

**Outdoor explorations with preschoolers:
An observational study of young children's developing relationship
with the natural world**

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ABSTRACT

In a longitudinal investigation of young children's developing relationship with and understanding of the natural world, eleven preschoolers and their teacher were filmed for 50 hours during weekly explorations at a local state park. Findings indicated that while outdoors children showed self-awareness with regard to environmental features, generated complex scientific theories around discoveries, and engaged in environmental stewardship. The teacher provided sensitive guidance for children's individual and collaborative explorations and for their appreciation of nature. The findings provide support for the premise that children's understanding of the natural world develops through direct, engaging experiences, supported by adult guidance and encouragement

Keywords: nature, outdoor play, stewardship, preschoolers, teacher guidance

Research shows that children's direct experiences with nature have decreased dramatically, and today's children are growing increasingly isolated from the natural environment and increasingly dependent on technology and time spent indoors (Kahn, 2002; Kellert, 2002; Louv, 2008). Many key environmental scholars argue that this trend is associated with negative outcomes for children's physical and psychological well-being. Because "people are unlikely to value what they cannot name," the separation of children from nature could easily lead to a generation where a passion for environmental protection is lacking or absent (Louv, 2008, p. 41). Sobel (1995) argues that children must bond with the natural world before learning about environmental degradation or taking on stewardship roles. Furthermore, it is problematic if children spend time learning about faraway rainforests but do not get to know their own backyards or local flora and fauna. The purpose of the present study was to examine young children's developing relationships with the natural world with a focus on the importance of social relationships with peers and teachers as well as their own responses during outdoor explorations.

Young children need unstructured opportunities for play in environments that "put them in touch with beauty, arouse their curiosity, and excite their imaginations" because children learn about themselves and the world through this type of authentic play (Wilson, 2012, p. 18). Diverse environmental affordances provide myriad opportunities for nature play and also facilitate children's physical, social, and cognitive development (Fjørtoft, 2001; Gibson, 1979; Heft, 1988; Sandseter, 2009; Wilson, 2012). Affordances are functional features of the environment characterized by particular physical attributes (e.g., water puddles on a muddy trail) and the unique response of the individuals who encounter them (e.g., one preschooler may take the opportunity to splash in each puddle while another child hops over them). The novelty of environmental affordances, such as trees for climbing and creeks for splashing, is

enhanced by the changing seasonal and climactic conditions encountered by children who have sustained, engaging experiences in natural outdoor spaces. Research has shown that through such experiences, children develop enhanced motor fitness and coordination, creativity, imaginative play, and prosocial behaviors (such as cooperation) along with a reduction in aggression (Fjørtoft, 2001; McClain & Vandermaas-Peeler, 2015; Sandseter, 2009; Wilson, 2012).

Adults who work in environmental education and/or protection often cite two types of experiences – playing in nature as a child and having a family role model who highly valued the natural world – as influential for their own commitment (Chawla, 2007). This attribution indicates the importance of nature play in childhood for developing a bond with the natural world and the value of both community and adult focus on youth connections with nature. In her interviews with 56 environmentalists in Norway and Kentucky, for example, Chawla (1999; 2007) found that nearly all adults in both countries recalled places they played as children or hiked as adolescents, and the vast majority of respondents also connected these experiences with memories of a special relative who “confirmed nature’s value” (Chawla, 2007, p. 146). Large-scale survey research conducted with adults in different countries also links positive environmental attitudes and behaviors with early nature experiences (see review by Chawla, 2007).

What makes early nature experiences so compelling? Place-based memories and affiliations are enhanced by the physical attributes of natural environments as well as the social relationships fostered through the shared experiences. Adults play a critical role in supporting the types of nature experiences that allow children to play and explore freely, develop positive social and emotional connections, and learn from their experiences (Chawla, 2007; Sobel, 1995; Wilson, 2012). When children and adults share positive nature experiences, “with appreciation for other things’ own way of being rather than fear or destructiveness, it lays a foundation for finding intrinsic value in nature” (Chawla, 2009, p. 14). Through children’s direct encounters in nature with adults, they develop an environmental identity that incorporates empathy, perspective-taking, concern for nature, and motivation to take care of the natural world (Chawla, 2009).

Through their experiences in the natural world, children not only learn to enjoy their time outdoors but also prepare for creative and informed participation in society and in environmental preservation (Chawla, 2002; Chawla & Cushing, 2007; Moore & Young, 1978). Authentic participation by children, where they clearly understand what they are doing and why, is closely linked to development of environmental stewardship (Chawla, 2002; Davis & Elliot, 2003; Hart, 1997; Heft & Chawla, 2006; Moore & Young, 1978). These authentic nature experiences are critical for shaping life-long values, attitudes, and behavior patterns toward the natural environment (Wilson, 1996).

Although early childhood is widely acknowledged as an important time for developing positive relationships with the natural world, surprisingly few longitudinal and observational studies have been conducted with preschoolers in unstructured natural environments (Davis, 2009; Kellert, 2002; Louv, 2008). Longitudinal studies with young children focused on experiences built into the curriculum and through unstructured play are particularly needed (Chawla, 2007). Furthermore, extant research evaluating children’s responses to the environment is often limited to children’s declarations of intent (e.g., plans to recycle) or reported feelings about the environment, as opposed to actual observations of their interactions in the natural world (Chawla, 2009). According to Chawla (2009), research on children’s environmental behaviors also has been limited to assessing simple actions such as recycling paper or turning off a light. She argues that children’s responses to nature move from simple to increasingly complex actions and that learning to care for nature proceeds within a social network of collective, collaborative interactions with peers and adults. The present study aims to explore this claim and to contribute to the field of early childhood environmental education by examining young children’s complex, developing relationship with the natural world over the course of one year. This research is an in-depth, exploratory study of a small group of preschoolers interacting with each other and their teacher in weekly outings to a local state park.

The current research was a case study of a preschool with an environmentally focused pedagogy inspired by the Reggio Emilia approach. The Reggio Emilia pedagogical approach was developed in Italy after WWII as part of a post-war reconstruction effort and is characterized by a social-constructivist approach to teaching and learning (Edwards, Gandini, & Forman, 1998, 2012; Hewett, 2001; Inan, Trundle, & Kantor, 2010). Reggio Emilia philosophy states that

“all knowledge emerges in the process of self- and social construction” and, therefore, the emphasis is placed on “each child in relation to other children, teachers, parents, his or her own history, and the societal and cultural surroundings” (Rinaldi, 1993, p. 105). The pedagogical focus is on play, inquiry, creativity, and discovery.

Reggio Emilia schools were originally developed with purposeful connections to the environment through intentional planning for interactions between the preschools and the municipal communities in which they were located (Edwards et al., 2012; Torquati & Ernst, 2013). A central tenet of this pedagogical approach is that the environment is a “third educator,” and the indoor and outdoor environments are carefully designed to provide opportunities for children to engage in stimulating and meaningful work in spaces that support developmentally appropriate learning and social interactions, are aesthetically pleasing, reflect the culture of the children and the community, and afford flexibility and creativity (Edwards et al., 1998; Torquati & Ernst, 2013). As Edwards et al. (1998) write, “the structures, choice of materials, and attractive ways in which educators set [spaces] up for the children become an open invitation to explore” (p. 163). Reggio-inspired preschool environments are designed to create interactions and cooperation between parents, teachers, and especially between children because social exchange is considered essential for learning. The preschools utilize outdoor spaces to increase children’s awareness of the natural world as they play outside and participate in ongoing projects where teachers encourage students to investigate the complexity of the natural environment.

The emphasis on exploration and collaborative learning in Reggio Emilia-inspired environments fosters children’s inquiry and discovery. By participating in everyday experiences in both indoor and outdoor environments, children co-construct knowledge through social exchanges with peers and teachers. Vandermaas-Peeler and McClain (2015) found that children who worked with a teacher in a garden at a Reggio Emilia-inspired preschool utilized inquiry skills such as observing, predicting, evaluating, and comparing as they prepared the garden beds and planted and harvested crops throughout the school year. Their social interactions with their teacher fostered mathematical and scientific inquiries as well as ecological awareness and positive affective responses to the natural world. In a qualitative study of natural sciences education in a Reggio Emilia-inspired preschool, Inan et al. (2010) found that the science projects involved themes that the preschoolers were excited about, and many topics emerged from shared science questions, such as, “How does a rainbow happen?” The teachers expanded the children’s questions into the curriculum and facilitated in-depth, sustained exploration of the topics through socially constructed inquiry and shared enthusiasm. The children were encouraged to use science process skills and actively engage in scientific reasoning. The present study builds on this prior research to examine children’s understanding of and reasoning about the natural world through exploration and discovery.

The present study was an investigation of children’s developing relationship with and understanding of the natural world over the course of one year in a Reggio-inspired preschool. Utilizing a longitudinal design, the children’s interactions with peers and their teacher were observed in the context of their on-going explorations at a local state park. The study focuses on three aspects of children’s developing relationship with the environment: emergent stewardship and appreciation of nature, their discoveries and reasoning about the natural world, and their awareness of themselves in relation to the environment. In addition, their shared experiences with peers and preschool teachers who modeled respect, curiosity, and valuing of nature were examined.

Methods

Context and Participants

The present research was a case study of a non-profit, Reggio Emilia-inspired and environmentally-focused preschool serving 12 children with mixed-aged grouping. The school is located in a mid-sized city in the Southeast and is part-time, open four days a week from 8:30 a.m. until 1:30 p.m. Children attend the school for two or three years.

A central tenet of the school is that children are capable individuals who are most likely to thrive when they engage in challenging, enjoyable, and meaningful activities in the context of a mutually respectful, consistent, and loving relationship with an adult. Teachers give children the opportunity to choose their own activities on a daily basis and provide support and guidance to foster independent and collaborative explorations. A key ethos of the school is structuring the day so that children have free movement between the indoor and outdoor classroom environments.

The pedagogical approach includes the following goals for children's development in nature: a respectful relationship with nature, a feeling of being at home in wild places, an appreciation for natural cycles, an ability to enjoy the beauty of the outdoors, and a feeling of empowerment through knowledge about ways to protect the natural world.

The school has an extensive outdoor environment with a playground, garden, and creek located on site. Five children also go to a local river with a teacher once a week to explore and play (see Figure 1 for images). The present study focused on the outdoor context of the river, which is a wild, naturally-provisioned environment with a trail. It is part of a state park located 15 minutes away from the school and includes a one-mile loop trail, large rocks, steep banks, and moving water.

The outdoor experiences at the river are designed to give children significant freedom while still keeping enough structure to make it manageable for them. The children have the freedom to walk and run along the trail at their



Figure 1. Children exploring the river and the natural environment at a state park.

own pace, but there are rules around stopping points. The teacher and children follow a one-mile loop trail divided into ten or so “rendezvous” spots selected by past preschoolers for some unique or interesting feature (e.g., the potty tree, which looks like a toilet seat) (see Figure 2 for a map of the rendezvous). The children can go ahead of the teacher but must stop when they get to the next rendezvous. In interviews, the teachers identified the rendezvous structure as the critical piece that makes the river experience work. Children’s ability to travel independently or in small groups ahead of the teacher between rendezvous enables freedom and exploration.

The participants included the school’s two teachers, Lisa (age 51) and Sharon (age 43), both Caucasian and female. Lisa founded the school and had worked there for 22 years while Sharon had taught there for 6 years. Lisa was the teacher who took some of the children to the river while Sharon stayed at school with the rest of the group. Additionally, eleven mixed-aged preschoolers (6 females and 5 males) who ranged in age from 33 to 59 months at the beginning of the study participated. Of the 11 children, 6 were Caucasian, 2 were African-American, 2 were Asian, and 1 was Latino. Average family income was in the \$60,000 to \$100,000 range.

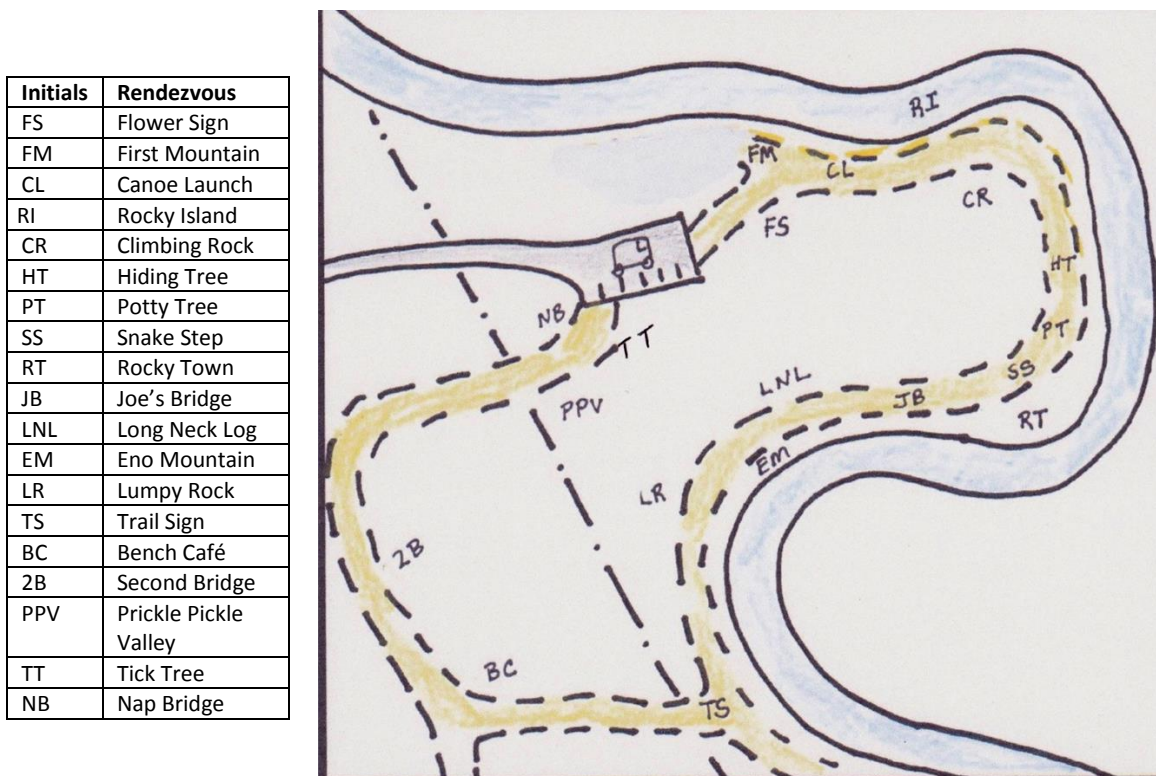


Figure 2. Map drawn by teachers at the school detailing the rendezvous spots. Teachers carry this map with them while at the river and show it to children at each rendezvous.

The Researchers

The primary researcher (Cara) was a female, Caucasian American, in her third year at the university. Cara collected all video observations and conducted both teacher and child interviews. She was an unobtrusive participant observer, participating only if a teacher or child spoke directly to her or if a dangerous situation arose. The children appeared comfortable engaging with her, but mostly ignored her. Cara attended the preschool as a child, grew up in the community, and is related to one of the teachers. This connection meant the children were already familiar with her and remained unbothered by her presence. Furthermore, any potential for bias was reduced by using continuous filming when collecting video data and preparing teacher interview questions ahead of time. The second

author, Maureen, was the faculty advisor and co-investigator. She was a second participant observer on one of the data collection days at the river, and helped conduct the teacher interviews in May. This project represented the beginning of a continuing research partnership with the teachers and the school community.

Data Collection

The researchers utilized data triangulation and between-method methodological triangulation (Flick, 1998; Flick, 2006) with video-recorded observations, child interviews, and teacher interviews. Data collection began in August 2012 and ended in May 2013. The children and accompanying teacher were video-recorded continuously for the 16 days they went to the river that year (some weeks the teachers decided not to go due to weather or scheduling conflicts). Because the teachers completed extensive documentation daily (Edwards, et al., 1998), the children were accustomed to having their language recorded and their pictures taken. In conjunction with video data, the children were interviewed at the end of each river trip in a group interview. The following questions were asked: (1) "What was fun today?" (2) "What was hard today?" (3) "What did you learn at the river today?" (4) "What is good about going to the river?" and (5) "What do we do to keep the river a nice place for everyone to come and for the things that live here?"

Teachers were interviewed by the first author in August, and by both authors in May, using a semi-structured approach. For the teacher interviews, sample questions included: (1) "Why is nature important for children's development?", (2) "If you were to list the top three reasons to take kids outside, what would they be?", (3) "List a couple of easy and/or creative ways to implement nature experiences that you can think of or that have been used at this school", (4) "What kind of nature experiences did you have as a kid?", and (5) "What role does community support and community involvement play in preschoolers' development, both in general and at this school?" The interviews were audio-recorded and transcribed verbatim.

Data Analysis

The first hour (or entire video if less than 1 hour) was coded for the 16 video-recorded river days. The first hour at the river contained a relatively balanced mixture of hiking, settled pretend play, and settled snack time. Coding was completed using the Observer XT 11.5, a software package that was used to code the frequencies of various behaviors layered with the time spent in each environmental affordance. The coded environmental affordances were flat surfaces, water (and the area immediately adjacent to the water), climbable surfaces (e.g. rocks), sloped surfaces (e.g. river bank), and rough, bumpy, or slippery surfaces (e.g. tree roots). Frequencies of behaviors were measured as "instances" with one instance coded for each time a behavior occurred. Behaviors were only double-coded if the child or teacher stopped the target behavior, moved on to a new behavior, and then returned to the initial behavior. To establish inter-rater reliability, two raters independently coded 20 percent of the data, and the calculated percent agreement was 80 percent. The researchers coded for children's awareness of themselves in relation to the environment, stewardship and appreciation of nature, and scientific discoveries and hypothesizing.

Children's awareness of themselves in relation to the environment was defined as children's talk or games about environmental affordances or challenges that involved a child linking or connecting what s/he was doing or seeing with her/his own awareness of what was happening. Examples of awareness include "I slipped into the water," "My boots are filling up with water," "You couldn't see us; we were hiding in the forest," and "This is sort of like a mountain." Awareness could be paired with stewardship (e.g. a child saying, "I don't want to move the flowers" because she does not want to hurt them).

Stewardship and appreciation of nature included examples of preschoolers showing a general appreciation for nature or direct stewardship (e.g. commenting that the river is beautiful or that trash should be picked up). An "other" category was used to code stewardship that did not fit into one of the existing categories (e.g. "If I pour the water in my boots on the grass, it can water plants" or asking to study a seedpod at the school's nature study table).

Codes for scientific discoveries and hypothesizing included plant, animal, or inanimate object identification and scientific principles or theories. For example, one child suggested that a "high tide" pushed a clump of grass up onto a tree that had fallen into the river. The code could involve actual testing or experience (e.g. noticing the water is

deep while standing in the water). Emotional state was coded only if there was clear negative emotion, because the children's baseline mood state was overwhelmingly positive.

For the qualitative coding of child and teacher interviews, the researchers utilized a constant comparative method, generalizing across specific statements to describe the children's' and teachers' experiences in general. A constant comparative method focuses on comparing the data throughout the analysis, following a circular process of comparing current codes and classifications with existing codes and classifications to ensure more accurate analysis and interpretation of data (Flick, 2006).

Results

Children's Awareness of Themselves in Relation to the Environment

Across the 16 days, 338 instances of children's awareness connected to environmental features were coded (see Table 1), indicating that children frequently verbalized an understanding of their relationship to their surroundings. Examples are provided in Table 2. In one example, after the children crossed the river through rushing water, Daniel reported back, "I've never been so far out in the water before." Emma responded to him by saying "When we were in the current, it was sort of like an earthquake." Another example came on a rainy day when Michael and Emma found a hiking spot about fifty feet away from the group:

Michael: It was fun when me and Emma got to stay by ourselves.

Lisa (the teacher): Oh up at the place where you climbed up to try and find shelter?

Michael: That was fun.

Lisa: Why was it fun to be with just yourselves?

Michael: Because then we could um like... not so much noise and like quiet peace.

The children noticed changes in their environment based on their cumulative experiences over time, and this was often reflected in their interviews at the end of each visit to the river. They noticed when features of the rendezvous stops changed, such as a fallen tree at one spot. When asked "What did you learn at the river today?" one child said, "I learned that you can build a bridge out of sticks," and then two weeks later, another child explained, "I learned that when we made the bridge out of sticks, and the rain moved it to a different place, the way it came back together was not a very strong way." Children's comments in response to "What was fun at the river today?" also exemplified awareness of themselves in relation to the environment, such as "I liked getting out of the mud" or "Playing in the water." Michael stated, "I liked that when I tried to go across that deep water. I liked how I kinda tried and tried and tried again, tried all over again."

In response to the question, "What was challenging at the river today?", all the children's responses were related to self-awareness of environmental features, primarily climbing on rocks or up steep hills, going in water, digging in the mud, and navigating the physical landscape. One child described how it was hard to get to rocks in the middle of the river. Another explained that it was hard "getting across that tree at Rocky Town. Getting across that little log. 'Cause there's a part you could hold on and then you couldn't hold on anymore." Michael explained that it was hard to "get down from [a] tree. It was easy to go up but hard to get down." Some of the physical experiences also had emotional components that made them challenging. For example, one child described "What was hard for me was I was kind of scared to go in that seaweed before near Alone Space rock."

Table 1
Overall Behavioral Frequencies for All Children

		<u>River</u>		
	Behaviors	<u>Total</u>	<u>Mean</u>	<u>SD</u>
<u>Discovery and Reasoning</u>	Plant ID	43	2.69	1.28
	Animal ID	85	5.31	2.92
	Inanimate ID	118	7.38	4.06
	Scientific Principles/ Theories	103	6.44	3.20
	Total	349	21.81	3.17
<u>Stewardship</u>	Picking up trash	17	1.06	0.93
	Leaving plants/ animals alone	12	0.75	0.42
	Verbally valuing nature	16	1	0.52
	Photo documentation	52	3.25	2.48
	Mindful looking/ listening	8	0.5	0.55
	Other	26	1.63	1.17
	Total	131	8.19	1.68
<u>Awareness Connected to Environmental Features</u>	Self in Relation to Environment	338	21.13	6.21
	Personal Challenge	30	1.86	0.32
	Total	368	23	6.16
<u>Teacher Guidance</u>	Strategies to solve challenges	37	2.31	1.45
	Memory keeper/bridges	110	6.88	4.18
	Total	147	9.19	3.82

Note: "Total" denotes the total number of observed instances across all days. Means were calculated as the total divided by the number of days (16) at the river.

Furthermore, children frequently verbally linked what they found physically fun and challenging with what they learned at the river. For example, one child stated, "I learned that getting down to Hiding Tree is tricky. That's what I learned." Other children talked about learning that it is hard to walk up long hills or learning not to run too fast or else they will fall. In a final example, children talked about learning how to throw dirt off their shovels.

Lisa (the teacher): Did you guys learn anything about when you were experimenting with the shovels and the dirt? Did you learn anything about how to make the dirt go where you wanted it to?

Anthony: I learned something.

Michael: Yeah, just look at the spot you want it to go and then flip it and it goes where you're looking at.

Emma: Yeah. That's what I learned too.

Anthony: And sometimes you don't know which spot you want to put it in. Which is the bestest.

The vast majority of children's awareness codes were connected to a positive or neutral emotion (329 total positive/neutral emotions), showing that children's perceptions of their experiences outdoors were very rarely negative.

Table 2
Examples of Children's Awareness of Themselves in Relation to the Environment

Location	Example
River	Daniel saying "I caught myself when I slipped!" after he almost fell on a muddy day.
River	Daniel asking his peers "Why is there no mud up here?" after he noticed that the higher part of the trail did not have mud, and Emma responding "Because we're not as close to the water."
River	Michael, Anthony, and Emma finding and comparing acorns: "Yours cracked open, now it looks like mine," "Here's one with a sharp top," and "This one is huge."
River	After the children cross the river through rushing water, Daniel reports back "I've never been so far out in the water before" and Emma says "When we were in the current, it was sort of like an earthquake."
River	After finding a hiding spot in a tree, Emma notes that "We have shelter from the rain."
River	Daniel explains to the teacher that "I tripped. And when I trip, I lean back so I don't fall."
River	On Gabby's first day at the river, she moves slowly past the rocks and roots, saying aloud that "I'm being very careful."
River	Michael practices his spatial awareness skills, thinking about how different rendezvous connect and explaining "So if we want to go straight to Climbing Rock, we don't go that way to Canoe Launch. We go this way."
River	Michael finds a meditation perch on a tree and describes it being "almost like an eagle perching on a limb."
River	As Anthony and Emma put their hands in the water, Anthony exclaims, "This is so cool!"

Scientific Reasoning and Discoveries, Stewardship, and Appreciation of Nature

Across the 16 river days, there were 246 instances where children identified plants, animals, or inanimate objects; 103 scientific principles or theories; and 131 stewardship codes (see Table 1). There were only 18 instances of negative emotional reactions to discoveries, mostly to animals. Children's discoveries were often supported by the

teachers' inclusion of photo documentation and mindful looking/listening into the routine at the river. Much of the stewardship was joyful and expressive (e.g. singing to a tree that had fallen down).

The children exhibited basic and complex inquiry skills (observing, identifying, comparing, classifying, communicating, and utilizing), showing early scientific reasoning (Kilmer & Hoffman, 1995). Older children in particular developed and tested concepts such as speed and depth of the water, occasionally using tools. For example, Michael put a stick in the water to test how fast it was moving and later realized that if he put a stick in the water, he could also test its depth by the watermark left on the stick. The children also frequently engaged in comparison (e.g. deciding whether one set of animal tracks looked like another set). In another example, Lisa (the teacher) spotted some yellow flowers on the side of the path and asked everyone whether the flowers were taller or shorter than they were. Several children stood next to the drooping flowers and announced that they were taller. Michael, in contrast, held the flower upright and judged that it was actually taller than he was. Thus, he demonstrated knowledge of using evidence to answer questions.

The children also demonstrated the ability to use logical processes when hypothesizing (e.g. "That made a really big splash because it was a really big rock"). Although a child's ideas might be grounded in a falsehood, they would often still utilize logic. For example, Michael told Lisa, "Hey, since there's not any leaves, maybe we'll see some mistletoe on the taller trees. Maybe we'll see mistletoe because there's no leaves and the only leaves that are left is mistletoe because that's a bush." Lisa asked, "It's a bush that grows inside trees, Michael?" He replied, "It's the bush that grows on top of trees – mistletoe." In another example, Daniel employed multi-step hypothesizing, though he also used pre-causal reasoning. He first said that the river was "mean" because it was moving so fast, indicative of attribution of intention to the river, and therefore "fishes are staying home." He then thought the fish would "get flushed all the way to the ocean... And they'll be happier in the ocean," which led him to conclude that the river is "strong" but maybe not "mean."

On her last trip to the river, Sophie, a younger child, showed multi-step hypothesizing and exploration, with teacher guidance, as she searched for water in a little creek off the river:

Sophie: Hey, look what's down there!

Lisa: What is down there?

Sophie: Water and it's so muddy.

Lisa: Oh my gosh, there's even water in the little creek.

Sophie: But not right there (pointing).

Lisa: But not everywhere. Really good point. Where does it go?

The children speculate about where the water goes.

Lisa: Where do you think the water comes from guys?

Sophie: From the rain!

In response to a suggestion from the teacher about figuring out where the water comes from, all the children began to dig to see if they found water underground. As Sophie dug with her shovel, she discovered rocks and realized that the rocks were making it harder to dig. Later, after she had been digging for a while without finding water, she concluded that water comes from rain only and does not come from underground.

Stewardship and appreciation of nature develops with experience and age, and in this study the older children demonstrated more complex stewardship. Many children were able to combine scientific principles or discoveries with valuing nature, and also with an awareness of themselves in relation to nature. For example, Michael understood that clouds are able "to make our plants grow. And to make us grow too because we drink water."

Continuing along that line, he explained that, “The best thing about water is, if we didn’t have water, we wouldn’t even be alive. It’s not just that the trees make us alive, but water does too. Water and food!” He recognized that “You know, everything is a part of nature.” Children also shared ideas about stewardship with one another, building on the group’s ideas (e.g. after Michael commented on rain, Daniel said, “Rain is good because it waters plants” and “The best thing about rain is that it can water plants”).

Teacher guidance was crucial for creating a context in which children outwardly expressed their ideas about stewardship. Lisa provided psychological and material tools that supported the children in building a connection with nature. She offered the use of a camera so that children could take photographs of their observations and discoveries and built in meditation moments each trip. Around snack time, the children would spend one minute in either mindful looking or mindful listening (determined by the teacher), starting and ending with Lisa ringing a bell. After the minute ended, children would report back on any sounds they heard or sights they noticed. She encouraged children to notice the environment with an intentional and appreciative focus. The children were able to make a direct connection to nature with her supportive but subtle scaffolding.

During interviews at the river, children talked about discoveries and appreciating nature, including making statements such as “I liked singing to Fallen Tree,” “I liked watching the turtles,” and “I liked seeing the butterfly.” Another child described learning that “I could get a little more closer to turtles than we did last time.” When asked about what they do to keep the river a nice place to come, both for people and for the creatures that live there, the children made connections to prior knowledge. They talked about picking up trash, not littering, not cutting down trees, and protecting animals by not touching them. The children made connections between rules at school and at the river, with one child explaining, “We don’t bring nature objects back to school ‘cause the animals might need to climb on them or eat them or something.” Connecting to natural processes, Anthony said, “And don’t take the leaves off where they’re growing. You gotta keep them there so they can grow even bigger.” In a different interview, Michael explained that, “For bears, we grow more trees because bears can climb and up on tall trees is good for them to hide from predators.”

In the interviews at the river, children were asked, “Why should we go to the river?” The children struggled to answer this question and repeated their same answers throughout the year, primarily saying that it is fun, that it gives children energy, that children get exercise, and that you learn new information and skills (e.g. seeing interesting creatures, finding footprints, learning how to hike and climb). A couple of children showed an appreciation of the aesthetics of nature, answering “That it’s so nice, just like so beautiful” and “Because there’s so much beautiful sounds.” The teacher encouraged the preschoolers to reflect on their days and challenged them to give thoughtful answers to the questions. In the passage below, Lisa pushed the children to think about why the teachers take children to the river.

Cara: What is good about going to the river?

Emma: That you get a lot of exercise.

Matthew: Yeah, that you get a lot of exercise.

Michael: And you can come practice your muscles.

Daniel: And you can get a little exercise.

Lisa: Okay, so guys, you guys have said that a lot of times when Cara’s asked it. I feel like that’s an idea that you have really strongly, that the river’s good for exercise. Now I’m just going to ask you to stretch a little and wonder ‘cause I’m going to point out to you that would you say you get exercise on the playground?

Daniel, Matthew, and Michael: Yeah.

Lisa: So why would we just not stay on the playground for exercise? Why would we come here? Why would we go to all the trouble to put your car seats in the van and drive all this way? What is particularly special about coming here that's different than school? In your opinion. I mean, I have my opinion, but your opinions.

Emma: Nature.

Daniel: Nature.

Anthony: Yeah, nature.

Matthew: Yeah, nature.

Anthony: Make sure that people are safe.

Michael: You know why I think nature: 'cause trees help you breathe and there's more trees right here.

Lisa: Do you actually mean Michael that when we come here, you think it helps our breathing.

Michael: Uh-huh. 'Cause there's more trees.

Lisa: Interesting. Do any of you notice that you breathe differently when you're here?

Michael: Yeah. (looking around)

Lisa: So interesting. I never thought about that before.

On the final day at the river for the school year, the researcher asked the children about their favorite aspect of going to the river. Many children immediately started looking around, up in the trees and at the sky.

Daniel: That there's so many trees.

Matthew: That we learn a lot of things every time that we come. New things.

Anthony: Like it's so warm here.

Daniel: And sometimes you can see the clouds moving here.

Emma: That even if it's really sunny, it's still shady.

Daniel: (looking up at the sky) Hey, I just saw a few rainbows come down sort of. It's like the sun's making the rainbows come straight down.

Michael: That it's kind of a challenge to stop at all the rendezvous.

Lisa: I would say the river grows your brakes, right?

The children practiced early scientific learning in the context of the constructive, child-centered approach. Through teacher guidance and peer collaboration, children developed the ability to observe, predict, compare, question, and evaluate in highly complex and interconnected ways. In conjunction with early scientific learning, the children showed advanced levels of stewardship, in a variety of forms. Furthermore, child interviews demonstrated that the children enjoyed their time in nature, finding it fun and challenging.

Teacher Guidance

Teacher guidance was examined in the video-recordings primarily through two codes: offering strategies to solve challenges and serving as a "memory keeper" (verbalizing connections between current children's experiences and

also connecting to the wider community of past preschoolers and families). Teacher guidance was further contextualized with interviews, particularly around the themes of fostering inquiry and cultivating an ethos of respect for nature.

Offering strategies for solving challenges. Across the 16 days, there were 37 instances of the teacher providing strategies to solve challenges (see Table 1). One day, for example, the water was very high and the children were walking on a narrow, muddy part of the trail next to the river. Lisa identified and reinforced a safety strategy used by one child by saying, “Matthew, it’s a good idea to put your hands like that. You’re really balancing.”

In another example, the children started walking one-by-one across a bridge they built to test it out. All the children but one crossed the bridge, and the teacher and other children offered guidance.

Lisa: I think we have one more tester – we have Olivia.

Olivia: No, I don’t want to.

Lisa: You’re not going to test it Olivia? I wonder why not.

Olivia: Because I’m too scared.

Michelle: I’m a person you can hold on to.

Daniel: Yeah, Michelle can hold on to you.

Emma: Anyway, it’s safe.

Lisa: Hey Olivia, you could be scared and try it anyway, which would be stretching your courage. It’s obviously a choice, but it’s just something to think about. It can be a really satisfying feeling to be scared and then try anyway.

Playing the role of memory keeper. The teacher was deliberate about connecting experiences at the river to school, to home life, and especially to past trips (110 memory keeper codes across 16 days, with an average of 6.88 per day; see Table 1). She frequently adopted the role of memory keeper to demonstrate growth over time in individual children. For example, after Daniel initially struggled crossing from the bank to a rock in the river, the teacher returned to it on subsequent trips as it became easier for Daniel.

Lisa: Hey Daniel, I have to tell you that I remember watching you do that early this year or maybe last year, and it took you so much longer.

Daniel: I figured out that I should face forward and then put one leg on and then turn around and hold my hands onto that little backrest and then once I get my other foot on, I sort of step onto that to the lower rock and then I can use my hands onto this rock.

Lisa: You just found a really comfortable procedure for yourself.

The teacher also used the role of memory keeper to offer new perspectives on events that occurred during their explorations. After one child fell in the water and was worried about being wet and muddy, Lisa encouraged him by articulating “that’s what you’re supposed to do here – get muddy or get wet.” By telling the story of a former preschooler who had the exciting record of falling 37 times at the river one day or by describing wet clothes as “awesomely river-y,” the teacher built an important narrative for the children. Her language encouraged children to take on challenges and to see engagement with the natural world in a positive light.

Fostering inquiry and discovery. Using an inquiry-based approach around discoveries, the teachers encouraged the development of early scientific reasoning through questioning rather than providing answers. Beyond discoveries, teachers also used questions to engage with children about their experiences, thoughts, and emotions. Through vocalization and documentation, the teachers guided collective emerging narratives, telling stories about the

children that enabled them to develop confidence. The narrative told to children, as described by one teacher in her interview, is “You don’t know how to do that yet because you’re still learning. It’s going to get easier when you practice.” Or, “That didn’t work that time. Sometimes that happens when you’re still learning to do something: you can’t do it yet or you mess up the first time you try.” Or, “That’s what it’s supposed to look like when you’re learning. It’s just exactly where it needs to be for now.” The teachers employed a growth mindset to foster children’s understanding of continuous learning, a particularly important strategy within a mixed-age group.

The teachers intentionally built a cultural context in which children knew their discoveries would be interesting and exciting to both teachers and peers. Within this framework, children often vocalized what they noticed and spent large amounts of time trying to understand what they discovered. The teachers, by asking questions and not providing answers, instilled in children a sense that if they discovered something interesting, they could learn about it. As one teacher explained in an interview, this approach helps children by “having inquiry as part of their regular life.”

Creating an ethos of respect and appreciation for the environment. Lisa identified the “profound mystery” of being at the river: “What is it that de-stresses the stressful environment enough for children to thrive there?” She explained that natural environments challenged the children around “the helpful behaviors, the problem solving behaviors, the physical endurance, physical risk-taking, [and] making something out of nothing like figuring out what to do with yourself when there’s no toys except five cups and five shovels.” When talking about how a child who, if left alone, would “never leave the concrete,” loves the river, Lisa asked, “How does that happen?” Sharon replied, “He was allowed to do it his way” because the teachers did not force him to engage and they gave him space. As Lisa said, the natural environment is “really rough and untidy, [and] it’s really beautiful... whatever that mess of mixtures is seems to work on kids in a way that mostly seems really beneficial to them, but I can’t exactly tease that apart.” At the river, children build a relationship with a wild space, a deep human need, which Lisa said “is grossly neglected in our current world.”

In interviews, the teachers explained that wild, unstructured places are forgiving and demanding at the same time, leading to significant growth and development. While it is challenging and uncomfortable with no set activities, children leave feeling empowered as they meet challenges. The teachers identified how the river offers a bounty of opportunities for unstructured play and exploration in an environment that is only naturally provisioned (as compared to a playground or the creek). At times, the environment can be harsher and more difficult for the children to manage as they get wet, fall down, or struggle with boredom, asking themselves “What can I find to do here?” The teachers identified the importance of providing sensitive and supportive guidance within a rich environment that encourages problem solving, pretend play, collaboration, and risk taking; and community support and involvement in children’s development, particularly around nature experiences. They take children outdoors because nature is a “mood boost” and a rich, ever-changing place to learn to be a scientist that opens imaginations and provides sensory input while developing children’s self-efficacy as they meet challenges. They also stated that nature is one of the fundamental human relationships so it is important to them that children connect with it. They believe that when children are in an environment with other children who are using their bodies, appropriate risk-taking develops. Nature is an outlet and a place where children can be wild. As the teachers explained, nature can “open children’s minds and imaginations to the possibility of how things are not just one way... everything is kind of open and moving and different no matter the day.”

Conclusions

The present research was a longitudinal case study of a Reggio-inspired and nature-focused preschool that emphasizes time spent outdoors and affords children multiple opportunities to connect with the natural world. During weekly visits to a local state park, the preschoolers verbalized their awareness of the natural environment, demonstrated scientific reasoning, and engaged in environmental stewardship through sustained interactions with each other and their teacher.

As demonstrated in prior research, authentic engagement with nature builds stewardship, environmental awareness, and a connection to a wild place. Those three aspects are key to building a generation that actively

engages with nature, has an environmental ethos, and generates creative conservation solutions (Chawla, 2002). As Chawla (2009) articulated, children move towards complex interactions with nature and a stewardship mindset within the context of collaborative and supportive peer and adult interactions. The results of the present study indicated that children articulated a developing awareness of their selves in relation to the natural world and exhibited stewardship verbally and through actions. In addition, these complex interactions with nature occurred in a context of consistent teacher guidance, interactions with mixed-age peers, and an appreciation for the environment as third teacher.

Examining the results within a longitudinal framework of change over time provides further support for the importance of consistent and repeated time in wild settings for children's awareness of themselves in relation to the environment, scientific reasoning and discoveries, and stewardship and appreciation, all three of which support building a relationship with wild spaces (Chawla, 2002, 2009; Sobel, 1995). Children demonstrated awareness of their surroundings by noticing new plants, by verbalizing their experiences of falling down or exploring new hiding places, and by asking their peers questions about discoveries. Over the course of the year, as children practiced being aware of their selves in relation to the environment, they gained a sense of their own competencies and also came to understand that they live in a world with other living beings (the natural world, their friends, teachers, and families). The children exhibited stewardship in a variety of forms throughout the year, displaying high levels of positive emotion, particularly excitement, indicating that they felt comfortable in the outdoor environment. The results depicted children's developing sense of place and connections to local flora and fauna, especially as they noticed changes from week to week, an awareness of continuity and change that is particularly important for the development of stewardship (Sobel, 1995). Findings from this study indicated that teachers helped cultivate a positive relationship with nature instead of a fear-based relationship, which may support later efforts at conservation and continued stewardship (Sobel, 1995).

The teachers supported children's scientific explorations and discoveries through socially constructed inquiry, which helps to build a connection to the natural world as knowledge is gained through recurrent positive experiences (Inan et al., 2010; Vandermaas-Peeler & McClain, 2015). Teacher scaffolding and involvement created opportunities for children to compare, classify, and communicate as a teacher asked questions or established connections between current and past experiences. Furthermore, the children had an inherently collaborative scientific reasoning and discovery process as they moved through the natural environment in small groups, sharing their findings and hypotheses with one another as well as their teachers. The inquiry-based approach aligns with and supports the teachers' focus on the Reggio Emilia child-centered constructivist pedagogy, in which children make discoveries within a supportive community of adults and peers. Because the school's teachers believe that children are active creators of their own knowledge and understanding of the world, they support the children in actively exploring their environment, asking questions, and reflecting on those experiences. Over the course of the year, the children strengthened their ability to make connections, ask questions, engage in scientific inquiry, apply logical thought, and grapple with confusing or unknown discoveries.

The results provide support for the importance of teacher guidance and support in creating an ethos of respect. The teachers intentionally tried to make the children view themselves as capable and full of interesting ideas. The teachers also gave children room to explore, fall down, and work through boredom, all within the safety net of peer and teacher support. Additionally, as the teacher played the role of memory keeper at the river, she was able to help the children see themselves in their broader context of school and home and to see their growth over time, thus building their capacity for taking on challenges. The narrative the teachers intentionally created at the river to encourage a growth mindset is the same narrative they build at school and that they teach to parents, cultivating a common thread across learning environments. By explicitly talking about how a relationship with nature is fundamental to healthy development, the teachers prioritized time outside with the children and helped the children come to see its importance for themselves.

The results are limited in their generalizability, given the small sample of children, the unique and selective characteristics of the preschool, and the particular natural environments that were studied. However, the intent of the present study was not to generalize to all preschools or all children. Rather, the case study results highlight the

value of repeated and regular experiences in wild settings for young children's developing relationship with nature within a supportive community of teachers, peers and parents.

Gaining a deeper understanding of the impact of recurrent experiences in wild settings on young children's development is important for psychologists, educators, and environmental activists. Findings indicated that while outdoors children showed self-awareness with regard to environmental features, generated complex scientific theories around discoveries, and engaged in environmental stewardship. The teacher provided sensitive guidance for children's individual and collaborative explorations and for their appreciation of nature. Current policies and practices may be pulling children out of the natural world, but results of the present study support the premise that time spent in nature with a caring adult facilitates children's understanding of and connection to the natural world (Chawla, 2009; Chawla, 2002; Louv, 2008).

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