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Preschool Children's Understanding of Nature and Environmental Stewardship

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To the Graduate Council:

I am submitting herewith a thesis written by Maureen D. King entitled "Preschool Children's Understanding of Nature and Environmental Stewardship." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Child and Family Studies.

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PRESCHOOL CHILDREN'S UNDERSTANDING OF NATURE AND ENVIRONMENTAL STEWARDSHIP

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ABSTRACT

Exposure to nature is important for children's development and the future of the natural world. Children's time spent outdoors has the potential to increase biophilia, one's connection with nature, impacting their attitude towards nature and nature conservation over their lifetime. Environmental stewardship begins with an understanding of nature and how one can protect the environment around them. This study sought to explore children's understandings of nature and stewardship by engaging a small group of preschoolers (n = 6) in photographing nature in their school's outdoor playspace and asking prompting questions using the photographs in a semi-structured follow-up interview. Photographs were coded for content and perspective. Interviews were transcribed and thematically coded using an open coding approach. Results showed that children primarily took pictures of trees, plants, and ground materials such as grass and dirt. When considering the ways in which they approached photographing nature, children often took photographs looking down and focused on one object. In follow-up interviews, children were able to convey beginning understandings of nature and initial ideas around stewardship of nature, with a particular focus on short-term effects of human interaction. Findings suggest even young children have understandings of nature and can express them variously. Implications are discussed.

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CHAPTER ONE

INTRODUCTION

There is no shortage of positive outcomes spending time outside has on an individual's health. From improved life satisfaction and emotional wellbeing, increased emotional connectedness with nature and environmental stewardship, to an overall healthy lifestyle, nature's benefits are eminent (Broom, 2017; Cheng & Monroe, 2012; Fjørtoft, 2001; Nisbet et al., 2009; Ward et al., 2016). Research has found that when children are exposed to nature at an early age, these benefits are strengthened (Rice & Torquati, 2013; Ward Thompson et al., 2008; Wells & Lekies, 2006). Unfortunately, children are spending less and less time outside and having even fewer opportunities in natural outdoor settings (Louv, 2005). A lack of outdoor exposure during early childhood can result in biophobia, a fear of nature which often leads to a reduced or nonexistent protection of the environment (Rice & Torquati, 2013; Soga et al., 2020; Zhang et al., 2014). However, when young children are given ample opportunities to interact with nature, strong connections with the environment are formed, resulting in environmentally conscious behaviors that extend throughout the lifespan (Broom, 2017; Cheng & Monroe, 2012; Nisbet et al., 2009; Ward Thompson et al., 2008; Wells & Lekies, 2006; Zhang et al., 2014).

While exposure to nature in early childhood is important, few studies have focused on these effects on preschool-aged children, a time where children are more commonly given opportunities to interact with nature, as compared to children 6 years and older who attend primary school. Even fewer studies have focused on what young children understand about nature evidenced through their own voices (Haas & Ashman, 2014; Skarstein & Ugelstad, 2020). Theoretically, having a better understanding of what young children know about nature can

improve early childhood environmental education while keeping it developmentally appropriate. This study aims to contribute to developmentally appropriate environmental education through unpacking young children's knowledge of nature, as well as by gaining a better understanding of environmental stewardship in preschoolers and their actions and knowledge of nature conservation.

CHAPTER TWO

LITERATURE REVIEW

Historical and Cultural Context of Outdoor Experiences in ECE

Early childhood education began, some say, with the introduction of the kindergarten by Friedrich Fröbel in Germany in 1837. Fröbel recognized children's innate ability to learn and socialize through play and activity, and opened up a kindergarten for children to attend before entering school. The term *kindergarten* in German means "children's garden." Fröbel understood the importance of children's learning and advocated for children's time spent outdoors (Fröbel, 1895). Gardening was one of the main activities introduced in his kindergarten where children learned how to grow and care for plants (Herrington, 1998). As other countries adopted Fröbel's theory and pedagogy, the importance of children's time spent outdoors has in many ways become the center of young children's education.

The introduction of forest schools in the early 1950's was the first formal education that centered around learning solely in an outdoor environment. Forest schools first emerged in Denmark in 1952, when Ella Flatau opened a "walking kindergarten" where neighborhood children gathered daily in a nearby forest to play, explore, and learn together (Williams-Siegfredsen, 2017). More forest schools began to open up around Denmark in the 1950's, and shortly after could be found throughout Sweden and Germany in the late 1950's and early 1960's. Today, forest schools are found across dozens of nations around the world. The outdoor learning curriculum of forest schools has laid the foundation for nature-based education in

preschools here in the United States, where there are an estimated 240 nature-based preschools around the nation today (The Forest School Foundation, 2020).

Nature-based education places an emphasis on learning through exposure to the outdoors, but also learning through children's freedom of exploration (The Forest School Foundation, 2020). When children are given the opportunity to learn outdoors, their learning is often guided through their own interests, which may enhance their learning altogether (Broderick & Hong, 2020). Children's overall wellbeing is also positively impacted through outdoor exposure (Ward et al., 2016). Nature-based education can take many forms. Some schools spend all day outside in forests or nearby nature reserves exploring and learning about their surrounding environments. Other schools simply have a natural outdoor environment in place of conventional playground equipment, where children are able to manipulate natural materials for exploration. However nature-based education looks, children are typically given the time to explore their natural environment through self-interest and unstructured opportunities.

Unfortunately, as children enter the public school system around age six they may be finding themselves in a setting that does not promote outdoor education, specifically in the United States. Public schools in the United States are required to follow curriculums mandated by school districts that place strong emphasis on standardized testing, leaving little to no room for outdoor education (Kohn, 2000). In countries like Australia, Norway, and Denmark the opposite is true. In Australia, the curriculum requires students to become active global citizens, recognizing the importance of their local and global environment and learning how to sustain it (ACARA, 2010). Public schools in Norway and Denmark implement outdoor school days throughout the week -- known in Danish as *udeskole* (Bentsen et al., 2008). These outdoor school

days bring the classroom outside, where children as old as 16 are able to spend their days learning the curriculum in an outdoor environment (Bentsen & Jensen, 2012).

While generally the United States public school curriculum neglects the use of outdoor education, unfortunately some early childcare settings are beginning to do the same-- placing too much emphasis on education standards, and too little emphasis on outdoor free play. This is disadvantageous because the outdoors has positive effects on children's learning and overall academic performance. For example, time spent outdoors is positively correlated with higher attention inside the classroom in children as young as 5 years old (Mårtensson et al., 2009). Another study focusing on children with ADHD who were between 7 and 12 years old found an increase in their attention after a 20-minute walk in the park (Taylor & Kuo, 2009).

As children's time outside the classroom decreases, research has also seen a decrease in children's time spent outside willingly. Many researchers worry not only about the negative effects this has on their development, but also the opportunities they are missing out on. In Richard Louv's book *Last Child in the Woods* (2008) he states that as children's experiences in nature decrease it causes a deficit within them. Nature-deficit disorder can have harmful effects on children's development such as behavioral problems, but also harmful effects on the environment as lack of exposure to the outdoors decreases children's willingness to protect it (Cheng & Monroe, 2012; Zhang et al., 2014). As today's children spend less time outdoors, they are becoming less and less active, less connected to nature, and more prone to biophobia, the fear of the outdoors (Frost & Sutterby, 2017). Biophobia in children has the potential to harm the natural world, as a fear of nature is negatively associated with environmentalism (Soga et al., 2020).

The Importance of Nature Exposure During Early Childhood

There is no shortage of evidence that spending time outside has a positive effect on children's development, and some research has found such effects to be amplified when children's outdoor exposure is in natural outdoor spaces. For example, in a study focusing on children's exposure to greenspaces and its impact on physical activity, cognitive development, and emotional well-being, Ward and colleagues (2016) found children's emotional well-being to be more strongly correlated to exposure to greenspaces than to just physical activity. This highlights the importance of children spending time outdoors in natural areas, as opposed to spending time just outside. Additionally, Fjortoft's 2001 study on forests as a natural playscape for children concluded that children who played outside in the forest scored higher on motor development tests than children who played on man-made playgrounds, specifically scoring higher in balance and coordination tests.

Another positive outcome of children spending time in nature during early childhood is an increase in their desire to be outdoors. This is known as biophilia, a person's emotional connection with nature and other living things (McCain, 2020). Once thought to be innate in humans, some researchers argue that in order for humans to develop a strong connection with nature, their connection must be provoked, perhaps in early childhood (Zhang et al., 2014). Acknowledging the importance of nature in early childhood enhances children's willingness to protect nature, leading to environmental stewardship (McClain & Vandermaas-Peeler, 2016).

Environmental stewardship is defined as the protection of the natural environment through conservation and other sustainable practices (National Oceanic and Atmospheric Association, 2021). Young children can exhibit environmental stewardship and an understanding

of environmental stewardship through behaviors and actions such as cleaning up litter and recycling, as well as understanding the impact of their choices on the environment. In one study, children as young as three years old exhibited self-awareness in regard to their natural environment during visits to a local state park (McClain & Vandermaas-Peeler, 2016). Research surrounding environmental stewardship shows an increase of conceptual knowledge with age, i.e., as children grow older, they demonstrate more advanced understandings around the need for environmental sustainability and stewardship (Engdahl Rabušicová, 2011). This suggests that it is important for children to have early experiences to understand environmental stewardship. Unfortunately, research surrounding young children's understanding of environmental stewardship is lacking. Because children's willingness to take care of the environment has been suggested to enhance through their contact with and their understanding of nature (Zhang et al., 2014), we must first look at children's understanding of nature to accurately conceptualize their environmental stewardship.

Photograph Elicitation Methods and Child Interviews

The purpose of the current study is to better understand children's understanding and knowledge of nature and environmental stewardship, as well as the connection between the two. In order to do so, the current study will utilize photograph elicitation methods by children. The use of visual tools in research with young children has re-evaluated the role children play, moving them towards becoming an active participant in the research process (Clark, 2010). As active participants of this research, the children will contribute their perspectives of nature and environmental stewardship through the camera lens, as well as through a recall interview process.

Stimulated recall methods are used to access participants' reflections on participation, usually when prompted by visual media of themselves (Mackey & Gass, 2005). Video-stimulated recall has become a common method used in research surrounding teacher education, where teachers recall thought-processes after watching video footage of them engaged in instruction (Calderhead, 1981; Stevenson, 2013). However, the stimulus that will be used in this study will be photographs taken by the children. In a similar study where children were given digital cameras and asked to take photographs of what they "saw" in nature, the photographs children took offered the researchers valuable insights into the children's understandings and interpretations of nature, as well as the impact nature-based education had (White, 2015). While this article was a great introduction to children's understanding of nature, the current study will take this a step further and also analyze children's understanding of environmental stewardship.

The purpose of the current study is to gain a better understanding of what preschool children know about nature and environmental stewardship, as well as how their understandings of each might be connected. The following study aims to answer the following questions:

1. What do preschoolers understand about nature?
2. What do preschoolers understand about environmental stewardship?
3. What is the connection between preschoolers' understanding of nature and their understanding of environmental stewardship?

Theoretical Frameworks

Two foundational frameworks will be used to support this study. Vygotsky's sociocultural theory of learning provides the theoretical foundation for this study based on his

ideas around children's learning through the use of tools (Vygotsky, 1978). Thomashow's ecological identity theory supports children's early exposure to nature experiences (Thomashow, 1995). Using Vygotsky's sociocultural theory as the theoretical framework for this study, children's use of a camera as a learning tool, and the use of photographs to support their thinking around nature while engaged in interviews, will help them understand nature through capturing what nature means to them and be able to discuss their understandings. Vygotsky states that tools can be used as mediational means in social interaction in order to support higher mental functions (Vygotsky, 1978). As children use a camera to capture their understanding of nature, as they will do in the context of the current study, the camera is thus a tool used to mediate their understanding of their surrounding environment. The photographs serve as tangible supports to allow children to reflect upon the somewhat nebulous construct of nature and be able to discuss it in ways they might not be able to without such artifacts. The camera and the photographs as mediational tools will allow children to express their understanding of nature in ways that they may not be able to through conversation and questioning alone.

The conceptual framework for this study is Thomashow's ecological identity theory. The formation of one's ecological identity happens through the development of one's relationship with the natural world and their exploration of their ecological identity (Thomashow, 1995). Additionally, children's ecological identity and their relationship with the natural world supports the formation of ecological consciousness. For this study children's use of a camera will support their own exploration of their environment and their understanding of nature and environmental stewardship. Through this exploration of nature and the development of their ecological identity, children's relationship with nature will strengthen, thus increasing their ecological consciousness.

CHAPTER THREE

METHODOLOGY

Participants and Context

This study took place at a university early learning lab school in a small city located in the southeastern United States. The study focused on children enrolled in one of the lab school's preschool classrooms serving children ages 3.5-5.5 years old. The lab school follows an emergent curriculum with practices and principles that are central to the Reggio Emilia approach. The school values the whole child and provides children with ample opportunities to explore and learn through engagement in activities governed by their own interests.

Children attending the school spend a significant amount of time outside each day. The outdoor areas available to the children include a garden in the front of the school and a fenced-in nature-based playground behind the school building. The playground offers large, open areas for children to play and explore their natural environment. Areas include a sandbox, a dirt/mud pit, grassy areas, a circular path for children to ride bikes on, large rocks, a wooden deck surrounding a large tree, an outdoor water sensory table, and a large woodchip area with logs and stumps used for walking and climbing on. This natural outdoor environment allows children to explore and learn with very few man-made materials. The only toys offered to the children are toy dump trucks, tricycle bikes, buckets and shovels for the sandbox and dirt pit, and balls. The children use these materials to engage with the natural environment around them.

The participant sample included six children from the same preschool classroom, ages 3.5-5.5 years old. The demographics of the children were collected through questionnaires filled

out by the children's parents, along with their consent for their child to participate in this study. Of the six participating children, five were identified by their parents as white/Caucasian, and one was identified by their parents as Black/African American. Four of the children were identified by their parents as female, and two were identified by their parents as male. All six participating children's first language is English, with one child speaking Russian as their second language, but not fluently.

The six participating children's parents were asked to list the average amount of hours spent outside each week, as well as where their outdoor time is spent. Three of the six children's parents listed their average outdoor time each week between 3-5 hours, one as 5-7 hours, and two as 7+ hours. All children's parents listed their backyard as a place where their outdoor time is spent each week. Other areas include man-made playgrounds (five children), nature preserves or natural settings (five children), and walking or biking around their neighborhood (two children). Additionally, to get a better understanding of each child's exposure to nature-based curriculum, the parents were asked how long their child has been enrolled in the lab school, and whether or not they attended a previous care center with a nature-based curriculum. Three of the six children began enrollment at the lab school between 0-1 year of age, and the other three children began enrollment at the lab school between 2-3 years of age. Three of the six children attended care centers prior to enrollment at the lab school, none of which followed a nature-based curriculum.

Procedure/Measures

Data collection took place in February of 2022 and involved two key processes- photograph elicitation and semi-structured interviews with the children. During the photograph elicitation process, children were given a camera to take photographs of nature around their

playground. Two children took photographs at a time using separate cameras, and were given a short introduction on how to use the cameras by myself prior to their allotted time. Children spent up to 25 minutes taking photographs around the playground before returning the camera to me. I took observational field notes of the children when they took their photographs as a form of data triangulation. I observed how each child approached the task, where they took their photographs, any oral language used during their photograph process, etc.

After each group of two children took photographs, I printed off six to eight hard copies of the photographs and returned the following day to begin their interviews (this process was repeated two more times until all six children were given the chance to take photographs and were interviewed). Printed photographs were chosen to include a variety of content, in hopes of encouraging a range of conversation between myself and each child.

Using the photographs the child took of nature and setting them out on a table in front of the child, I asked questions in order to better understand their understanding of nature and environmental stewardship (see Appendix A). The interviews with children were made up of 6 questions, 4 of which were coded for children's understanding of nature, and 2 that were coded for children's understanding and demonstration of environmental stewardship. All six children were asked to identify what they took photographs of, what they consider to be a part of nature, and how they would take care of the nature they photographed. Because interviews were semi-structured and varied based upon children's responses, some additional questions were asked. For example, some children's responses led me to ask more questions about how animals might be affected if we don't take care of nature (e.g., "What would happen to the birds nest in the tree

if we didn't take care of the tree?). Other responses led me to ask more questions of where parts of nature came from (e.g., "Where do you think that feather came from?").

I audio recorded each interview and then independently transcribed them. Photographs taken by the children and the audio transcriptions of interviews were then analyzed.

Data Analysis

Photograph Analysis

Photographs taken by children were analyzed first through content analysis of themes (Krippendorff & Bermejo, 2005). Themes were identified through frequency of subject matter present in photographs. I developed a coding system that accounted for subject matter captured in photographs. This was done using the following overarching themes: trees, plants, earth materials, landscaping, playground equipment, and anything that did not fit into any of the other categories (marked as "other"). Sub-coding of themes present within the children's photographs is detailed below (see Table 1 for reference). Because I was interested in the children's viewpoint as well as the subject matter in pictures, photographs were coded for the focal point, perspective, and vantage. Focal point in photographs accounted for the amount of content photographed, i.e., focusing the photograph on one thing vs. including multiple items in the photograph. Perspective accounted for the standpoint of the child when taking the photograph, i.e., taking the photograph from close proximity to the object(s) (within 1 foot) vs. taking the photograph farther away from the object(s) (farther than 1 foot). Vantage accounted for the direction the photographs were taken, i.e., taking the photograph by aiming the camera up, down, or laterally. In order to more

Table 1 Sub-coding of Overarching Themes.

Family	Codes
Trees	Deciduous Tree Sticks Leaves (on ground) Coniferous Tree Logs Trunk Holly Tree Stump Holly Berries (not on tree)
Plants	Grass (e.g., clover) Bushes Other Plants
Earth Materials	Mud/Dirt Rocks Sand Wood Chips Water Clouds Sky Bird's Nest
Landscaping	Fence Landscape Bricks Landscape Timber Stepping Stones Concrete Pathway Planter Pots & Boxes
Playground Equipment	Toys Play Stage Tires Tricycle Wooden Boxes/Crates Wood Porch/Porch Steps Wooden Spool Table Water Table Sand Box Playground Gazebo/Slide

Table 1 Continued.

Family	Codes
Other	Buildings Cars People (not children) Other

comprehensively account for children's understandings, the field notes were analyzed qualitatively while considering trends and patterns in photograph content and approaches.

To ensure reliability, a trained reliability coder (graduate research assistant) coded a sample of photographs. Prior to reliability coding, I met with the reliability coder and explained the coding process and the code structure. A select number of randomized photographs were chosen by myself to show the reliability coder, explaining the subject matter and corresponding codes. Using randomization of photographs, the reliability coder coded 15% (n = 28) of the 181 total photographs. When reliability coding was complete, there was 89.3% agreement between my codes and the codes from the reliability coder. The misalignments between coders stemmed from the reliability coder's unfamiliarity with the outdoor playground. There were multiple instances where I coded for all items seen in the distance of photographs (e.g., logs, holly tree, sandbox), and the reliability coder missed one or more items. Additionally, some misalignments in codes were the result of differences in perspectives (e.g., I coded "deciduous tree", reliability coder coded both "deciduous tree" and "trunk"). These misalignments accounted for the 10.7% disagreement between codes, suggesting the coding system itself was fairly robust.

Interview Analysis

Interview analysis began with transcriptions of interviews done by myself. After the interviews with children were transcribed, open coding was used to identify core themes present within the data (Miles & Huberman, 1994). Themes present in interview data were dependent upon children's responses to questions.

Following open coding, axial coding was done through cross-analysis of interviews to identify core categories and subcategories. The identified codes were then placed into core themes (see table 2). Before performing further analyses, I chose three of the six children's data to focus on. This allowed me to look across and find connections between photographs and interviews more deeply. These three children, Aurora, Marie, and Noah were chosen over the other three children because of the following reasons: the photographs they took were more varied in terms of content and perspective, and they provided more in-depth interview responses.

Following the interview analysis of the full sample, and using the data from the three focal children, I performed a constant comparative analysis (Glaser & Strauss, 1967) between themes found within those three children's interviews and the themes found within their photograph samples. Core categories, subcategories, and themes are further explained in the findings section.

CHAPTER FOUR

FINDINGS

Photograph Analysis

To better understand what children know about nature and environmental stewardship, six preschoolers were given cameras and asked to take photographs of nature. A total of 181 photographs were taken between the six children in this study. When looking at the overarching themes (trees, plants, earth materials), 81% (*n* = 148) of the total photographs included trees, 45% (*n* = 82) included plants, and 81% (*n* = 148) included earth materials. In order to further analyze the photographs children took, focal point, perspective, and vantage were also accounted for. Of the total 181 photographs, 73% (*n* = 133) were taken of one thing rather than multiple (focal point), 67% (*n* = 123) were taken up close, as opposed to farther away (perspective), and 8% (*n* = 16) were taken looking up, 60% (*n* = 109) were taken looking down, and 30% (*n* = 56) were taken looking laterally (vantage).

Further analysis of the photographs that were taken looking down (*n* = 109) found that 92% (*n* = 101) were taken of one focal object. Some of these focal objects include stumps, dirt/mud, rocks, trees, plants, and logs. In 3% (*n* = 4) of the photographs taken of one focal object while looking down, the focal object was a man-made object (e.g., water pail, sand bucket). All other photographs taken of one focal object were included within the larger themes of trees, plants, or earth materials. Content analysis of findings is shown in Table 2.

Interview Analysis

Following each child's photograph elicitation, I met with each child individually to conduct semi-structured interviews. Interviews with children were semi-structured, and my questions were contingent upon children’s responses. Some children were asked more follow-up

Table 2 Content analysis findings.

Family	Prevalence
Content	
Trees	81% (*n* = 148)
Plants	45% (*n* = 82)
Earth Materials	81% (*n* = 148)
Landscaping	39% (*n* = 72)
Playground Equipment	34% (*n* = 62)
Other	37% (*n* = 68)
Approach	
Focal Point (one thing)	73% (*n* = 133)
Focal Point (multiple)	26% (*n* = 48)
Perspective (up close; within 1 foot)	67% (*n* = 123)
Perspective (far away; further than 1 foot)	32% (*n* = 58)
Vantage (up)	8% (n = 16)
Vantage (down)	60% (n = 109)
Vantage (lateral)	30% (n = 56)

questions than others. This was dependent upon the child's responses and extent of detail they gave. For example, some children pointed out multiple things in each photograph they took, others did not. In the instances when children only labeled one thing, I prompted them by pointing to other subject matter in the photographs and asked, "can you tell me what this is?" Following the transcription and open coding process, Table 3 represents the codes that emerged from the data. Core themes include: what is and is not nature, stewardship of nature, and understanding of nature. These themes are further explained below.

What is and is not nature

This core theme includes any quotes from the children when they are correctly identifying subject matter taken in their photographs. Also included in this core theme are times children correctly noted that certain subject matter taken in their photographs are not a part of nature (e.g., toy truck).

As explained in the Methods section, in the beginning of each interview I laid out between six to eight printed photographs the child took the previous day. I told the child that I wanted to talk about the photographs they took. Some children began to look from photograph to photograph, immediately making comments on what they took. For example, my interview with Aurora began with her commenting things such as, "look at that log!" while pointing to her photograph of a log. This is an example of a child correctly identifying subject matter in a photograph without my prompting. However, other children were not as quick to talk about their photographs openly, and understandably needed some prompting. In these situations I would ask questions like, "Can you tell me what you took a photograph of here?" or "Can you tell me about this photograph?"

Table 3 Interview Codes and Core Themes.

Core Theme	Code	Quotes
What is and is not nature	Identify something	"I took a picture of the pumpkins." -Cora "Trees, rocks, a berry tree. That's grass." -Lincoln "And this is grass… This one is, uh, sand… Root… Um, trees… And pines." -Noah "Cars, and pumpkins, and chairs, and trees." -Paige
	Understands certain objects are not nature	*(What about this [points to toy truck]. Do you consider that nature?)* "No." -Aurora *(What about this [points to toy truck], would you consider that nature?)* "I don't think I would do that one. That's a truck." -Noah
Stewardship of nature	Human actions can harm nature	*(How might somebody hurt those plants?)* "By trying to make it break, the plant pot." -Marie *(How might you hurt a tree?)* "Banging it." -Noah "Kick it (tree) and you kick it and it hurts it." -Paige
	Human actions can protect nature	"You grow it with a seed and you take care of it." -Cora *(How can we take care of grass?)* "To not pull it." -Lincoln *(How can you take care of those [pines]?)* "Not take them out the plant." -Noah *(How could you take care of grass?)* "By not pulling it out." -Noah "So, how you take care of a log, is by not trying to break it." -Noah *(How do you take care of a pumpkin?)* "You don't kick it, you don't punch it." -Paige
Understanding of nature	Things in nature grow	"Make sure that it (tree) grows enough time before it really needs to be cut down and it's rotting away." -Aurora "Because, because they (pumpkins) are growing." -Cora
	Knowledge of animals and their habitat	"Put it (bird) back in the bird's nest." -Paige "Birds live in a nest! In the tree." -Paige

Table 3 Continued.

Core Theme	Code	Quotes
Understanding of nature	Knowledge of plants and change over time	*(Do you know how we can help a pumpkin grow?)* "Put the seeds in and, and cover it up with dirt." – Cora "So how you take care of a tree is water and sun." – Noah "Put the seed under the ground and grow." – Paige
	Plants need water to grow	*(What else do you think a pumpkin might need to grow?)* "Water!" – Cora "Giving it (tree) water." - Marie

Some children took photographs that included outdoor toys such as trucks, as well subject matter that falls under the category of trees, plants, or earth materials. I intentionally included these photographs for my interviews with children in order to ask whether they consider it to be a part of nature or not. In my interview with Noah, one of the photographs I printed off included a toy truck that he captured, along with the sandbox and trees. After he explained that scooping the sand out of the sandbox would not be taking care of it, and that leaving the sand would be helping it, I pointed towards the truck and asked, "Would you consider that nature?" He responded with, "I don't think I would do that one. That's a truck." This is an example of a child correctly noting that certain objects captured in their photographs are not a part of nature.

The above examples include questions I asked the children that elicited responses that make up this core theme. Other questions that elicited responses for this core theme include: "Do you want to talk about that photograph?" "What else did you take pictures of?" and "Can you tell me what you took pictures of?" Further examples from children's interviews that highlight what is and is not nature can be found in Table 3.

Stewardship of nature

This core theme includes quotes from children that highlight both how human actions can harm nature and how human actions can protect nature. Examples include not cutting down trees (human actions can protect nature) and kicking or banging a tree (human actions can harm nature).

During my interviews with each child, after they identified what they took photographs of, I would ask questions such as, "How would you take care of that tree?" or "How might

someone maybe hurt a tree?" For example, during my interview with Lincoln, after pointing to a photograph of grass and asking what he took a picture of, he said "Grass." I then asked, "And how do you think we can take care of grass?" He responded with, "To not pull it." This is an example of how human actions can protect nature. Examples of how human actions can harm nature were also elicited through the questions listed above. During my interview with Marie, she correctly labeled the plants she took a photograph of. I asked her, "How might somebody hurt those plants?" She responded with, "By trying to break it. The plant pot. And by throwing the dirt out of the plant pot." These examples highlight the questions I asked the children that elicited responses that make up this core theme. Other examples from children's interviews that highlight their stewardship of nature can be found in Table 3.

Understanding of nature

This core theme includes quotes from children that highlight their understanding of plants and animals. Codes within this core theme include: an understanding that things in nature grow (e.g., pumpkins grow), knowledge of animals and their habitat (e.g., bird's live in bird's nests), knowledge of plants and change over time (e.g., pumpkins grow from seeds planted in the ground), and plants need water to grow.

During my interviews with each child, there were times that the children exemplified an understanding of nature. For example, during my interview with Cora, she correctly identified the pumpkins she took a photograph of. I asked her, "Do you think pumpkins are a part of nature?" Cora responded with, "Yes. Because they are growing." I went on to ask how someone might help a pumpkin grow, and she stated, "Put the seeds in and, and cover it up with dirt." She also responded with "Water!" as something that will help the pumpkins grow. All of these

responses from Cora exemplify an understanding of nature; pumpkins are growing, they start from a seed, and need dirt and water to grow.

Another example of children's understanding of nature was highlighted through their knowledge of animals and their habitat. During my interview with Paige, we talked about one of the photographs she took of a bird's nest in a tree. Paige correctly identified the bird's nest in the tree. I asked Paige, "How would you take care of a bird or maybe a bird's nest?" Paige responded, "Put it back in the bird's nest!" Later in the interview we came back to this same photograph. I asked Paige, "What would you tell them (someone at home) about it?" Paige said, "Birds live in a nest, in a tree!" This discussion with Paige highlighted her understanding of animals and their habitat, and her overall understanding of nature. Other examples from children's interviews that highlight their understanding of nature can be found in Table 3.

Focal Children

I chose three focal children from my sample of six children in order to focus on their data and look across and find connections between their photographs and interviews. These three children, Aurora, Marie, and Noah, were chosen over the other three children because of the following reasons: the photographs they took were more varied in terms of content and perspective, and they provided more in-depth interview responses.

The three focal children took a combined total of 92 photographs. Of those photographs, 78% (n = 72) included trees, 47% (n = 44) included plants, and 72% (n = 67) included earth materials. Additionally, 84% (n = 78) were taken of one thing rather than multiple (focal point), 79% (n = 73) were taken within one foot proximity of the object, as opposed to further than one foot (perspective), 8% (n = 8) were taken looking up, 67% (n = 62) were taken looking down,

and 23% (*n* = 22) were taken laterally (vantage). A sample of the focal children's photographs can be found in Table 4.

Aurora

Aurora is a female, White/Caucasian five year old preschooler. When given the camera during the photo elicitation process, Aurora took 45 photographs. Of those 45 photographs, 84% (*n* = 38) included trees, 53% (*n* = 24) included plants, 77% (*n* = 35) included earth materials, and 28% (*n* = 13) included all three. Additionally, of the 45 photographs Aurora took, 75% (*n* = 34) were taken on one thing rather than multiple (focal point), 64% (*n* = 29) were taken up close as opposed to further away (perspective), 15% (*n* = 7) were taken looking up, 51% (*n* = 23) were taken looking down, and 33% (*n* = 15) were taken looking laterally (vantage).

During Aurora's photograph elicitation time, she spent close to 15 minutes taking photographs. As I took notes while observing her, I was surprised to see how dynamic Aurora was in her photograph elicitation process. This was evident in the variety of vantage points she used in her pictures. Of all of the children I observed, she was the only one to crawl onto structures to take photographs. At one point she crawled on top of their climbing dome to take a picture of the trees. When looking at the vantage of each child's photographs, Aurora took the most photographs looking up (*n* = 7).

While Aurora was the most dynamic with her photograph elicitation process, she also moved the quickest around the playground. She took the most photographs compared to the other two focal children (*n* = 45), and took the most photographs from a distance (greater than one foot away), when compared to Marie and Noah (*n* = 16). Aurora took photographs at the same time as Noah, but each other's presence did not seem to be a distracting factor. As Aurora moved around the playground she did not follow Noah, nor vice versa. Some comments Aurora made during

Table 4 Focal Children.

Child	Photo	Quotes	Core theme(s)
Aurora		"It's a tree." "You make sure that no one cuts it down." "Make sure that it grows enough time before it really needs to be cut down and it's rotting away."	What is and is not nature Stewardship of nature Understanding of nature
Aurora		"Look at the logs." *(What about this [points to toy truck]. Do you consider that nature?)* "No."	What is and is not nature
Marie		"This is a rock." *(What were you looking for under the rocks?)* "Worms and bugs and things." *(How might someone not take care of a worm?)* "Crushing it."	What is and is not nature Stewardship of nature Understanding of nature
Marie		"A feather." *(Where do feathers come from?)* "Birds." *(And how do we take care of birds…? Or how would someone not take care of a bird?)* "Throwing a stick at it and it, like hurt it." *(Where do birds live?)* "In nests. In trees."	What is and is not nature Stewardship of nature Understanding of nature

Table 4 Continued.

Child	Photo	Quotes	Core theme(s)
Noah		"So how to take care of a root is by not pull–is by uh… is by, so what you have to do with roots is you have to pull them out." *(How might a root grow?)* "Um I think with a seed." *(And how do you take care of that seed to help it grow?)* "Um, water, sun, and rain."	What is and is not nature Stewardship of nature Understanding of nature
Noah		*(Can you think of any sort of nature that might be under this?)* Uh… animals. Did you know that some animals live underground? *(What kind of animals live underground?)* "Um, mice." *(So if we pulled things out of this ground, what would it do to those animals underground? Would it be helpful for them?)* "No. Cause it would take away their dirt.	Stewardship of nature Understanding of nature

her photograph elicitation process included: “I’m taking pictures of nature. I’m going to take a picture of this (pointing to grass). This is amazing. Nature is so cool!”

When looking at the subgroups that make up the core themes, 46% (*n* = 21) of the photographs Aurora took included rocks, and 46% (*n* = 21) included grass. Of those photographs taken of grass, 11 were taken within one foot distance (perspective). Additionally, of the photographs taken of rocks, 11 were taken within one foot distance as well (perspective). When considering the content, perspective, focal, and vantage of the photographs Aurora took, her sample was quite varied. This was not the case for Marie or Noah’s sample of photographs.

During my interview with Aurora, I came prepared with eight photographs printed off that she took the previous day. The sample of eight photographs included a variety of content, perspectives, vantages, and focal points, which highlighted the variety within Aurora’s photograph sample. Aurora seemed extremely eager to start talking about her photographs. I began by asking her what she took photographs of, and she responded with, “Nature.” She then began to point from photograph to photograph, labeling what she took photographs of. Aurora needed very little prompting during her interview, allowing me to sit back and listen as her voice was highlighted through her descriptions behind the photographs she took. She displayed great understanding of nature, noting that the toy truck she captured in one of her photographs is not a part of nature. When describing a photograph she took of a tree, she explained how trees are alive and growing, that they should not be cut down unless they are rotting away, and that cutting a tree down would hurt it. This conversation further highlighted Aurora’s understanding of nature, how things in nature grow, and how humans can both positively and negatively affect nature.

Marie

Marie is a female, White/Caucasian four year and nine month old preschooler. When given the camera during the photograph elicitation process, Marie took 21 photographs. Of those 21 photographs, 85% (n = 18) included trees, 42% (n = 9) included plants, 80% (n = 17) included earth materials, and 38% (n = 8) included all three. Additionally, of the 21 photographs Marie took, 90% (n = 19) were taken on one thing rather than multiple (focal point), 95% (n = 20) were taken up close as opposed to further away (perspective), 4% (n = 1) were taken looking up, 76% (n = 16) were taken looking down, and 19% (n = 4) were taken looking laterally (vantage).

During Marie's photograph elicitation time, she spent close to 25 minutes taking photographs. As I was observing her, I noted how meticulous Marie was when choosing what to take photographs of. She did not rush around the playground to take photograph after photograph, instead she walked from one point to another, looking around, and carefully choosing what she wanted to photograph. This is evident in that Marie took the most amount of time to take photographs between the three focal children, but took the least amount of photographs (n = 21).

There were multiple times during Marie's photograph elicitation when she grabbed objects and set them on top of something else to take a photograph. At one point she set a leaf on a table to take a photograph, and another time she set a feather on a planter box to take a photograph. While taking photographs, Marie got close up to the objects she was focusing on. This is apparent through her photograph sample, as 90% (n = 19) were taken of one thing (focal), and 95% (n = 20) were taken within one foot of the object (perspective). Additionally, 80% (n = 17) of her photographs were taken looking down (vantage). Some comments Marie made during

her photograph elicitation process included: “I hope I can take a picture of a bug or a worm. I am trying to find a worm. I think it’s under that rock. *(In response to a photograph she took of the rocks)* That’s nature.”

When looking at the subgroups that make up the core themes, Marie took nine photographs that included leaves, all of which were the focal object of those photographs (focal), and were taken within one foot distance (perspective). Of these nine photographs taken of leaves, all but one were taken looking down (vantage). Additionally, Marie took nine photographs of mud/dirt. Of those photographs, 88% (n = 8) were taken within one foot distance (perspective), in 77% (n = 7) of those photographs the mud/dirt was the focal object (focal), and 66% (n = 6) of those photographs were taken looking down (vantage). When considering the content, perspective, focal, and vantage of the photographs Marie took, the large majority of her sample was taken of one thing, up close, and looking down.

During my interview with Marie, I came prepared with eight photographs printed off that she took the previous day. I began the interview by asking Marie to tell me what she took photographs of. Marie quickly identified all of the content in her photographs, and needed very little prompting. After she identified the content in her photographs, I asked her if there was one photograph in particular that she liked the most. Marie went on to tell me that the photograph of the plants in the plant pots was her favorite. As our conversation went on she displayed great understanding of nature, noting that the plants need water, breaking the plant pot and throwing the dirt out would be harmful to the plants, and that worms live under rocks in the soil. Additionally she displayed understanding of animals and their habitats, commenting that birds live in nests in trees, throwing sticks at the nest would be harmful to the bird, and that giving a worm soil to live in would help take care of it.

Noah

Noah is a male, White/Caucasian five year and four month old preschooler. When given the camera during the photo elicitation process, Noah took 26 photographs. Of those 26 photographs, 61% (*n* = 16) included trees, 42% (*n* = 11) included plants, 57% (*n* = 15) included earth materials, and 7% (*n* = 2) included all three. Additionally, of the 26 photographs Noah took, 96% (*n* = 25) were taken of one thing rather than multiple (focal point), 92% (*n* = 24) were taken up close as opposed to further away (perspective), none were taken looking up, 88% (*n* = 23) were taken looking down, and 11% (*n* = 3) were taken looking laterally (vantage).

During Noah's photograph elicitation time, he spent close to 15 minutes taking photographs. As mentioned before, Noah took photographs at the same time as Aurora, but each other's presence did not distract them from their photograph elicitation process. While taking photographs I noted how close he got to the objects he was capturing. He spent time taking photographs in areas of the playground that none of the other children went to, such as the tires near the slide, where grass and other plants grow. I also observed how confident Noah seemed while taking photographs, making comments to himself such as, "Cool. These are some cool pictures." During the 15 minutes Noah spent taking photographs he did not rush himself, and, similarly to Marie, took his time choosing what to photograph. This is evident as he spent the same amount of time taking photographs as Aurora, but his sample resulted in fewer photographs; 26 photographs compared to Aurora's 45.

Similar to Marie's sample of photographs, the large majority of Noah's sample was taken of one thing, up close, and looking down. When looking at the subgroups that make up the core themes, Noah took 10 photographs that included grass. In all 10 of these photographs the grass was the focal object (focal), and all 10 were taken within one foot distance (perspective) looking

down (vantage). Noah also took seven photographs of rocks. In all seven photographs the rocks were the focal object (focal), and all seven were taken within one foot distance (perspective) looking down (vantage).

During my interview with Noah, I came prepared with seven photographs printed off that he took the previous day. I began the interview by asking Noah to tell me what he took photographs of. As Noah began to correctly identify the content in his photographs, shortly into his interview he began to open up and explained, in detail, what he took his photographs of. Noah's interview lasted the longest of all the children, just over seven minutes long. Some things Noah mentioned while looking at his photographs include: not pulling the roots of plants out of the ground, banging a tree would be harmful to it, we can take care of pine trees by leaving the pinecones on the tree and not pulling them off, and grass grows from a seed and needs water and sunlight.

One photograph in particular sparked a conversation that Noah prompted himself. After telling me that removing the rocks and sticks from the dirt (captured in his photograph) would be harmful, he asked if I knew that some animals lived underground. I responded by asking him what animals live underground. Our conversation led him to tell me about how mice can live underground, and that removing the dirt would be harmful to those animals. During this conversation Noah exemplified a broader sense of nature than what was only captured in his photographs. Additionally, throughout his interview he displayed understanding of animals and their habitats, an understanding of how things in nature grow, and how humans can both positively and negatively affect nature.

CHAPTER FIVE

DISCUSSION

Research suggests that as children age, they spend less and less time outdoors through schooling (Kohn, 2000), thus, it is more salient than ever to understand just how much children's outdoor time affects their development. This study aimed to answer multiple questions related to children's understanding of nature and their understanding of environmental stewardship. Through the use of photograph elicitation and child interviews, this study supports not only that children have a solid understanding of nature, but also that their actions can have a direct effect on either the harm or protection of nature.

It is clear through the prevalence of photographs children took of trees, plants, and earth materials that children consider them to be a part of nature. Comparably, the lack of photographs taken of playground equipment such as toys and tricycles, or photographs taken of nearby buildings or cars suggests they may not consider them to be a part of nature. Children's understanding of what is a part of nature may have influenced the vantage of their photographs, in that some children may understand weather to be a part of nature, and therefore have taken more photographs looking up. Others may not have developed this understanding yet, as it was rare for the children to take photographs looking up. Additionally, children may understand the ground terrain to be a part of nature, and focused on taking most of their photographs looking down at the ground.

While all six children in this study varied in age, they all demonstrated an understanding of what is and what is not nature through the photographs they captured independently, and in the individual interviews I conducted. The children were also able to express a basic understanding that things in nature grow, such as plants and trees. The youngest child in this

study was three years and eight months old during data collection. In contrast, the oldest child was five years and four months old during data collection. Despite their age gap, they both expressed a clear understanding of nature and what nature needs to thrive. Plants starting their growth from a seed, and their need for dirt, water, and sunlight, were all mentioned during interviews with these children.

While all children expressed understanding of nature, some of the older children demonstrated a broader sense of nature, beyond what was captured in their photographs. Noah (aged five years and four months) for example, expressed his understanding of animals, their habitat, and humans' effect on animals during his interview. While talking about a photograph he took of the dirt, he went on to talk about how mice can live underground. Even though he did not capture a photograph of a mouse, and I did not mention a mouse, he was able to make this connection. This example demonstrated his use of symbolic thinking about nature beyond just the content of his photographs. While the younger children's understanding of nature that they expressed during their interviews were directly related to the photographs they captured, they still demonstrated a solid understanding of nature. For example, when looking at the photograph she took of a bird's nest, Paige talked about how birds live in nests in trees. These expressed understandings of nature from my sample of children could be influenced by the context of the study, including both the natural outdoor playground and the lab school's nature-based approach, meaning that participating children have consistent exposure to nature and opportunities to learn in and about nature. Interestingly, the children did not focus on taking photographs of humans or of one another. Had they done so I would not have included them in my findings, per IRB guidelines. However, this suggests that the children do not consider themselves or other persons to be a part of nature. This is consistent with findings of similar studies on children of various

ages who also did not make the connection between people and nature (Grugel, 2008; White, 2015). Future studies might consider further examination of children's understanding of the relationship between humans and nature.

These expressed understandings of nature parallel findings conducted in similar studies (Grugel, 2008; Keliher, 1997; Sampaio et al., 2018; Strommen, 1995). For example, Sampaio et al. (2018) found that children who have regular contact with nature were able to correctly label more animals when compared to groups of children who do not have regular contact with nature. However, these studies failed to focus on children in preschool, instead focusing on elementary-aged children. Having the knowledge that children as young as three and a half years old have a solid understanding of nature not only demonstrates that children possess ideas about nature and can express these ideas competently, but may also suggest the need for increased opportunities for children to be exposed to nature at a young age in order to form these nascent understandings.

Children's understanding of environmental stewardship was also the focus of this study. Environmental stewardship can be defined as the protection of the natural environment through conservation and other sustainable practices (National Oceanic and Atmospheric Association, 2021). The children in this study demonstrated emerging understandings of stewardship, noting the actions one takes can have a positive or negative impact on the environment. Actions such as banging a tree, cutting a tree down, pulling out grass, or breaking plants served as the basis of how a person may harm nature according to the participating children in their interviews. In contrast, children expressed ways of taking care of nature in the form of helping a plant grow by giving it water. Additionally, in the context of this study, some children referred to *not* harming nature as a way to take care of it. Children's expressions of environmental stewardship focused mostly on one's immediate actions towards the environment and whether those actions are

harmful or not, as opposed to long-term effects. These findings parallel those found in studies that also focused on environmental stewardship in children (Grugel, 2008; Haas & Ashman, 2014; McClain & Vandermaas-Peeler, 2015). For example, McClain & Vandermaas-Peeler (2015) observed children's play in a state park where they made comments about picking up trash, and not wanting to move fauna or wildlife. These comments are similar to how the children in the current study mentioned it would be harmful to remove plants from the ground and cut down trees. However, many of these studies focused on older children where higher levels of thinking were demonstrated, such as the impact littering and pollution have on the environment (Keliher, 1997). These stewardship examples from previous literature (littering and pollution) represent a broader understanding of stewardship that accounts for long term effects, rather than the immediate effects expressed by children in this study. However, children's expressed understandings of environmental stewardship that were demonstrated in this study support the need for children's exposure to nature, and the engagement in conversations surrounding human's effects on the environment early on, both short term and long term.

The methodological approach to this study through the use of photographic elicitation methods offered a window into children's understandings that a conversation would likely not provide. Providing the children with the tools to capture what nature means to them resulted in more personal, individualized findings that highlight the children's voices. Using printed photographs to prompt responses in the semi-structured interviews with each child provided multiple tangible artifacts for children to reflect on, enhancing their understanding of nature, environmental stewardship, and the connections they made between the photographs they took and the explanations they provided. These connections may not have been made had they not been given the physical photographs they took the day before to reflect on.

Children's understanding of nature and environmental stewardship through the use of photograph elicitation methods conducted by children and child interviews are unique to this study. I found two similar studies that utilized photograph elicitation by children (Grugel, 2008; White, 2015). However, White (2015) did not focus on environmental stewardship within young children, focusing instead entirely on their relationship with/understanding of nature. Conversely, Grugel (2008) included stewardship in their study, however, their participant sample was made up of elementary school-aged children demonstrating more advanced and nuanced understandings of these constructs. Additionally, while visual representation methods are becoming a more common technique used in research, specifically with young children, I was unable to find any previous studies that considered the standpoint of the child when taking photographs (perspective), the amount of content captured in each photograph (focal), or the direction the photographs were taken (vantage). These factors aided in the analysis of my data, and helped me further connect the patterns of each child's photograph samples, helping me to better understand how they approached the task.

Limitations and Future Directions

The sample size of my study was definitely a limiting factor. With only six participants, my results are not generalizable to larger populations of children. Because this study was conducted at a lab-based preschool with a nature-based curriculum, I can assume that results would differ if a similar study were conducted at a preschool without a nature-based curriculum. Additionally, the children in this study likely have had experience responding to photographs, as the teachers at the lab school utilize documentation methods as an approach to teaching and learning. All six children have been enrolled in their current lab school program for at least one year prior to data collection. Their time spent in their nature-based curriculum likely influenced

their understanding of nature. This study is also limited by the time of year the photographs were taken (winter), limiting, for example, the amount of flora in bloom. Future studies should take this into consideration, as it will likely influence the range of content captured.

The homogeneity of the sample was also a limitation. Five of the six children were also identified by their parents as white. All six children were monolingual, English speakers. The sample of children participating in the study do not reflect the population of children in the US broadly. Further, socioeconomic status was not accounted for in the demographic surveys and may play a role in children's exposure to and understanding of nature. Although outside the scope of the current study, future research should examine these understandings among a more heterogeneous population of children and in other contexts and settings in order to examine more broadly how children understand nature.

Conclusion

The current study's findings demonstrate that young children's experiences in nature may have an effect on their understanding of nature and their understanding of environmental stewardship. These findings both demonstrate the capability of preschoolers to make sense of the world around them, understand their relationship with the environment, and emphasize the importance of young children's exposure to nature starting at an early age.

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Appendix A. Prompts for semi-structured interview.

Interview Questions

- What did you take a photograph of in this photograph? (UN)
- Can you tell me about these photographs you took of nature?
    - Why did you take this photograph?
    - What were you thinking about when you took this photograph? (UN)
    - Where in this photograph is there nature? (UN)
- If you were to show your mom or dad the photographs you took but could only choose three, which three would you show them?
    - Why did you choose these three photographs of nature to show your parents? (UN)
- How do you take care of nature? For example, how might you take care of this (point to whatever is in photograph)? (UES)
- Why is it important that we take care of this (point to whatever is in photograph)? (UES)

VITA

Originally born in North Carolina, Maureen Disque King grew up in southeastern Minnesota. After graduating high school, she attended the University of Wyoming and received a Bachelor of Science degree in Family and Consumer Sciences with a minor in Early Childhood Education. Taking a gap year to apply to graduate schools, she chose to attend the University of Tennessee, Knoxville to pursue a Master of Science degree in Child and Family Studies. Her research interest includes early childhood development and the importance of unstructured play and outdoor exposure in early childhood. After graduation, she will move back to the mountain west to pursue a career in higher education.