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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 public 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**
Fresh Air	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.
Water	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.
Natural Sunlight	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.
Views of Nature	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.
Plants	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.

Natural Materials	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.
Natural Colors	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

Observed Nature Related Activities in the Classrooms	
TYPE of ACTIVITY	**OBSERVED EXAMPLES**
Experiment Investigations	Pumpkins in different stages of decomposition on a countertop available for children to observe from day to day.
Nature Art	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.
Workspace Activities	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.
Book Choices	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.
Observed Nature Related Activities Outdoors	
ACTIVITY	**EXAMPLE**

Experiments	**Icicle Demolition:** 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.
	Water Flow: 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.
Creating Sculptures	Creating snow people using snow and loose parts.
Fort Building	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.
Simulated Cooking	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.
Running	Chasing each other or participating in snowball fights.
Sitting Alone	Children would sit alone under the playground equipment or, at a picnic bench, or in the snow away from others, appearing to peacefully contemplate.
Sitting with Others	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).
Playground Equipment	While outside, the children rarely played on the playground equipment
Outdoor Activities Described as Typical but Not Observed	
Physical Education	Taught outside in the play area by a specialist.
General Nature Hikes	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.
Targeted Nature Hikes	Hikes to identify insects, trees, or specific plants in various areas of campus during different seasons.
Content Teaching	Academics taught outside instead of inside. Reading picture books outdoors. Music lessons taught outside.
Lunch	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 (σ), 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	$\bar{X} \geq 0.75$	$\bar{X} = 0.74\text{-}0.61$	$\bar{X} = 0.60\text{-}0.51$	$\bar{X} \leq 0.50$

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.

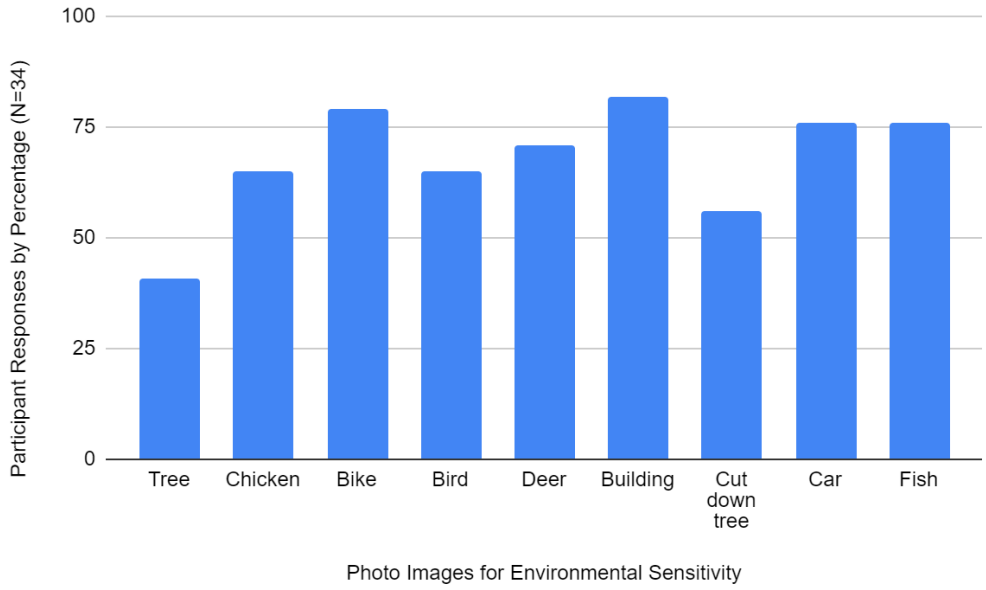
Game 1A: Environmental Sensitivity (Feelings)

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

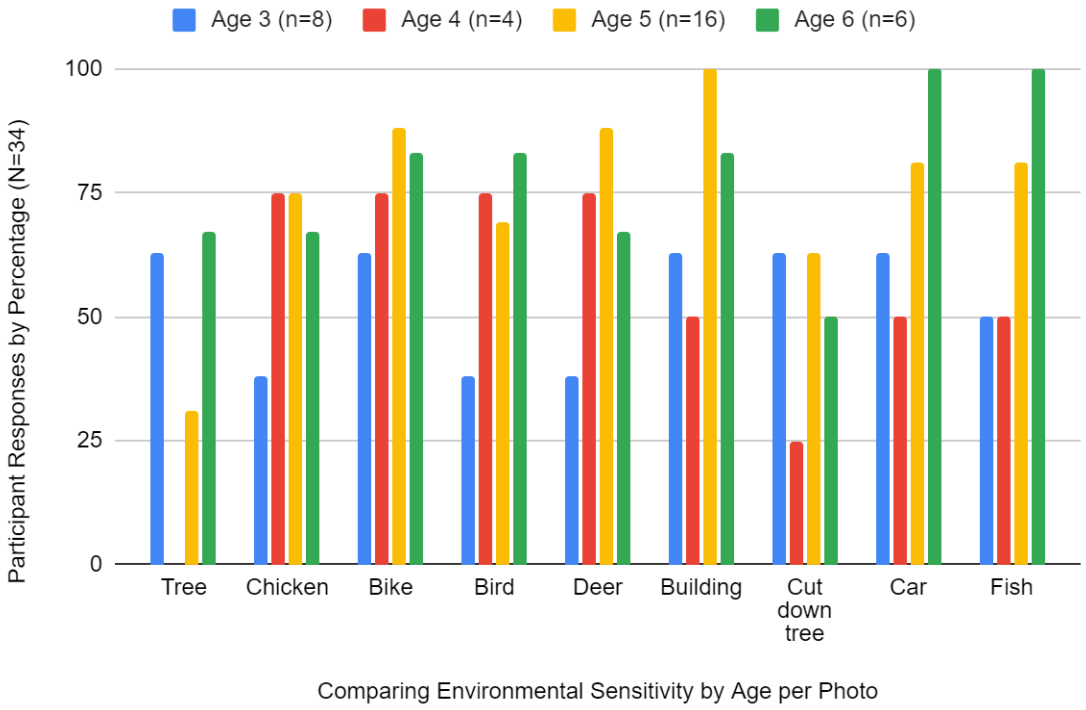


As the answers for Games 1A were yes/no, there is a possible random correct answer of 0.50 or 50%. To understand whether or not the cohort responses demonstrated a statistically significant positive correlation of correct answers to indicate connection to nature, an ANOVA was calculated, and the p-values 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 = 1.86×10^{-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

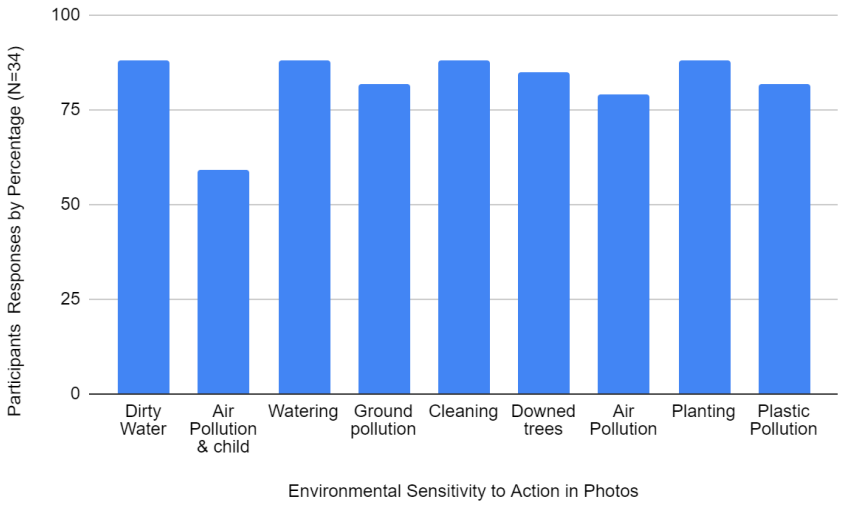
Klingensmith (1953) and Zaitchik et al. (2014) pointed out, the Piagetian concept of animism explained that a young child's knowledge of 'alive' can refer to anything that can move or demonstrate activity. With this logic, cars and bicycles could be interpreted as alive as they move, and trees as not 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.

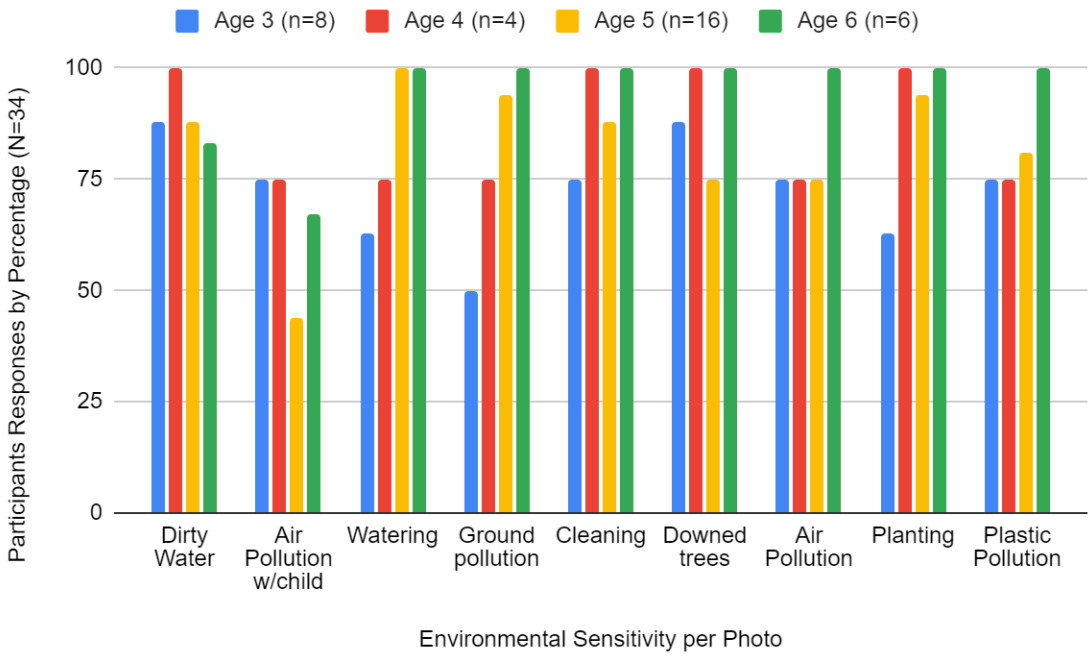
Results. Children's ES responses were (30/34) for watering plants, cleaning up the ground, and planting a tree, dirty water, and cut-down trees, and (28/34) for garbage on the ground and plastic pollution, indicating a strong ES. The exception was the photo of air pollution from smokestacks across a 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 = 4.9×10^{-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

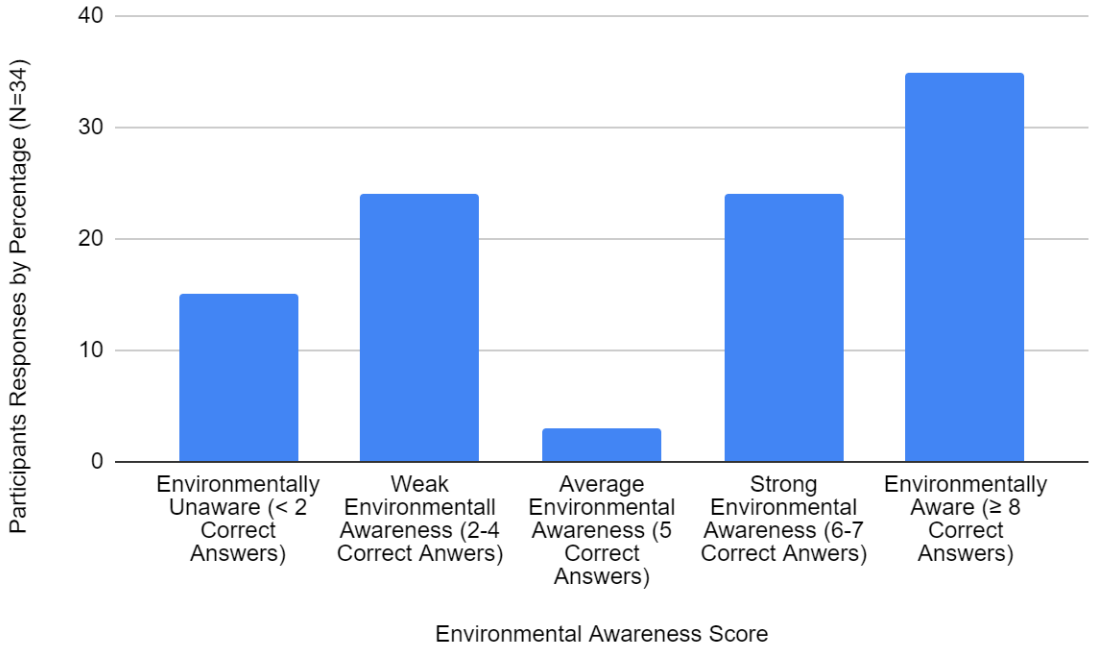
Examples given in this study of qualitative data indicating cognitive incoherence from participants included:

- 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

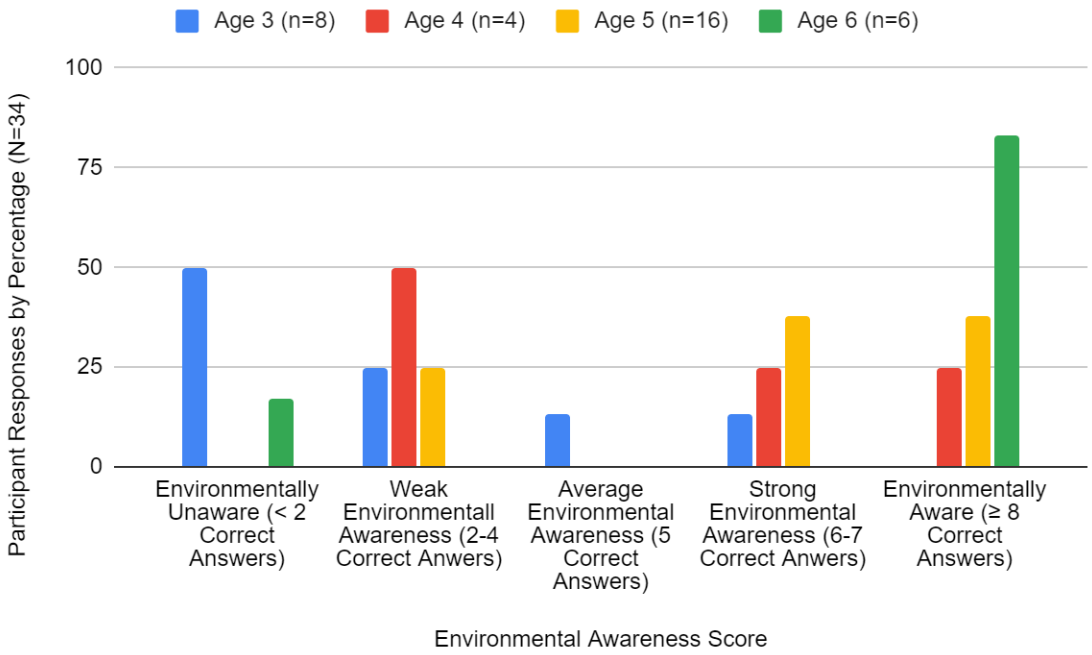


Game 2A did not have a possible random score as it is a matching game; multiple matching answers could be given. There were a total of nine possible correct matches. The regression statistics indicated that age was a correlating variable to matching correct answers. However, calculating an ANOVA to determine 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



Game 2B: 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–themself, 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

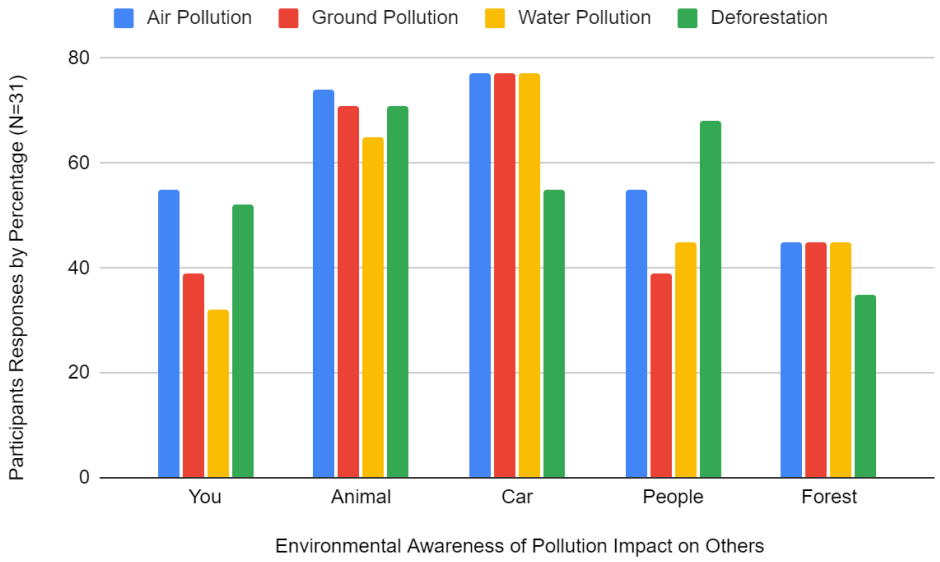


Figure 8. Game 2B: Age 3 Environmental Awareness of Pollution Impact

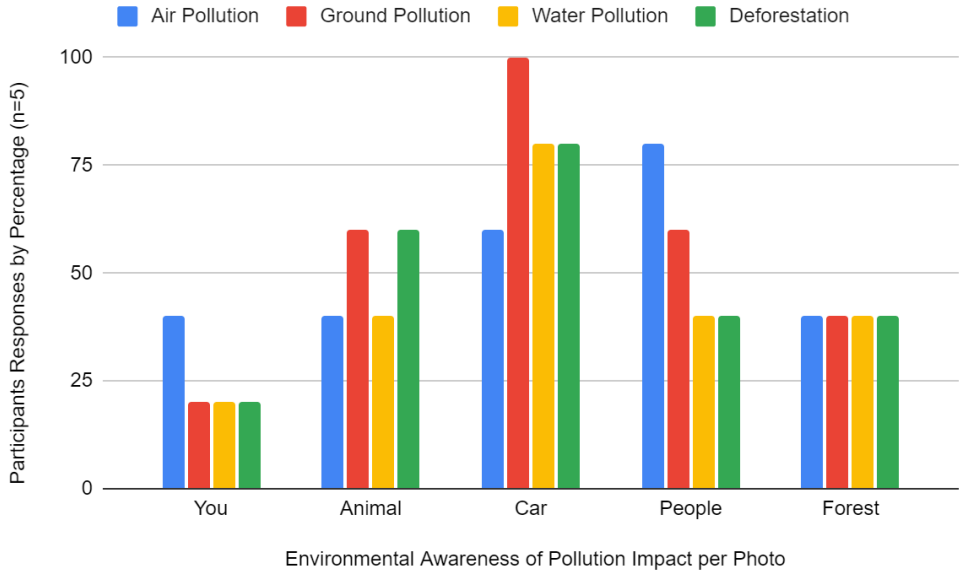


Figure 9. Game 2B: Age 4 Environmental Awareness of Pollution Impact

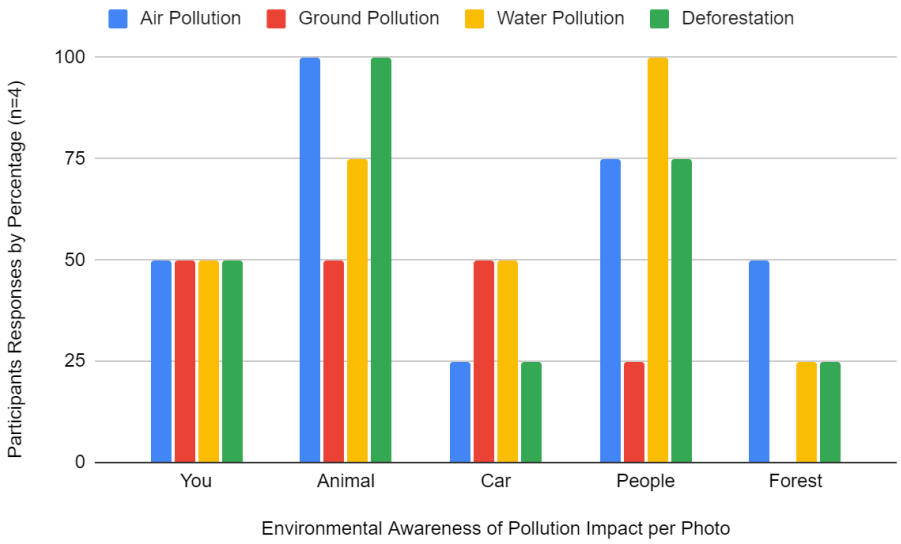


Figure 10. Game 2B: Age 5 Environmental Awareness of Pollution *Impact*

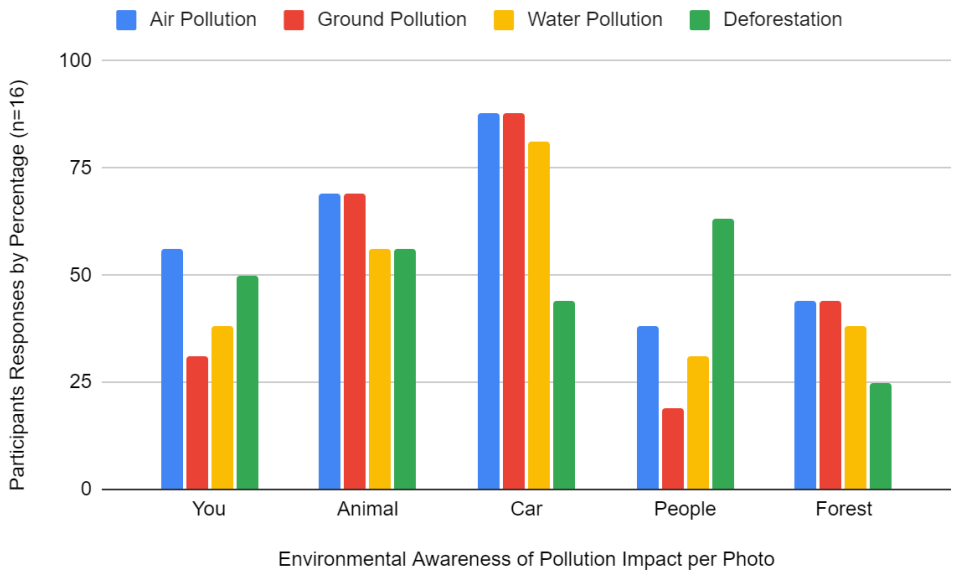
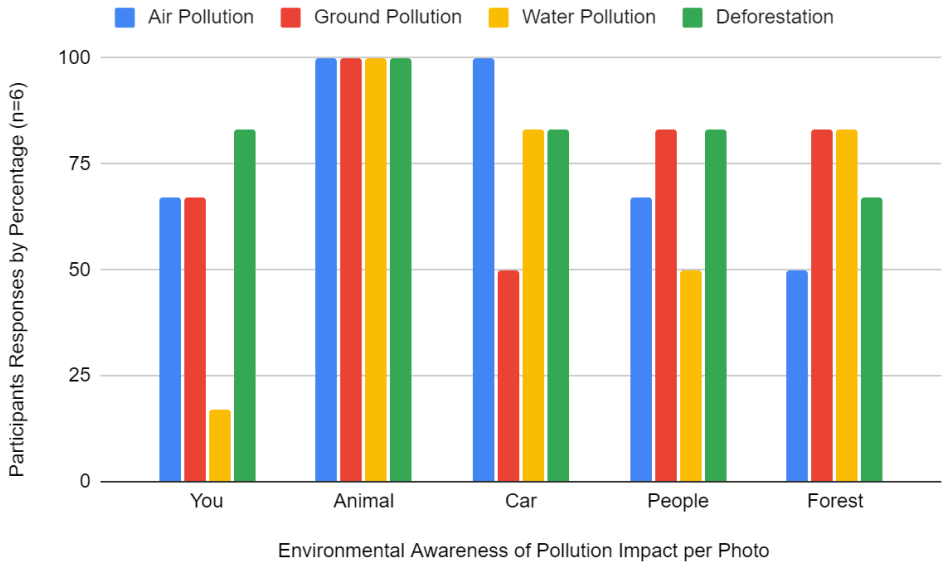


Figure 11. Game 2B: Age 6 Environmental Awareness of Pollution Impact



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
Negative Questions						
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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