i.e., stating that eggs come from Mom (who is from nature but not the source of the product) which is not a possible match in the game. The cohort demonstrated moderate EA, and age was a contributing variable.

**Figure 6.** Game 2A: Environmental Awareness by Age

### **Environmental Awareness (Issues)**

Game 2B assessed children's EA, measuring the participant's understanding that various environmental issues can harm the biosphere. Participants were shown pictures from List 1—air pollution, ground pollution, water pollution, and deforestation—and asked to explain what they saw. Then, they were asked if each type of environmental depiction from List 1 could harm entities from List 2—themselves, animals, cars, people, and forests. The child was then asked what were the environmental issues in each List 1 picture. Game 2B was the fourth game, and 3/34 of the participants did not complete it, so all their answers were removed from the data set, resulting in an N=31.

**Results.** The cohort demonstrated a strong EA that environmental issues could harm living beings. Specifically, a clear understanding ( $\bar{X}=0.77$ ) that cars would not be harmed by pollution as living creatures could. However, they were not as clear ( $\bar{X}=0.55$ ) about the impact of deforestation on cars, IHM4 stated deforestation would hurt cars, "trees could fall on the cars," and EKF6 stated, "the sticks could cut the tires." The cohort and each age group viewed the environmental issues posed a greater threat to animals ( $\bar{X}=0.70$ ), than to people ( $\bar{X}=0.52$ ) and an even smaller threat to themselves ( $\bar{X}=0.44$ ). This cohort demonstrated a strong EA, and disaggregated data indicated that age was not an influencing variable.

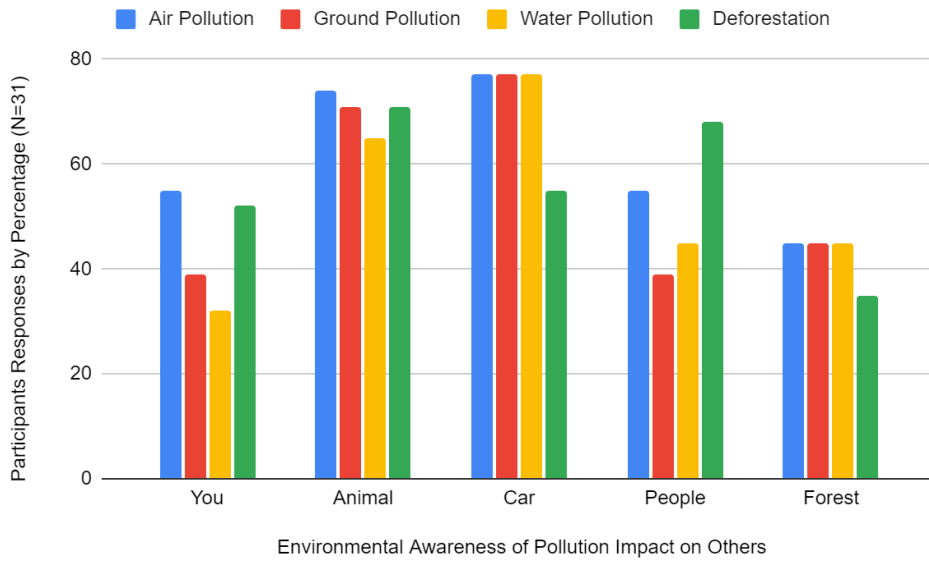
**Discussion.** More participants in this study viewed animals as in greater danger from pollution than people, let alone themselves. It could be related to content about pollution or environmental issues learned in school and their stage of affective development. Altun (2020) explained, "Children's ability to recognize affective and cognitive consequences of environmental pollution on other species' life conditions is related to their pro-environmental orientations" (p. 1827), meaning their developing environmental perspective could relate to how much they feel connected to other living creatures or view themselves as animals.

On the other hand, why more participants viewed animals as being in greater danger than themselves could simply be optimistic bias on the part of the children. Habicht et al. (2022) defined *optimism bias* as "the overestimation of positive outcomes, may be particularly important during childhood when motivation must be maintained in the face of negative outcomes" (p. 1843). The cohort demonstrated a strong EA or understanding that environmental issues

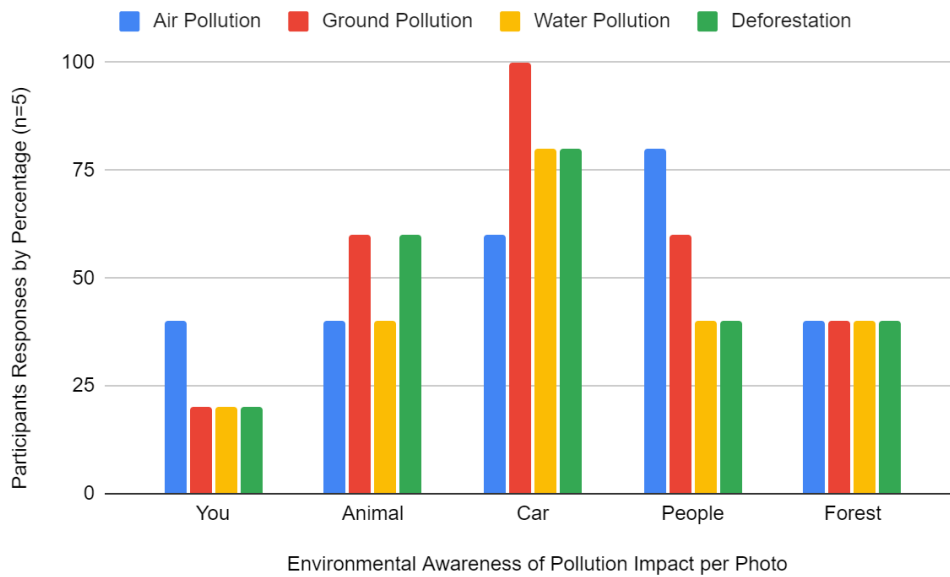


are harmful. We can only speculate why the cohort inferred different risks existed to different categories of the biosphere.

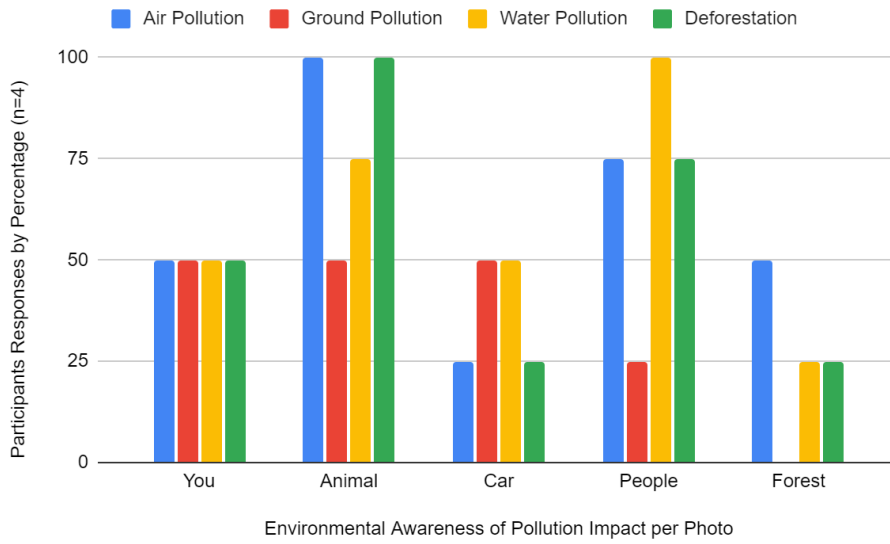
**Figure 7.** Game 2B: Environmental Awareness of Pollution Impact



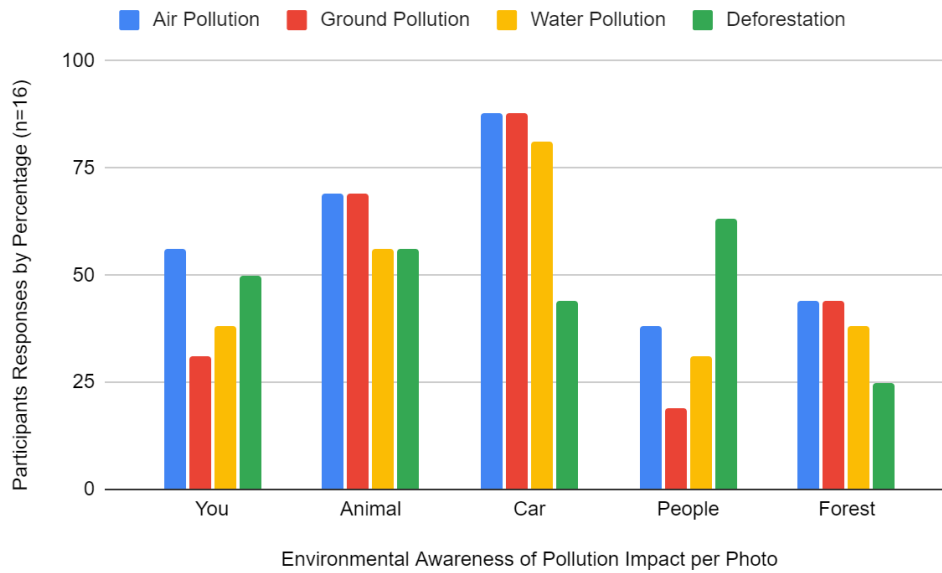
**Figure 8.** Game 2B: Age 3 Environmental Awareness of Pollution Impact

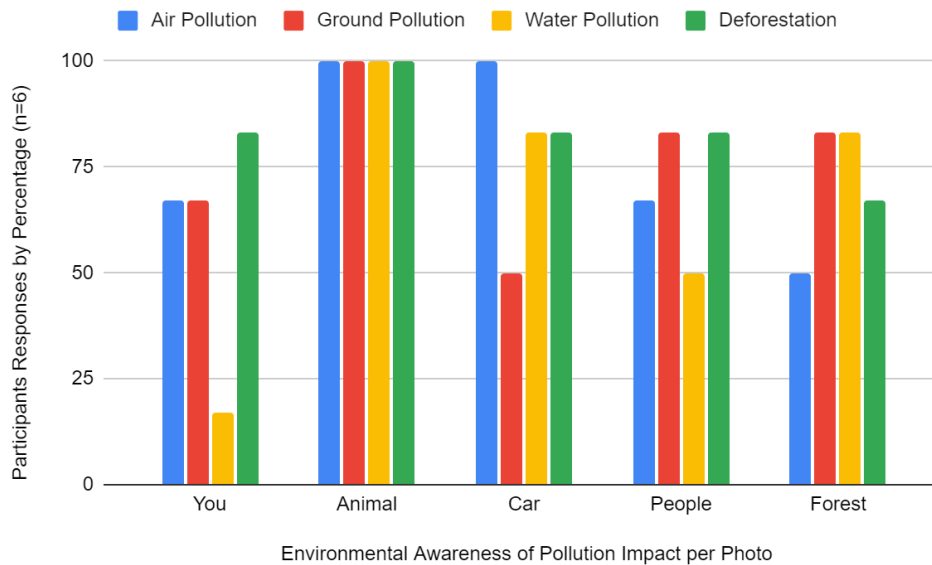


**Figure 9.** Game 2B: Age 4 Environmental Awareness of Pollution Impact



**Figure 10.** Game 2B: Age 5 Environmental Awareness of Pollution Impact



**Figure 11.** Game 2B: Age 6 Environmental Awareness of Pollution Impact

### Games 3A & 3B: Environmental Preferences

Games 3A and 3B measured children's environmental preferences (EP) for play spaces. They chose between six photos of play areas: a backyard, playground, farm, inside, street, and forest. The participants were asked a series of questions in Game 3A about which play spaces they played in the most, most preferred, and felt the safest. In Game 3B, they were asked which play spaces they least liked to play in, least preferred the most, and felt unsafe. Two participants did not engage in either game. Therefore, the data set has an N=32.

**Results.** The majority of the children played at playgrounds the most (21/32) and preferred playing outdoors at playgrounds (20/32), although they felt safest playing indoors (18/32). Qualitative responses to why participants preferred the playground included: "it is fun" (BHF5), "it is where we go" (FKM5), "it is at school" (DKF3), "it has slides and swings" (DHF5), "I like to climb on things" (KKM4), "fun to play in nature" (GKF3), "outside is more fun than inside" (NHN5), "I like being with the animals" (EHM3). Although adults might assume choosing playgrounds constitutes playing on playground equipment, the children in this study conducted nature-play outside at the school playground. Rarely were children seen playing on the playground equipment.

The forest (4/32), farm (3/32), and inside (3/32) are basically tied as the next preferred place to play. Children who preferred playing inside (3/32) explained why: "I'm at school" (EHM3), "I like inside to play on my tablet" (QKF4). Reasons children gave to explain why they chose inside as the most safe place to play included: "nothing can chase you" (HKF6), "it is safe from the tornadoes" (IKM5), "safe because of a walls around me" (BKM5), "no one can steal you" (FKM5). Qualitative responses explained why participants preferred the forest (4/32) included: "leaves are fun" (GHF2), "I can make things like forts" (PHM5), and "I can jump in piles of leaves" (OHF5), "I like the pretty leaf piles" (GKF3). Children's qualitative responses to enjoying farms (3/32) included: "I'm home" (KHF6), "I live on a farm" (GHF2), and "I like to pet the goats" (FKM5). Results indicated an overwhelming cohort opinion that they play the most and prefer playing outside at playgrounds, even though they feel the safest place to play is indoors. Game 3A data indicated the cohort demonstrated a strong level of connection to nature regarding EP.

Game 3B asked where children did not want to play the most, and the majority stated that the street was the least safe (22/32) and where they played the least (17/32) and did not want to play (14/32). Participants overwhelmingly responded that they could get hurt playing in the street because cars are dangerous. Forest was the second most common answer (4/32) as the least safe place to play, citing qualitative responses such as: "a wolf might eat you" (CKF5), "leaves and bugs get on me and in my hair" (IKM5), "I could get lost" (FKM5), "I just don't" (QKF4, DKF3), "the wild animals" (HKF6). Participants who chose the farm as their least favorite (6/32) or unsafe (2/32) listed

reasons such as: “I don’t like honeybees or goat friends” (RKM3), “I’m scared of dogs” (NHM5), “Cornfields are scary, you could get lost in the tall corn” (PHM5). Two children interpreted playing on a farm as playing in a barn stating, “Poop is in there and I have to wear a mask to breathe” (BHF5) and “no place to run in a barn” (BKM5). Playing inside or in their backyard was only picked as the least favorite by 2/32 or least safe by 1/32. The quantitative and qualitative data indicate that, in general, the least preferred play spaces were places children perceived they could get hurt. Disaggregated data for Games 3A and 3B indicated that age did not influence EP.

**Table 4.** Game 3A & 3B: Environmental Preferences N=32

Positive Questions	Backyard	Playground	Farm	Inside	Street	Forest
Q1: “Where do you play the most?” and “Why?”	1	21	2	6	1	1
Q2: “Where do you like to play the most?” and “Why?”	1	20	3	3	1	4
Q3: “Where do you feel the most safe to play?” and “Why?”	5	3	3	18	0	3
<b>Negative Questions</b>						
Q1: “Where DO you NOT like to play?” and “Why?”	2	0	6	2	17	5
Q2: “Where DO you NOT like to play the most?” and “Why?”	2	4	6	1	14	5
Q3: “Where DO you NOT feel safe to play?” and “Why?”	1	3	2	0	22	4

**Discussion.** Most likely, children of this age do not have free range to decide if or how often they play in these different settings. Presumably, life experience influences children’s choices; those experiences are relevant to exhibiting EP. If a child spends most of their playtime on playgrounds, it is understandable that they might decide that was also their favorite place to play. Although playgrounds usually have manufactured equipment to play on, data from this study indicated that choosing a playground was not viewed by these children as playing limited to the equipment but as playing outside. Qualitative data revealed that some children lived in apartments and did not have access to a backyard; this could limit their experience to understand if they would want to play in one.

### Synthesis of Six Games

Table 5 consolidated results from this modified GT tool to answer the research questions: To what extent do 3- to 6-year-olds demonstrate connection to nature at a Montessori school in the upper Midwest, and was age an influencing variable? The level of connection to nature was based on qualitative responses to questions and quantitative data analysis. Table 5 summarizes the strength of environmental sensitivity, awareness, and preference.

**Table 5.** Results from the Six Modified Games and Their Indication of the Strength of Connection to Nature

Game	Measuring Environmental Nature-Connection	Strength of Connection to Nature				Age as a Significant Variable
		Strong	Moderate	Low	Lack	
1A	Sensitivity (owie)		*			yes
1B	Sensitivity (emoji)	*				yes
2A	Awareness (matching game)		*			yes
2B	Awareness (environmental issue)	*				no
3A	Preferences (positive)	*				no
3B	Preferences (negative)		*			no

### Teacher Interviews

#### Results

Shared patterns of discussion or themes that emerged through the interviews included:

- Quantity of time children spend outside at school
- Adapting to being in nature to foster wonder and curiosity
- Children's demonstration of respect for nature

The following describes the thematic story and will refer to statements or storylines from teacher interviews.

#### Discussion

**Quantity of Time Children Spend Outside at School.** The two teachers explained that children were granted daily unstructured playtime outside throughout the year. Teachers also facilitated more structured learning adventures, such as plant or insect identification hikes, which took place in the woods and other parts of the campus. One of the teachers explained that lunch was often a picnic outdoors in the fall (2022), and picture book read-alouds would occur outside in the open air. The quantity of time children spend exposed to nature is a concern many scholars have mentioned (Beery & Jørgensen, 2018; Chen & Adler, 2019; Louv, 2008; Wilson, 2016). Although there is not a set number of minutes or hours per day children spend outdoors at this research site, the teachers and director of the school testified that time spent outdoors is a philosophical priority for the school.

T1 referred to the school functioning the way a forest kindergarten would or spending all day outside during the pandemic, a time when many of these children would have been enrolled in the ECE program. This is a Montessori school and as such teaches an appreciation for the natural world (Chawla, 2013; Lillard, 1972; Montessori, 2013; O'Donnell, 2007). During my observations, the school functioned as a nature-based school using ECEE pedagogy; for example, environmental education was not a subject but interdisciplinary (Biedenweg et al., 2015) using a holistic approach to understanding how the earth functions (NAAEE, 2016) with the understanding that adults can encourage children's engagement with nature by allowing for their wonder and curiosity to flourish (Carson, 1956;

Ernst & Burcak, 2019; Knight, 2013; Sobel, 2013, 2016). Although less than 25% of the day was spent outside during the weeks of this investigation, T2 explained that they spend significantly more time outside in warmer months.

**Adapting to Being in Nature to Foster Wonder and Curiosity.** This theme confirmed the recognition that the children's interaction with nature changed as they had more experience being in nature. The teachers explained that children without experience of unstructured play in nature did not know what to do; it took time for them to initiate exploration as they became more comfortable as part of that environment. Children new to unstructured play in nature and playing in various weather conditions demonstrated a needed adjustment period to learn, observe, and acclimate to the space before their natural wonder and curiosity could flourish in nature. The teachers explained that as the children become more comfortable outdoors, their curiosity and wonder to explore developed with time. Lindholm (2018) explained:

Wondering and curiosity accordingly reflect somewhat different modes of questioning and stimulate exploratory joy from different positions. Curiosity remains in the space of terms, concepts, and causality. Wonder emerges from a wordless experience of something's existence. And while wonder is more ignited by perception, curiosity is more ignited by reflection. (p. 990)

Leopold (1949) emphasized that to adopt an ecocentric worldview, children need time for play-based, self-directed learning. Schein (2014) emphasized the importance of allowing children to reflect on their curiosities and discoveries to allow them to connect with nature and understand their place in the world. Thus, the daily play-based, self-directed learning at this school allowed the children to develop their curiosity and wonder; and connection to nature through their discoveries and reflection on those experiences.

**Children's Demonstration of Respect for Nature.** As environmental generational amnesia and extinction of experience in nature can result in a distancing from the ecosphere, developing respect for nature requires time interacting in and with their natural surroundings. As Beery and Jørgensen (2018) stated, "Given concerns for a severely diminished childhood experience of nature coupled with alarm for a rapidly diminishing global biodiversity . . . childhood nature experience [are potentially] an important part of biodiversity understanding" (p.13). Both teachers expressed observing their students' evolution of respect for nature over time spent interacting within nature spaces.

ECEE encourages children to learn about nature in the natural environment, and early childhood environmental education for sustainability (ECEFS) emphasizes ECEE learning with the intent to teach for sustainability. Green et al. (2016) stated, "Young children's agency to act for sustainability can also be facilitated independent from adults when children have established trust, autonomy, and a sense of competency with familiar environments" (p. 1042). The teachers explained that over time, the children learned not to litter but would pick up trash from the ground and throw it away properly. Children demonstrated respect for living creatures as beings with their own right to exist for themselves as living beings.

In summary, these children were regularly exposed to a variety of nature features and activities indoors and outdoors. Teachers observed that as children spent increased time outdoors, their respect for beings and loose parts increased. This respect for others spilled over into taking better care of the inside environment and showing more respect for each other. The interviews confirmed a dedication to the nature-based aspect of the Montessori school pedagogy. However, concern was raised that the lack of ECEE training could impact future commitment and efficacy of nature-based teaching.

### **Comparison of GT Tool Results for Three Studies**

The Giusti (2012) study took place in Stockholm, Sweden, using the original GT tool to measure the ES, EA, and EP of 4 and 5-year-old children and comparing cohort connection to nature between those attending 24 schools that have the highest and those with the lowest access and experiences to nature during the regular school day. It found that the cohorts ES and EA were strong and significant, while the EP was weaker. The Omidvar (2018) study evaluated 20 3- to 5-year-old children in Reggio-Emilia preschools in Halifax, Canada, and found that the children did not indicate

connection to nature. This study took place in the upper Midwest of the United States at a rural Montessori charter school, using a modified version of the GT tool, and found that the cohort of children demonstrated a moderate to strong connection to nature in all three categories: ES, EA, and EP.

A comparison of the three studies' EP results indicated similar quantitative results but varying qualitative responses to reasons for play space areas. The children's choice to play at playgrounds and that playing inside is the safest corresponded with the cohorts in the Omidvar (2018) and Giusti (2012) studies. However, the conclusion regarding the strength of EP (Game 3A) differed. Omidvar (2018) and Giusti (2012) inferred that the cohorts in those studies had a weaker connection to nature than this study determined about its participants. Omidvar et al. (2019) stated, "Children's negative attitudes towards natural environments, . . . have resulted in feeling more safe and free in indoor environments and playgrounds, and being reluctant to spend time in green and natural environments" (p. 96). In other words, choosing playgrounds was interpreted to be avoiding natural environments. Yet, this study's cohort expressed wanting to be at a playground with nature, animals and enjoy swings. This researcher's observations were children at the playground engaged in nature-play and not with the playground equipment. Thus, these children were eager, not reluctant, to spend time in natural environments.

In all three studies, cohorts found playing on the street or a forest as not preferred or safe (Game 3B). However, the strength of those opinions varied.

**Table 6.** Perceived Safety Playing in the Street versus Forest in Three Studies

	Cohorts' Viewed Least Safe Play Space		
	Giusti, 2012, p. 37	Omidvar et al., 2019, p. 94	Yates, 2023, pp. 167-168
Street	40.9%	20%	69%
Forest	54.5%	20%	13%

Data for all three studies indicated that some children expressed fear of animals or getting lost. Giusti (2012) explained:

Children scared of wilderness, regardless of the motivation, are in preschools with significant *less* access to all Environmental Qualities [accessibility to nature as recreation, natural beauty, wilderness, and rurality] and reversely, children who do not show such fear are in preschool with significant *more* access to all the natural environments. (p. 43, emphasis in original)

This research school gave access to all the Environmental Qualities of nature referred to and defined by Giusti (2012): nature for recreation, natural beauty, wilderness, and rurality.

These three studies used versions of the GT tool to measure the ES, EA, and EP of similarly aged children attending schools that maintained a nature-based philosophy in three different countries. The results are conclusions based on those cohorts of children at those places and times.

**Limitations of the Study**

**Possible Limitations to this Modified GT Tool**

Reflection on children's responses to the modified GT tool led to ideas for improvements that could be made for the GT tool's future use.

### ***ES Games***

In Game 1A, children were asked, “Can this image in the photo feel an owie or get hurt?” The objective was to see if they understood or demonstrated empathy towards living beings. This cohort indicated a strong ES for animals and a lack of ES for plants. A limitation could be the wording of the question or the participants’ knowledge of plants. A child has their own experience or knowledge of getting hurt, which includes their reaction to injury. If hurt, they might scream or cry, bleed or bruise. Plants under distress also might scream as they create ultrasonic sounds, release fluids, and change color in response to that injury (Khait et al., 2023; Wohlleben, 2015), but these plant responses are most likely not understood by young children.

Nevertheless, people in this area of the country tap maple trees and use the sap to make maple syrup, but this is viewed as a positive thing, not as trees bleeding or being harmed. Determining that the children exhibit a lack of connection to plants could indicate construct underrepresentation, “the assessment fails to capture important aspects of the construct” (McMillan & Schumacher, 2010, p. 174), or the game layout failed to offer enough opportunity or content for the children to demonstrate the question’s objective. Therefore, if, in the game, a child states that trees cannot be hurt, and the researcher infers the response as not demonstrating ES to plants, they may be incorrect. The child may feel connection to trees as fellow living beings but cognitively do not know that plants express injury similarly to people. To increase the validity of this game, a possible solution could be to include living yet injured plants, i.e., a tree with a clear burn mark or a living tree after a severe storm. An expansion of qualitative follow-up questions regarding participants’ opinions about plants could also be illuminating.

### ***EA Games***

A limitation of Game 2A was that nine product photos matched the corresponding nine sources in nature. The number of correct answers indicated a connection to nature; however, some children would hesitate with a photo and put it to the side to continue matching. Then they matched that card with the unmatched card left on the floor. This does not indicate content knowledge so much as deductive reasoning skills. This issue could be resolved by avoiding a 1:1 match with more nature photos available to match the nine products.

Game 2B was tedious, with the same question asked repeatedly, and children started demonstrating boredom. Then, being asked about four different environmental issues and which of the same five choices would hurt was repetitive. The typical time to complete the six games was 30 minutes per child. Some children found it difficult to focus for that amount of time. A solution could be as simple as taking a physical wiggle break.

### ***EP Games***

There were six photos of play areas. The children did not choose to play in the most natural setting, the forest. This choice could also indicate construct underrepresentation. A change to these games to increase the opportunity for the children to demonstrate the question’s objective could be to increase the choices participants are given. More photos of natural settings such as forests but also a creek, a pond, a meadow, and a lake beach provide more locations that demonstrate more natural settings.

Giusti et al. (2014), Omidvar et al. (2019), MacKeen and Wright (2020), and this researcher all recommend that more locations conduct this type of research using the psychological GT tools. Great care must be taken in choosing the photographs, considering the participants’ culture, biotic members, and abiotic features of the study site. Another suggestion is to monitor the time required to complete the games and include a wiggle break.

### **Generalizability**

A limitation often cited in ECEE research is that a small sample size cannot be generalized to a greater population. The cohort for this study was made up of two classes of 3- to 6-year-olds, one class of 16 students, and one of 18, giving an N=34. The number of participants of each age varied extensively, and all had a small sample size: eight 3-year-olds, four 4-year-olds, 16 5-year-olds, and six 6-year-olds. Nevertheless, those 34 children were 100% of the



Children's House student body at this particular school—a case. This study is a snapshot of one group of young children from one school at one point in time; the results cannot be generalized to the greater public. However, generalizing to the general public was not an objective of this study. Yin (2009) pointed out that a common “concern about case studies is that they provide little basis for scientific generalization” (p. 15). He compared research on a particular group's generalizability to that of the generalizability of an experiment: “The case study, like the experiment, does not represent a ‘sample,’ and in doing a case study, your goal will be to expand and generalize theories (analytic generalizations) and not to enumerate frequencies (statistical generalization)” (p. 15). In other words, analytic generalization will relate the results of this mixed methods study to previously developed theory, not attempt to generalize the results of this study to a population beyond this cohort of children. The theory is that ECE, with routines and curricula taught with repeated exposure to nature, can result in children demonstrating connection to nature (Beery et al., 2020; Beery & Jørgensen, 2018; Giusti, 2014; Lithoxoidou, 2017). This study was an example or evidence of that theory.

### **Implications of the Study**

#### **Children's Voices in Research**

Children are experts regarding themselves, what they want to do, and why they believe what they believe. As some scholars have pointed out, to truly understand children's perspectives and feelings regarding nature, we must listen to their voices (Boileau, 2013; Elliot et al., 2014; Wilson, 2019). Concluding child perspectives based on their own words can increase the validity of the data as it has not been filtered through another adult. As Boileau (2013) explained, “Children may have not yet developed logical thought, but their statements should nevertheless be considered valid on the sole basis that it is from their own perspective on the world” (p. 147). The notion is that if research is about children, it is beneficial to include their unfiltered statements and opinions in the data collection.

#### **Federal and State Policy**

In the United States, many lawmakers are debating if publicly (government) funded preschool education should become mandatory. Barrable (2019) pointed out, “The importance of young children learning about the natural environment has been recognised in policy and curricular frameworks around the world. Moreover, there has been a call for children to spend more time outdoors and to reconnect with nature” (p. 59). As this country debates whether preschool will become publicly funded, the question of what kind of ECE must be at the forefront of the discussion.

Meeting the goal of equal access to quality preschool education requires looking at pedagogy and teacher training, not simply spaces to place children and the number of teachers needed. As many scholars have pointed out, the emphasis on academics can result in developmentally inappropriate pedagogy trickling down to ECE that is not in the best interest of children (Brown et al., 2020; DeVries & Zan, 2005; Lee, 2006; NAEYC, 2020). Ernst & Burcak (2019) explained, “As research connecting natural outdoor environments and children's well-being continues to grow, there is renewed interest at both the policy and practice levels in many countries to encourage access to outdoor and specifically natural spaces for nature-play” (p. 4). This researcher advocates ECEE as the foundational pedagogy used in ECE.

#### **Environmental Education Teacher Training**

One walk along a nature trail and simply playing outside is rarely enough for a child to connect with nature. Pyle (2005) pointed out that “few students (or teachers) have even the most basic acquaintance with their local fauna and flora” (p. 310). As a Montessorian explained, “The Montessori guide is always the dynamic link between the material that teaches the child and the child. In this case, the materials are nature.” She elaborated, “If a guide goes on a nature hike with children, they point things out and ask probing questions. They are role models on how to be in nature. Without training a teacher doesn't know how to do this” (personal communication, May 5, 2023). This type of modeling is also the pedagogy of EE. As was illuminated in the teacher interviews, maintaining a nature-based philosophy at the school will require new teachers and paraprofessionals to receive ECEE training. It cannot

be assumed that ECE or even Montessori teachers are prepared to embrace nature-based pedagogy without the training to know how to do so. I recommend that educational policymakers require ECEE as part of teacher preparation for licensure and environmental education training for teacher licensure across all grades and subjects.

### Contributions to Scholarly Literature and Future Research

This investigation contributes to the growing body of knowledge and literature on ECEE. It also adds to the growing work using modified versions of the psychological GT tool to measure young children's connection to nature. This study referred to the psychological GT work of Giusti (2012) in Stockholm, Sweden, Omidvar et al. (2019), and MacKeen and Wright (2020), who used variations of the GT tool in Halifax, Canada, and Yates (2023) modified version used in the Upper Midwest of the US, these three cities have different cultures from one another, but Eurocentric cultures dominate all three. As MacKeen et al. (2022) stated, their "modified instrument creates a lasting impact in the field of environmental psychology as it should be considered a living tool that is manipulated to suit different geographic, cultural, and young developmental stages" (p. 29). That statement can also apply to this investigation as images were modified to suit this Upper Midwest site. MacKeen et al. (2022) determined that photo modification for specific geographic locations and cultural norms of student populations are required for "the clarity, ease of use, appropriateness and relevancy for measuring children's connection to nature and environmental knowledge" (p. 29).

More research comparing and contrasting children's connection to nature and academic learning from schools that consider themselves nature-based to conventional ones in the same geographic area could influence policymakers' development of plans for current and future school design, curricula, and pedagogy.

### CONCLUSION

This investigation aimed to measure to what extent 3- to 6-year-olds demonstrated environmental sensitivity, awareness, and preferences at a nature-based Montessori school in the upper Midwest of the United States and asked if age was an influencing variable. Results indicated that this cohort of children demonstrated a moderate to strong connection to nature in all three categories. Age was an influencing variable measuring environmental sensitivity and some aspects of environmental awareness, but not environmental preferences regarding where to play. This mixed method study adds to the body of work conducted in early childhood education, environmental education, early childhood environmental education for sustainability, and Montessori education.

In response to the guiding inspiration of this research, connection to nature is needed for people to have a conservation or environmental mindset. Educational leaders can make decisions to facilitate opportunities for students to connect with nature. Nature is child development; we live outside as well as inside. All people are part of and dependent on ecosystems. Nature destinations can be field trips, but they can also be out the front door and biophilic design for indoors. Educational systems can help prevent children's *extinction of experiences* in nature. It will not address the inevitable *environmental generational amnesia* but can help children develop an *ecological conscious* as they learn to live in harmony with the earth as members of the ecosphere.

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## CHILDREN'S BOOKS AND RESOURCES REVIEW

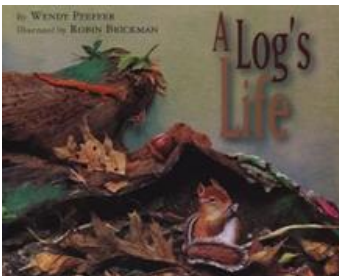
**Carla Gull**

Book and Resource Review Editor

*Merry Lea Environmental Learning Center of Goshen College, USA*

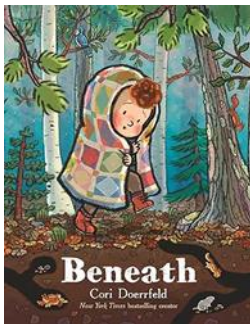
### Death, Decay, and Decomposition: Book and Resource List

Death, decay, and decomposition are normal parts of life cycles in the natural world, such as when leaves wither and drop, flower petals wilt, or we find a dead insect on a walk. What lessons are to be learned about, in, with, and for nature when we lean into death, decay, and decomposition in a natural context? Understanding death in nature can help build social and emotional skills and resilience as we get to know the natural rhythms of life in our settings. Explore scientific elements, such as life cycles, food webs, ecosystems, living/nonliving, etc. Ultimately, we can build community, empathy, and connection through discovering life and renewal within death, decay, and decomposition. Here are a few books and resources that have been helpful for me on this journey.



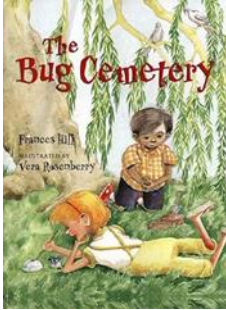
#### ***A Log's Life*** by Wendy Pfeffer

Starting with the important biodiversity of an oak tree, carpenter ants begin to move in, followed by wood-boring beetles, mildew, mushrooms, and fungi. The oak falls to the forest floor and the larger mammals find new homes while ants, millipedes, spiders, slugs, fungi, and termites move in. The log becomes hollow over many years with time, weather and animal activity making it spongy. It eventually starts to look and feel like dirt until, eventual, an acorn starts a new tree.



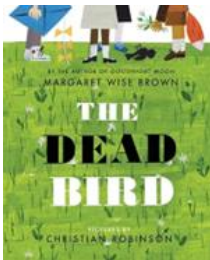
#### ***Beneath*** by Cori Doerrfeld

As a grandfather and child deal with loss, they explore the woods, contemplating what is beneath—the blanket, ground, water, bird, and chipmunk tunnels. The book reminds us that beneath what is falling apart is something starting to form as we see the new starts under the leaf litter. “Beneath appearances are experiences. Beneath actions are explanations.” Both have broken hearts to mend together beneath the night sky.



***The Bug Cemetery*** by Francis Hill

When a dead ladybug is found, the children bury it with a painted rock tombstone, flowers on the grave, a moving speech, and pretend tears. Neighbor kids bring other dead insects for burial at a dime a dead bug, complete with lemonade stand. Unfortunately, when a friend's cat is hit by a car, the tears are real and the children have a real funeral, burying him in the Bug Cemetery, creating Buster's Garden where cats can chase insects. "Funerals aren't any fun when they're for someone you love."



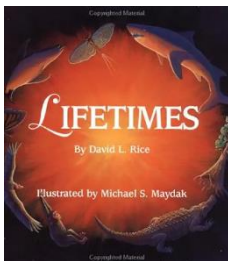
***The Dead Bird*** by Margaret Wise Brown

Children at play find a dead bird, though "it was still warm and its eyes were closed." There was no heartbeat and the bird began to get cold and stiff, "the way animals got when they had been dead for some time—cold dead and stone still with no heart beating." The children bury the bird and plant flowers as they process their experience of loss in this classic story.



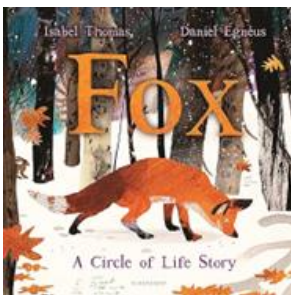
***The Decomposition of Jack*** by Kristin O'Donnell Tubb

With a road kill scientist for a mother, Jack's social emotional health goes through similar stages of decomposition as he tries to figure out his parents' divorce. While this chapter book is geared for upper elementary readers, I thoroughly enjoyed learning about decomposition and finding new life through Jack's eyes. Great imagery and information on the applications of decay and roadkill.



***Lifetimes*** by David L. Rice

This book can be read on different levels, with additional questions to investigate and dive more deeply—tell about it, think about it, look it up, and find out investigations. Discover how long various organisms live from mayfly (about 1 day) to a whale to a bacteria to humans. Appropriate for early elementary and up, though some preschoolers would enjoy parts as well.



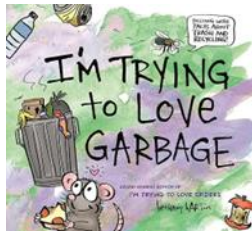
***Fox: A Circle of Life Story*** by Isabel Thomas

A mother with playful kits teaches her children to follow scent trails and tests their skills as they grow. Unfortunately, she is hit by a car and the body begins to decompose with the help of insects, birds, and fungi. The old particles of fox find a new place for rebirth in the spring. "Life is everywhere. Death is not just an end, but a beginning." Backmatter includes information on the building blocks of life, what is death, what is decomposition, the cycle of life, and how death is not just an end.



***Fungi Grow*** by Maria Gianferrari

This book, dripping with sound and action words, can be read on different levels with simpler text or more detailed explanations of fungi. The colorful illustrations show the world of fungi above the ground as mushrooms and under the ground as mycelium. The backmatter includes a glossary, how fungi heal and help, fungi facts, fungi life cycle, and additional resources.



***I'm Trying to Love Garbage*** by Bethany Barton

This speech bubble based introduction to nature's garbage collectors (scavengers, detritivores, decomposers) shares the importance of dealing with our waste in the natural world. It also shares why we need to reduce our inorganic waste, such as plastic toy or running shoes that take 1,000 years to break down. Options include reducing, reusing, and recycling.



***The Invisible String*** by Patrice Karst

An often recommended book to help deal with separation anxiety and loss, sharing about the invisible string made of love that connects us to our loved ones. The string even reaches all the way to Uncle Brian in heaven.



***Jake's Bones*** by Jake McGowan-Lowe

Beginning at age 7, Jake shared the bones he found and how he cleaned them. Jake also shares the 7 golden rules of bone collecting, including do no harm. This non-fiction book geared for elementary children (though preK would like the variety of pictures) chronicles Jake's bone collecting journey, teaches us about bones and skeletons, and documents his bone cleaning process. With plenty of personal narrative and great pictures, this is a winner. Find out more about Jake and his process at [jakes-bones.com](http://jakes-bones.com).



***Living Things and Nonliving Things: A Compare and Contrast Book***  
by Kevin Kurtz

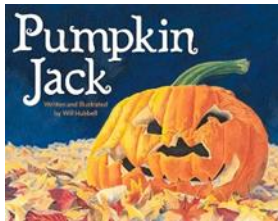
One of the few living/nonliving books, I've found that deal with the complexity of what is alive/not alive, such as things that used to be alive but are now dead (like a mummy). The book claims if a thing breathes, drinks water, takes energy and nutrients from the environment, reproduce, and grow and change, then it is probably a living thing. With words like most, probably, and some, there is room for (and some examples) the nuance and conversation around what is alive and not.





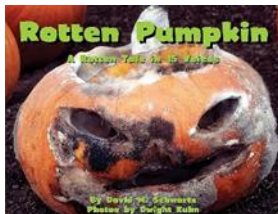
**Pumpkin Circle** by George Levenson

A visit to a pumpkin patch encourages us to explore the life cycle of a pumpkin. These detailed photos illustrate the planting of a seed, the growing plant, delicate blossoms, and pumpkins to harvest. We also see the change in the jack-o-lantern as it begins to decay and eventually becomes a new place for seeds to grow. Fun movement to the words as well!



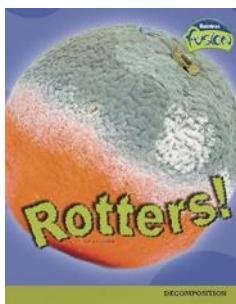
**Pumpkin Jack** by Will Hubbell

A young boy watches his jack-o-lantern decompose in the garden over time as mold covers the pumpkin and it gets flatter. In spring, new life emerges from the seeds of his carved pumpkin. The boy follows the journey of the pumpkin plant, sharing his pumpkins with others. Many classrooms have been inspired with their own Pumpkin Jack, putting a jack-o-lantern in a jar in the classroom, observing the changes, and watching it eventually sprout with the addition of a bit of dirt.



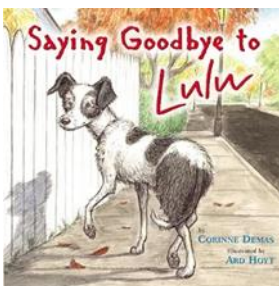
**Rotten Pumpkin: A Rotten Tale in 15 Voices** by David Schwartz

Follow the journey of a jack-o-lantern as it decomposes, with mice nibbling away, a squirrel visitor, slugs, flies, and more. Black rot, reddish fungi, and bread mold also move in. Learn about life that interacts in the decomposition of the pumpkin! Better suited for mid elementary, though the pictures are interesting for all.



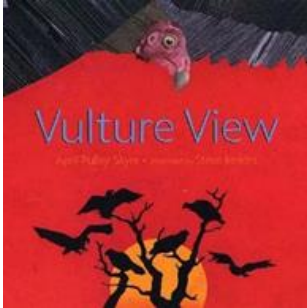
**Rotters** by John Townsend

This older nonfiction book explores the many organisms, such as microbes, bacteria, and fungi, that help plant life decompose. Text features, like bolded vocabulary words, guiding questions, and definitions, help explain what happens as plants and bodies decay. "Rotten fact! One teaspoon of soil can contain over a billion microbes. There are tiny insects, grubs, and worms in there, too." Geared for elementary readers.



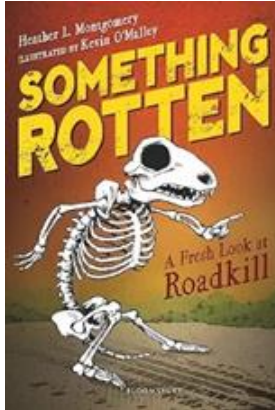
**Saying Goodbye to Lulu** by Corinne Demas

A girl loves her dog, Lulu; however, the dog eventually starts declining due to old age eventually leading to her death. "We put Lulu in a box with her favorite toys and a sock from each of us that smelled like us. We covered her with my blue sweater. We buried the box in the backyard." The girl goes through the grieving process as she missed Lulu, finally saying goodbye in spring at the cherry tree marking Lulu's grave with the hope of new beginnings. Heart touching story.



**Vulture View** by April Pulley Sayre

With short rhyming phrases, interactive options and cut paper illustrations, learn about turkey vultures and how they interact with the world around them. One of my long time favorites, this was a spark book for finding out more about death, decay, and decomposition. Turkey vultures have a keen sense of smell, use air vents to glide, are careful with their preening habits, and like to eat rotten dead stuff! “Those fragrant flowers? No, no. That spicy smoke? No, no. That stinky dead deer? Yes, yes!”



**Something Rotten: A Fresh Look at Roadkill** by Heather Montgomery

I could not put this book down! Geared for upper elementary, this narrative nonfiction takes us on a roadkill journey as the author explores a variety of applications of dead animals. Heather interviews biologists studying disease, explores the discovery of a new bird species from a wing, dissects a snake, and chats with a boy about his bone cleaning and rebuilding skills. Montgomery reminds us that death is just the beginning of the process, with much life along the way, as we learn right alongside her. I now find myself tallying roadkill on my commute! “Warning: This book is *not* for the squeamish.”

### ADDITIONAL RESOURCES

***But Why? Why do people die? Questions about Death.*** Podcast episode. (2017)

This episode starts with a warning to preview it, giving practical terms and information about what is death.

<https://www.vermontpublic.org/programs/2017-10-13/why-do-people-die-questions-about-death#stream/0>

Warden, C. (November 2019). ***Creating a place to place to explore interconnectedness of the earth. Community Playthings.***

In this article, Warden recognizes that children innately are curious about the life cycles around them, including death and decay. Sharing stories illustrating the concept in the early years, Claire asks us to make space for “curated decay” and cultural approaches to death.

<https://www.communityplaythings.co.uk/learning-library/articles/creating-a-place-to-explore-the-interconnectedness-of-the-earth>

Born, D. P., & Schonfeld, D. J. (2019). ***Life and Death in Nature.*** *YC Young Children*, 74(2), 68-77.

Practical tips for teachers in having conversations around death while also sharing examples and stories of how classes have explored the concepts on their own as they found a vole in the corn bin which launched a thoughtful discovery and inquiry process.

<https://www.jstor.org/stable/26808915>

***Mister Rogers' Neighborhood: Death of a Fish Episode.***

In this episode, Mr. Rogers notices a dead fish in the tank. He tries to revive it with salt and ultimately buries it when he recognizes the body of the fish is dead. The episode takes a sensitive approach to how we deal with the feelings around the death of a pet.

<https://www.misterrogers.org/episodes/death-of-the-goldfish/>

Blagojevic, B., Grotton, V., Polk-Hoffses, S., & Thomes, K. (2016). **The Rotten Truth—Discovering Decay!** *Teaching Young Children*, 10(1), 8-11.

This NAEYC article illustrates how one class explored decay through watching a pumpkin rot, exploring living and nonliving things, talking to a mycologist, and creating a decay museum with help from the parents. Additionally, the authors started a website to house additional materials and resources around decay.

Article: <https://www.naeyc.org/resources/pubs/tyc/oct2016/rotten-truth-discovering-decay>

Website: <https://sites.google.com/site/discoveringdecay/>

**Acknowledgments:**

A special thanks to like-minded educators, such as Megan Gessler and April Zajko, who share additional resources when I start down a rabbit hole!

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