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Addressing Policy, Practice, and Research That Matters

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TABLE OF CONTENTS

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EDITORIAL NOTE

Of Swallows, Smiles, and Saving the Earth

Ken Finch
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Swirling, zooming, rising and diving in a multi-hued blur: I was beset by an energized gaggle of swallows. I loved it. I want kids to love it, too.

Actually, I both loved and understood it. I am far-beyond-fortunate in my retirement, as at that moment I was mowing little walking paths through the hayfields of our Vermont hilltop farm. The big lawn tractor was doing all the real work, so I could watch the fun. Barn swallows and Tree swallows were the players: small, colorful insectivores (insect eaters) that fly with grace, speed, and exceptional maneuverability. "Insect eaters" was the key to understanding the scene. The spinning mower blades were stirring scores of insects out of the hay; the swallows knew a feast when they saw one. Their twisting, erratic flights were their feeding behavior: catching tiny insects on the fly, gulping them down, and coming back for more.

However, *explaining* nature's beauty and wonder is very different from *feeling* it. And at that moment I was indeed (per today's vernacular) feeling it. First and foremost in my awareness was delight, not knowledge. I couldn't help but smile – literally – at the beauty and kinetic energy of those six or eight birds churning around me, like atoms gone wild within a molecule. My head was spinning to follow the commotion, but it was my heart that was being moved, not my brain cells. Understanding the phenomenon was just for bonus points.

For many years I have been quick to tell early childhood audiences that I am an environmental educator, not an early childhood educator. The two realms fit perfectly together for young children, of course, and over the decades I have gained a decent working knowledge of child development. But my primary perspective has always remained that of an environmental crusader: focused on preserving the natural world that we all depend upon, regardless of our mastery of executive functions or our social/emotional skills. Nature bats first, and last.

In 1980 Thomas Tanner of Iowa State University published his groundbreaking research about the life history of conservation leaders, searching for what commonalities they might have. Tanner found those to be childhood experiences in natural settings. This was the first prominent step in a long journey that has come to rework the core paradigm of environmental education and steer it into a happy collision with early childhood education. The gestation period for this understanding was long, but it gradually gained momentum through vehicles such as Robert Michael Pyle's book, The Thunder Tree (1993), and Dr. Louise Chawla's extensive published research in what has become known as the field of significant life experiences (e.g., "Life Paths Into Effective Environmental Action"). Early on, a smattering of environmental educators began to seriously ponder the implications of this nascent research and commentary: that emotional connections to nature, forged in the context of relatively unstructured play and recreation, have more power and lasting personal impact than does cognitive learning about the environment. No one questioned the ultimate importance of combining the two, emotion and cognition. But there was an emerging case for crucial sequencing.

Then, in 2005, Richard Louv's much-praised book, Last Child in the Woods, brought the issue of children's declining time in nature into the broader public's eye – as well as to a larger audience in environmental education (EE) and to initial attention from the early childhood education (ECE) community. Since then, there has been a rising trend line of new initiatives to connect children to nature, in greater numbers and more-varied ways. That trend seems to be accelerating rapidly, and I am personally delighted at the myriad wonderful efforts underway and the growing chorus of effective voices advocating for children's unstructured time in nature. Also expanding is related research, and thus far it seems to consistently support the premise that frequent, positive, childhood experiences in nature are the most common source of life-long conservation values. We now usually call these experiences "nature play."

Perhaps inevitably, the term "nature play" has come to encompass a very broad range of activities and approaches. Ideally, I consider nature play to be children's self-directed play and explorations in a natural or naturalized setting, whether expansive or tiny. It is play without goals; play and exploration for their sheer, inherent joy – but which guides children towards comfort in, and affection for, the natural world. Yet some see nature play as just a new name for the game-based environmental education activities that have been used for decades. Others see it as denoting virtually any activity that gets kids outside. Still others view it as outdoor play that's done on logs and rocks made of fiberglass, with lifeless "streams" made of concrete, or amidst the cacophony of outdoor musical instruments and noisemakers. And some teachers simply take it as motivation to create a nature-themed classroom activity center, without any correlating outdoor experiences. None of these are bad for kids; they all have developmental value. But are they actually nature play?

Personally, I'm more inclined to see it as swallows and smiles.

I am neither a researcher nor an academic; I'm just an old EE practitioner. As such, I offer here no compelling data sets or dizzying lists of references. Instead, I speak of what I believe. No one will ever conclusively prove the dominance of heart over head, or beauty before brains, or emotion trumping science. But 40+ years of professional experience, combined with 60+ years of life, have thoroughly convinced me of the supremacy of the first of each of those three dualities. Nevertheless, I will never dismiss the importance of environmental knowledge. Indeed, given the complex nature of current environmental issues, it is more vital than ever that the public grasp at least the basics of ecological science. But faced with limited time and limited resources – as EE and ECE operations inevitably are – I advocate for the fostering of children's emotional connections to nature as the keystone piece in the creation of a more environmentally concerned and active population.

On my office shelf I have a well-worn spiral notebook from my college lab course in environmental science. It is 45 years old; no other college work has escaped my recycle bin. This surviving notebook holds outstanding explanations of basic ecological concepts, combined with many wonderful little examples and anecdotes about nature. I can flip through it productively even today. But it is not top-of-mind when I consider what has fostered and fueled my love of nature. Instead, I'll recall the lizards, beehives, and black widows in Grandpa's Arizona yard. The family travels to National Parks. The quiet hours spent catching mostly small, inedible fish in the C & O Canal. Off-season teenage tenting on the sands of nearly deserted Assateague island. Spectacular, hard-earned trail views from atop the Green and White Mountains. Eating a camp dinner beside a wilderness pond, while a beaver cautiously chews his own supper of shoreline tubers, barely six feet away. Cowering amidst too-close lightning in the Tetons' Hurricane Pass. And rocking gently in a solo kayak in a Boundary Waters lake, savoring a midnight moon and a musical score from yodeling loons. These are what stir my soul, not scientific equations or survey percentages. These are what make me give a damn.

Careful review of the significant life experiences research will reveal that despite the influential preeminence of nature play and caring mentors, cognitive learning is nevertheless the factor that stirs *some* people into personal conservation values. Others are similarly moved by participation in outdoor-oriented youth groups, by their early employment experiences, or by witnessing wanton environmental destruction in their own lives. We humans are not all the same, thankfully. Thus, it is important for the early childhood environmental education profession to incorporate multiple approaches to connecting children and nature, just as it is important for all teachers to understand and apply different learning styles. But these diverse strategies should never be used to the exclusion of

intentional efforts to foster emotional attachments to nature. These need not be as grand-scaled or spectacular as some of the personal examples I cite, but they must be *authentic, first-person experiences with real nature*. They can be the magical spectacle of watching a Monarch emerge from its chrysalis, the delight of a child growing her first carrot, or just quiet moments lying in the grass, watching the clouds drift by. Is there an elementary school or an early childhood center in the country that couldn't facilitate some or all of these, with but minimal effort and expense? I doubt it.

This summer – our first at our new Vermont home – seems to have zoomed past. Happily, I didn't miss out on the bubbling songs of Bobolinks in the fields, the glimpses of our local foxes and deer, the mist rising in front of the distant mountains, and night skies overflowing with stars. Perhaps more important than my own delights, though, were the moments when our visiting, five-year-old, urban granddaughter was able to experience similar bits of authentic nature. She can't yet speak powerfully about them, other than perhaps her pleadings to her butterfly-net-armed Nana to "catch bigger ones with pretty patterns!" But I have no doubt that she will remember these days. Nana's and Grandpa Ken's Vermont farm will help shape her childhood and her life.

I know – and try to never, ever forget – that I am fortunate to live where and how I do, both now and in decades past. But I know, as well, that authentic nature experiences are available to *all* young children, urban or rural, given a parent or mentor who will guide them outside and share their own love of the natural world. They do not need facts or fears; they need chances to fall in love with nature. The famed American naturalist, John Burroughs, put it perfectly over a century ago: "Knowledge without love will not stick. But when love comes first, knowledge is sure to follow." If you work with children and nature, emblazon that wisdom in your mind. Or better yet: in your heart.

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Four Methods for Engaging Young Children as Environmental Education Researchers

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ABSTRACT

This article contributes to the ongoing dialogue regarding what it means to engage young children as active researchers in Early Childhood Environmental Education (ECEE) and Early Childhood Education for Sustainability (ECEfS). Drawing from a participatory and phenomenological framework, this paper considers the advantages, challenges, and opportunities of four interactive data collection and analysis methods (Art Making, Role Playing, Building a Model, and Book Making) used to explore the nature of children's experiences in a northern boreal forest. Specifically, facilitating art and model building in the forest provides a backdrop for children to reflect on the beauty and awe of nature; it also provides an opportunity for children to interact with and incorporate aspects of nature into their artistic creations. Children's engagement in role-play in/with nature encourages children to construct stories and scripts to depict their interests and understandings of their local ecology. Children incorporate real and imagined elements into their schematic representations, drawing from past and present experiences within a socio-cultural context. Additionally, bookmaking can be used as a tool to encourage children to create a narrative of their experiences. As a data analysis instrument, children are invited to reflect on photographs and artwork previously collected in order to interpret, reconstruct, present, and document their environmental experiences.

Keywords: children as active researchers; early childhood environmental education; role-playing; building a Model; bookmaking; art making

Around the globe, childhood researchers advocate for children to take a more active role in research (Alderson, 2001; Einarsdóttir, Dockett, & Perry, 2009; James, 2009; Punch, 2002). Scholars within the fields of Early Childhood Environmental Education (ECEE) and Early Childhood Education for Sustainability (ECEfS) have also argued for the promotion of children's agency in research and practice (Barratt Hacking, Cutter-MacKenzie, & Barratt, 2013; Davis & Elliot; 2014; Green, 2015). Indeed, in a recent review, Green (2015) identified a strong trend in ECEE and ECEfS scholarship moving towards participatory approaches *with* children that honor children's voices and perspectives. However, among the studies reviewed the degree in which researchers included child-centered data collection approaches varied. In other words, issues of control, which have long been debated among qualitative researchers (Lincoln, Lynham, & Guba 2011), remain even more contentious in studies involving young children. Specifically, children are subordinately positioned in an adult world. While children are recognized as active agents of culture and change, their ability to create change is heavily influenced by adults and the world around them (Corsaro, 2005). Undeniably, in research involving young children the power-imbalance between the adult researcher and child participants can greatly impact *what* data is collected and *how* it is interpreted. Therefore, researchers must be aware of their own role and how their presence, or lack of presence, influences children's actions and behaviors. Research is also influenced by a number of relational and contextual factors. Thus, methodological approaches of research involving young children fall under great scrutiny; adult researchers must continue to critically engage in discussion on what it means to engage children as active participants in research. As Punch (2002) argued ''reflexivity should be a central part of the research process with children, whereas, researchers critically reflect not only on their role and their assumptions, but also on the choice of methods and their application'' (p. 323). Thus, this paper is aimed at advancing the conversation about what it means to engage children as active agents of research in ECEE

and ECEfS. The aim of this article is to present and critically examine four participatory data collection methods in a study exploring young children's experiences in a forest.

Research Approaches Involving Children

To begin, it is necessary to provide a background on participatory methods of research *with* children. Specifically, Barratt Hacking et al. (2013) described a continuum of methodological approaches for research involving children from traditional, research *on* children approaches, to alternative, research *with* or *by* children designs. This continuum can be used to interpret the ontologies, epistemologies, and methodologies that inform early childhood research.

Specifically, research *on* children approaches derive from positivist and objective paradigms, and in many cases experimental designs or traditional measures employed in fields such as developmental psychology (James, 2009). Such studies view children as objects of research, perceiving children as "human becomings" not yet developed into fully competent and functioning adults (Lee, 2001, p. 7). Adults are positioned as the primary interpreters of children's experiences and behaviors with little to no input from children. In perceiving children as incapable of understanding, researchers often elect not to disclose to children that a study is underway. Furthermore, researchers embracing this type of methodology might consider children vulnerable and in need of protection from complex problems or issues (Duhn, 2012). In other words, they are likely to avoid the risks and uncertainty associated with critical frameworks and action-oriented methods of research.

As researchers move along the continuum towards research *with* children approaches, children are more likely to be listened to and acknowledged. Informed by contemporary sociological understandings, children are considered "people worthy of study" and whose actions can contribute and make a difference in society (James, 2009, p. 34). Under this approach, research recognizes the United Nations Convention on the Rights of the Child (UNCRC), which set precedence for children's citizenship and rights of participation (United Nations 1989, 2005). Specifically, Article 12 under the UNCRC established respect for the views of the child, asserting that children have the rights to "participate in all matters of relevance to them," including research (Barratt Hacking et al., 2013, p. 438). Child-friendly data collection methods are used to encourage active participation, such as artwork, photography, and other interactive activities. However, in utilizing research *with* children approaches, researchers should be careful not to facilitate tokenistic forms of participation (Hart, 1997); whereas, children's participation may be manipulated or enacted at a superficial level. In other words, although children's voices are recognized as significant and important, adults may still be heavily leading and directing the process. That is, the way research is guided and facilitated by adults will greatly influence what children share or don't share in the process.

Whereby, research *by* children approaches aim to engage children as the researchers or co-researchers of a project. Under this approach, children are viewed as competent social actors, "active in the construction of their own lives and the lives of those around them and of the societies in which they live'' (James & Prout, 1990, p. 8). Ideally, children would lead all steps of the research process including posing a research question, determining data collection methods, collecting and analyzing data, and interpreting and presenting findings. Rather than leading the inquiry, the researcher would take on a supportive role, stepping away from their own notions of how the study should be done in order to allow children's questions and ideas to emerge and guide the inquiry. In other words, children's agency should be at the forefront of the research process.

Engaging children as active researchers in the research process is challenging, particularly with young children. As Duhn (2012) explained early childhood educators (and researchers) tend to be led by maternal notions, whereby, children are positioned as innocent and vulnerable and in need of protection. Duhn (2012) warned that this can lead to the over-protection of young children, characterized by a closely monitored environment and restrictive pedagogy and practices. This maternalistic discourse, in turn, can be is contradictory to invoking children's agency with their environment and in ECEE and ECEfS research. Restrictive frameworks and procedures may limit children's voices from being heard and promulgate the positioning of children at the subordinate (powerless) end of the child participant/adult researcher relationship. For example, this might lead an adult to restrict children's engagement with their environment by stating: "don't play over there it is too dangerous" or "there are too many mosquitos to

explore outside." An adult researcher may also be tempted to place restrictions on children's creative activities: "you may only use these colors," "the photograph must be glued on the page like this." While I am not arguing against the importance of ensuring children are safe and cared for, I am suggesting that ECEE and ECEfS researchers continue to consider large and small day-to-day decisions that encourage and discourage children's engagement in the research process.

In my mind, the fine line of providing guidance and promoting agency must be considered and reconsidered continually throughout the research process. Furthermore, if we want to grow as a research community and encourage our children to take an active role in addressing ever prominent environmental and sustainability issues, we must continue to engage in dialogue about the ethics of engaging in research *with* and *by* young children. This paper is aimed at advancing the conversation by attempting to discuss the advantages, challenges, and opportunities of four methods for engaging children as agents in research. Specifically, the following question will guide this inquiry: What methods can be used to promote children's agency in ECEE and ECEfS research?

METHODOLOGY

This study was informed by a participatory and phenomenological framework, focusing on the "careful description of ordinary conscious experience[s] of everyday life" (Schwandt, 2015, p. 234). Phenomenological meanings are derived from "perception (hearing, seeing, etc.), believing, remembering, deciding, feeling, judging, evaluating, and all experiences of bodily action" (Schwandt, 2015, p. 234). Rejecting scientific realism, reality is subjective to each individual. As such meaning is socially constructed and is based on an individual's past and present experiences. Phenomenology is person-centered; it is concerned with "Daesin," that is human existence, or one's experience of "Being-in-the-World" (Heidegger, 1967). As such data collection methods are aimed at eliciting participant's understandings, feelings, and perspectives and rich descriptions of their experiences of "being" in a particular environment.

Study Context

The study included thirty-one 3-to-6 year old children enrolled in a University early childhood education program. However, on any given day, only around 20 children were involved in the research, as some children attended the preschool part-time. Set in a northern boreal forest, the children, with their teachers and researchers, visited the same patch of forest near their school eleven times for approximately an hour each time over a ten-week summer period. Time spent in the forest primarily consisted of open-ended play and exploration.

The research team, consisting of the author and three undergraduate research assistants, provided a supportive role in ensuring that children's ideas and perspectives directed the project. As such, the study took on a deductive and naturalistic, and exploratory approach, meaning that while there was some general structure to the overall project, the process evolved and emerged based on children's interests (Bogdan & Biklin, 2007). As well the children's teachers supported children's agency in the process, encouraging child-led initiatives and risk-taking behaviors during their open-ended forest play and exploration. The Institutional Review Board of the University in which the researcher is affiliated approved the research. Permissions were obtained from the early childhood education center director and teachers as well as from parents of the children who participated in the project. Child assent was sought at the beginning of the project and during all research activities. In this way, children were invited to choose what, if, and how long they wanted to engage in each particular research activity.

Overview of Research Methods and Strategies

The overarching goal of the larger research project was to explore methods for engaging children as active researchers in all aspects of the research process including topic selection, question formulation, methods selection, and data collection, analysis, and interpretation. Table 1 provides an overview of the methods and strategies used in the larger research project. While several strategies were used throughout the research process, for the purposes of this article only four strategies and methods will be presented: Art making, Role-Playing, Building a Model, and Bookmaking. Other methods used, including Sensory Tours and Video-Stimulated Recall Discussions, are presented

elsewhere in another publication (Green, 2016). With that said, in presenting these four methods it is essential to provide the reader with the overarching picture of the entire research process to examine *how* and *what* data was collected by the children.

Table 1
Methods and strategies used to engage young children as active researchers

Steps of Research	**Strategies and Methods**
1) Posing Research Questions/ Selecting Topics	• Small wearable cameras were used to collect video footage of children's exploration and play in the forest. • Adult researchers reviewed video recordings to identify footage that might interest children. • Video footage was presented to small groups of children for discussion. • Children expressed an interest in learning about their experiences of four phenomenon in the forest: rosebushes, forts/castles/houses, bugs, and sticks/"X-marks-the-spot." • Topics formulated the research questions: How do children experience (rosebushes, forts/castles/houses, bugs, and "X-marks-the-spot") in the forest?
2) Selecting Data Collection Methods	• Children choose the phenomenon that most interested them and were grouped accordingly. • "X-marks-the-spot" was the most popular. • Groups were then presented a book of interactive, developmentally appropriate data collection methods and invited to choose methods that most interested them (see Figure 1).
3) Collecting Data	• Children expressed interest in creating art, role-play, building models, and sensory (GoPro) tours. • These data collection centers were constructed in the forest. • Children rotated through centers creating data to further explore their experiences in the forest.
4) Analyzing and Interpreting Data	• Using video-stimulated group discussions, children were invited to view video footage and interpret their own experiences. • Bookmaking was also used as a data analysis and interpretation method. Children were presented with photographs and pictures of their art, models, and role-play and invited to talk about their experiences. Each child created a book page with photographs, drawings, and direct quotes to illustrate their unique experience in the forest.
5) Presenting Findings	• Children presented their research to family and community members in the forest. They shared their experiences of the forest and research process and the book pages they had created. • After the presentation, children led adults on a tour of their data collection centers and their special places in the forest.

Figure 1. Pages in the book, *Our Data Collection Methods*, were used as a prompt to invite children to choose data collection activities.

Four Data Collection and Analysis Methods

The children in this study expressed interest in four main topics, or phenomenon, surrounding their experiences in the forest, including: rosebushes, forts/castles/houses, bugs, and "X-marks-the-spot." The children invented the X-marks-the-spot game during their play and exploration in the forest. They engaged in the game by seeking and finding sticks that crossed in the shape of an X. Several variations of this game emerged during the project, including V-marks-the-spot and T-marks-the-spot. These topics became the focus of their data collection activities. Four centers were developed in the forest based on children's preferences: an Art Center, Building a Model, Role-Playing, and Sensory Tours. Initially, a rotation schedule was devised to enable the groups of children to circulate through the forest centers over the course of four days. However, after the first two days of using the rotation schedule, it became apparent that assigned centers and assigned groups did not necessarily support children's autonomy in the project. Children in the Art Center wanted to explore Role-Playing or Building a Model and children participating in Sensory Tours wanted to do art (or vice versa). Additionally, children's interests in forest phenomenon often overlapped; thus, it did not seem appropriate, for instance, to ask children to create art about bugs when they wanted to focus on "X-marks-the-spot," or vice versa. Thus, by the third day, children were invited to freely explore whichever phenomenon and data collection centers most interested them at any given time. This, in turn, aligns with the nature of engaging children as active agents in their own research. A drawback, however, in offering free-flowing center exploration was that sometimes centers became overly populated or children were unable to complete their projects before it was time to leave the forest. Table 2 highlights advantages, challenges, and opportunities of the four data collection centers used in this project. These will be further discussed in the sections that follow.

Art Making

"Like language, art is a symbol system that can be used to generate meaning" (Isenberg & Jalongo, 2001, p. 106). While art as a method has grown in popularity in childhood environmental education research with children (Green, 2015), it is important to consider what type of art activities are appropriate for the skill level of children involved in research. For young children who are still developing their fine motor skills, painting may be more inviting than drawing. In our study, we provided materials for both painting and drawing). An Art Center was constructed in the forest by placing a large board on four tree stumps for a table and stringing a line between two trees to hang finished

artwork. Children were invited to draw or paint about their forest experiences using the medium they preferred; some did both.

Art is a meaning making process; through the creation of art, children represent and interpret their own experiences. We invited children to describe their creation in order to ‘‘record[s] the journey of their constructions of meaning’’ (Einarsdóttir, Dockett, & Perry, 2009, p. 219). In this way, focus was placed on the process of meaning making rather than children’s artistic abilities or their finished products. Completed artworks were then hung to dry on a clothesline to dry and shared and admired with others.

Figure 2. Children’s paintings hanging to dry in the Art Center.

Creating art in the forest allowed for unique interactions with forest flora and fauna that could not be had indoors. During one art center session, a group of children interacted with a caterpillar that happened across Heidi’s paper:

> **Derek**: *Hey there’s a caterpillar on your…*
> Heidi drops her marker in the bucket and looks up at Ms. Bethany, pointing to the caterpillar.
> **Heidi**: *Ms. Bethany, there’s a caterpillar on my page.*
> **Ms. Bethany**: *Oh wow.*
> **Ms. Taylor**: *Did you draw a cater … oh is that…*
> **Heidi**: *No, it’s a real one*.
> **Ms. Taylor**: *Oh, it’s a real caterpillar right there.*
> **Ms. Bethany**: *He wants to see your art there, Heidi.*
> Heidi touches her paper near the caterpillar and laughs.
> **Heidi**: *I think he wants…I think…I think he thinks it’s a real tree.*

During the interaction with the caterpillar, Heidi along with her teachers personified the caterpillar, assuming its intentions and behavior. As an individual’s environmental identity is formed through interactions and experiences, Heidi’s empathetic response towards the caterpillar is indicative of her growing relationship with the natural world (Green, Kalvaitis, & Worster, 2015).

Setting up opportunities for socializing through group art making encourages children to engage in discussions about what is meaningful to them, communicate shared experiences, and bounce ideas off one another. In this way, the art table creates a common ground for children to express their particular interests in topics.

On the other hand, social influence might also pose limitations. That is, children can be easily influenced by the activities of others around them and might strive to create similar artwork (Einarsdóttir et al., 2009). Furthermore, a child might try to construct what they perceive the researcher wants, rather than authentically express his ideas and perceptions. One way to mitigate social influence is to include multiple methods for children to share their perspectives of their environment. This allows for triangulation of the various data sources. In other words, salient aspects of children's experiences will emerge multiple times through multiple methods. For instance, if a child draws a picture of himself looking for ladybugs on a tree and then creates a model with a similar description this likely demonstrates something that is important to him.

In considering possible limitations of art making as a method, some children might create artwork that seems unrelated to the environmental context. It is important, however, not to dismiss a child's creation as irrelevant, rather a researcher might invite a child to explain the connection that she is making to a particular setting. Furthermore, there are logistical considerations when facilitating art activities with children especially in nature as art making can be messy. Spill proof paint containers and non-toxic products support the common goal of consideration for and preservation of the environment.

Building a Model

Building and molding is a common feature of childhood play, whether indoors or outdoors, in formal (classrooms) or informal (forest) settings, children love to explore how 'stuff' fits together and what that 'stuff' might become. Indeed, "children learn best through manipulation of materials in which they can see the effects they have on the world around them" (Swartz, 2005, p.100). In other word, through building and molding, children are interpreting and constructing their own sense of place in their environments. Childhood place research has also revealed children's inclination to manipulate "loose parts" or objects in nature (Hart, 1979; Kjørholt, 2003; Kylin, 2003; Sobel, 2002). Cobb (1977) described this as "a sort of fingering over the environment in sensory terms, a questioning of the power of materials as a preliminary to the creation of a higher organization of meaning" (p. 48). In other words, by manipulating objects and settings through their play, children are personally making meaning of the world around them and developing environmental competencies (Green et al., 2015).

Figure 3. A child's model: The mushrooms are "houses;" the green moss is "the grass;" and the sticks are the "bushes, prickles and things."

In our research, we invited children to use natural materials to build models to represent their environmental experiences. First, children were provided with buckets to gather materials from their environment, including sticks, leaves, spruce pine, bark, moss, mushrooms and other interesting objects. Next, children shaped and glued their objects onto cardboard surfaces, creating miniature worlds to represent both real and imaginary elements of their experiences. After children were done constructing their models they were invited to describe them. Bug homes, mini villages, tiger huts, tiny lakes, and rivers were among the features depicted in children's models. Some accurately represented the local flora and fauna of their environment, while others extended their depictions to include features that were not native to their environment (e.g. tigers).

The primary advantage of the Building a Model method is that models constructed by children represent their particular interests in their environment. For instance, Sergo built his home in the forest. This, in turn, validated his interest in claiming a place in the forest, which he demonstrated during other data collection activities. Katherine built a ladybug on a tree, demonstrating her environmental competency of the creatures that she had interacted with in the forest. Others incorporated native flora and fauna of the local habitat that they had not come into direct contact with during their forest explorations (i.e. bears, salmon, and berries). Nevertheless, such depictions provide insight to their personal interactions with the local outdoor environment, both past and present.

Additionally, children's descriptions of their models provide insight into the social, cultural, geographical and familial influences of their nature experiences. Several children created their houses and described features of their yard (i.e. kid pool). They also talked about going on hikes with a family member, or engaging in hunting and gathering activities (i.e. berry picking). These all make up the local ethos of their place (Kjørholt, 2007).

As well a third advantage and disadvantage of the Building a Model method is that children incorporated both real and imaginary elements in their models in order to interpret their surroundings. While this can be viewed as an advantage, especially in considering fantasy play as an important feature of children's environmental identity development (Green et al., 2015), it might also be perceived as a disadvantage in that their representations may not fully reveal the truth of their lived experiences. Facilitating multiple methods to explore children's experiences, as discussed earlier, provides one way to overcome this. If children repeatedly represent and tell about an experience or particular phenomenon then likely it represents a salient aspect of their environmental identity.

A possible disadvantage, or challenge, associated with the Building a Model method is that it may not be suitable for especially young children who are still developing their fine motor skills. It is important to keep in mind the age and skill level of children when considering this method. It may be challenging for younger children to use liquid glue or to cut or shape materials into distinct environmental features. Thus, when facilitating this method with young children, researchers may want to employ an ample number of adult or peer assistants. It is also wise to arrange for enough assistance for video or audio recording children's descriptions of their models. Because models may be very abstract and indistinguishable, children's explanation of what they created is of upmost importance. Finally, allow plenty of time for children to create and construct their models. Rushing the process may lead to gaps or a disjointed understanding of children's environmental experiences.

Role-Playing

Childhood is full of fantasy play and creativity. Why not harness children's imagination by employing role-play as a data collection method? Role-play requires children to consider ideas from various perspectives and draw upon their own beliefs, values, and experiences. As O' Sullivan (2011) explains:

> Role-play is concerned with representing and exploring different people's points of view, and different points of view forge different types of knowledge. It places participants at the centre of the learning experience, and allows them to build their own bridge of understanding. As a result of this informed consideration, they are better able to resolve problems and issues. (p. 513)

Figure 3. Children pretending to be bugs in the Role Playing center.

Thus, role-play is a useful data collection method for studying children's environmental experiences. By assuming the role of human and other entities of the more-than-human-world (i.e. plants, animals, or other environmental features), children begin to explore their personal relationship with nature. Additionally, through role-playing children engage in empathetic reasoning, that is, they think about how it might feel to be someone or something else - like a bug, sunflower, or another creature (Donohoe & O'Sullivan, 2015). Additionally, children's environmental competencies are harnessed through perspective taking and emotional understanding. This encourages children to think about how they feel about and relate with various entities in nature. Furthermore, role-playing promotes children's social engagement with peers and when orchestrated outdoors, children are more likely to relate their stories to their environment. In other words, they are more likely to incorporate elements of the natural world into their role-play. They may assume a stick as a sword or build a nest out of pinecones.

In our research, we created a stage like area for children to role-play in the forest. A sheet was strung between two trees, a tarp was laid across the forest floor, and puppets (flower, tree, sun), costumes (ladybug, butterfly), and other prompts (a talking stick) were made available for children to act out their forest experiences. First, children were invited to choose their desired role by selecting among various costumes or puppets. This, in turn, supported their autonomy in engaging as active researchers. Next, children were reminded of the phenomenon in which they had previously expressed an interest (i.e. bugs, X-marks-the-spot, sticks, forts, houses, castles). They were then encouraged to construct a narrative based on their role selection and their expressed interests in certain topics. Question prompts were used to encourage children to think about and facilitate their participation in the role-play: *"Let's think about what we like to do in the forest. How can we make a story about what we like to do? Can we use things around us to make that story? What might you say? What might you do?*

Children responded by assuming different aspects of their environment and reenacting key interactions of living flora and fauna through their perspective. In this way, they demonstrated their understanding of environmental relationships and how humans interact with particular features of their environment. Additionally, the researcher participated by assuming a role, often a role that was assigned by children. In this way, the researcher engaged as a facilitator as well as an active participant of the experience. For instance, in one scenario the children asked the researcher to play the role of the 'Forest,' in another situation the researcher was invited to be 'Mr. Stickerbush.' Puppets or costumes were used to act the appropriate role. By taking on the role of an environmental feature, the researcher was able to evoke the children's experiences and gain deeper insight into how they perceived their own experiences within the forest. As the 'Forest' the researcher was able to ask the children how they interacted with it, what they liked best about it, and what the forest meant to them. As 'Mr. Stickerbush' the researcher asked similar

questions and the children actively responded by lightly stroking the 'Mr. Stickerbush' puppet; the children responded appropriately as if poked by a wild rosebush in real life.

Studies have shown that discourse between children and an adult researcher is enriched when researchers assume a role compared to discussions generated by a traditional teacher/researcher role (Aiken, 2014). In turn, children may feel more comfortable with researchers engaged in playing a role; this can "open up possibilities for new storylines and admissible actions" (Aiken, 2014, p. 255). Similarly, research has also shown that children are more likely to view puppets as peers rather than authority figures (Belohlawek, Keogh, & Naylor, 2010; Simon, Naylor, Keogh, Maloney, & Downing, 2008). We found this to be the case; even shy children were more inclined to engage in conversations with puppets worn by adults (Luckenbill, 2011; Keogh & Naylor, 2009). Thus, by taking on an imaginary role researchers are venturing towards new avenues for engaging children in expressing aspects of their environmental identities.

Another benefit of role-playing as a data collection method is that children perceive it as fun and engaging. In our research, children were drawn to the Role-Playing center, curious and eager to join in the excitement. Many revisited the center on multiple occasions, enacting and reenacting similar stories. This served to validate children's experiences and interests in particular topics. Additionally, role-play, as a research method, offers flexibility to cater storylines to fit both the shared ideas of groups as well as individual ideas on any given topic. For instance, while a group might decide to create a story about bugs in an environment, individual children can express how they think and feel about a particular bug.

While social dramatic play is a common activity among young children, role-playing as a research method is a bit more structured and focused. In planning to use this method, researchers should purposively think about which types of roles are appropriate for a given environment. To the extent possible, costumes and prompts should reflect the flora and fauna of that setting. It is also important for researchers to have materials on hand for children to design additional costumes to fit with the story lines that they conjure up. We found that storylines were often limited to the props available to children. However, by creating a stage in nature, children can be encouraged to incorporate their environment into their role-play schemes.

Bookmaking

Bookmaking can be used in various forms throughout a research project in order to document what took place and to create a visual that children can revisit time and time again. In our research project, we engaged children in bookmaking collectively as a group and individually. First, a Research Big Book was used to document children's engagement in the project from beginning to end. Second, each child was invited to create a book page to show and tell about his or her forest experiences.

Bookmaking engages children in the making of the research. Children's ideas can be built upon from the inception of a project, including documenting their experiences with each aspect of the research process and capturing their ideas about the topics they wish to explore. In this way, books were used to keep record of the research as well as to engage children in data analysis and interpretation.

A Research Big Book

In our project, a Research Big Book (large flipchart) was used to introduce children to the research, capture their ideas, and to document what they did together: *"Over the next several weeks, we will be making make a story together. Even today we will be making this story, I would like to write in the story the things that you say. You can add pictures or whatever you want in the story – this will be our story about research. What do you think? Would you like to make this story together?"*

From the onset of the project, the children were invited to collaboratively make a story about them and for them. Each time we met in the classroom to reflect on their forest experiences, we added new pages to their book, including photographs, quotes from their discussions, and drawings that they created to represent their experiences.

Discussions were framed around video-stimulated recall; specifically, children were invited to view videos of their forest exploration and talk about their experiences. Teachers helped facilitate the discussions and wrote down children's comments on sticky notes. Children were then invited to stick "their words" on the Research Big Book page; these notes were later transcribed into the story of their experiences. Overall, children expressed excitement in revisiting pages previously created; they built upon and extended previous understandings.

Individual Book Pages

While children's environmental experiences are to some extent socially informed, each child constructs personalized meaning of their experiences. For this reason, we also worked one-on-one with children, inviting them to make their own page and share what they remembered and liked best about their forest experiences. Children were presented with an 11 X 17 sheet of paper, pictures and photographs, and a variety of craft supplies (markers, stickers, glue sticks, stickers, and glitter paper). The bookmaking activity was introduced by stating: "*Today you are going to make a book page about your experience in the environment. I have some pictures of you and artwork that you made. You can decorate your book page however you wish*."

As a child creates his or her book page, they can be invited to describe what they were doing in a photograph. They can also be invited to draw pictures to illustrate their experiences. Below are some probes that can be used to engage children in data analysis and interpretation:

1) *Tell me about your experience in the [name of environment]. What do you remember? What did you like best? What was your favorite thing to do?*
2) *I am going to show you a photograph. What do you find interesting in this photo? What were you doing?*
3) *Tell me about what you notice (qualitative description).*
4) *Is there anything that you can count (quantify)?*
5) *Would you like to draw a picture of your experience the [name of environment]? Is there anything else that you want to share about your experience?*

Bookmaking as a data analysis activity provides an opportunity for children to reflect on and validate their interests in selected topics. For instance, in our research, Peter drew and talked about bugs during his bookmaking activity:

Researcher: *Do you remember what you did when you were in the forest?*
Peter: *Yes.*
Researcher: *What did you do?*
Peter: *I was trying to look for beetles.*
Researcher: *Beetles…oh wow!*
Researcher: *Do you want to draw anything about your experience in the forest?*
Peter: *Uh-huh.*
Peter takes the lid off a marker and begins to draw.
Peter: *How about I draw a bug. This one is a bug. It has two legs.*
Researcher: *I like that bug.*
Peter: *And that one's a ladybug.*
He draws a second bug on the other side of his paper.
Researcher: *That's a ladybug?*
Peter: *Uh-huh.*
Researcher: *And what did you do with a ladybug?*
Peter: *I don't know. I went and found one.*
Researcher: *Did you find lots of ladybugs in the forest?*
Peter: *Yes.*

Figure 4. Peter's book page with photographs, drawings, and quotes illustrating his forest experience.

During the bookmaking process, Peter had the opportunity to interpret data (in this case a photograph) that was captured during his forest play and exploration. He interpreted the photograph of himself looking for bugs in the forest. He also drew a picture of bugs, demonstrating that he had internalized the search for bugs as an important part of his forest experience. The bookmaking activity also demonstrated Peter's growing understanding about bugs: some bugs have two legs and ladybugs live in the forest. Peter also reflected on his experience with sticks; he tried to get around the sticks, fought with sticks, and was trying to break the sticks (see Figure 4). In this way, Peter analyzed the photographs of his experiences in the forest and the book page depicts his interpretation of his experience.

Additionally, children were invited to wear a small camera (i.e. a GoPro) on their forehead while creating their book page. This revealed a child's viewpoint, depicting their interests and what drew their attention. The wearable camera revealed Peter's attentiveness to a photograph. For example, Peter continuously exclaimed, "*Hey that's me*," while bringing a photograph close to his face for further examination. The camera also showed when Peter looked towards the door, or when he became distracted by a peer or another object in the classroom. In this way, a researcher becomes aware of what excites a child, revealing more about their individual experiences. As well there are also logistical benefits to using wearable cameras to film the bookmaking process. This frees the researcher's hands from holding a camera, allowing for a more authentic interaction between a child and adult researcher without the awkwardness of a camera in between.

CONCLUSION

In this paper, four interactive methods were presented for engaging children as active researchers. Data collection centers were facilitated in the forest; this provided an authentic context for children to construct and interpret meaning of their environmental experiences. Creating art in the forest provides a backdrop for children to reflect on the beauty and awe of nature; it also provides an opportunity for children to interact with and incorporate aspects of nature into their paintings or drawings. While artistic representations have been used quite extensively in early childhood research, inviting children to use materials from nature to build models and to engage in role-play encourages children to create and recreate representations and scripts of their experiences. As well book making as a data analysis and interpretation tool, provides children with the opportunity to reflect on and further share salient aspects of their experiences. Bookmaking can be used as a tool for children to collectively and individually construct understanding; photographs, drawings, and quotes can be incorporated into book pages and presented. In our

project, children used the book pages as a prompt to share the story of their experience with their families and other community members.

When selecting among the methods presented in this paper, researchers should consider children's interests and skills. Materials and activities should align with children's fine motor abilities and their cognitive and socio-emotional development. For instance, while role-play can be fostered across the early childhood spectrum, social perspective taking is still emerging during the early years and this need be considered when interpreting the roles that young children assume (McDevitt & Ormrod, 2013). Additionally, skills that require fine motor precision such as cutting and pasting may be challenging for the very young. Furthermore, while painting and model building provides a means for children to creatively represent their perspectives, it is important to invite children to talk about what they create. Representations may be abstract and difficult to decipher, children's verbal descriptions can shed light on past and present environmental experiences as well as socio-cultural and familial influences. Along this line, it is important to enlist sufficient adult help to assist with art-making (i.e. cutting or gluing) and video recording children's descriptions. As well researchers should also consider incorporating multiple methods to validate children's expressive understandings. Understandings that emerge multiple times through several activities are more likely representative of salient aspects of their experiences.

Finally, promoting children's agency in ECEE and ECEfS research is not a simple matter. It is one that should be treaded upon delicately and lightly. It requires a deep level of reflexivity and a willingness to modify, adjust, or even terminate an approach should it be found ineffective or disengaging. In other words, children more often than not have alternative ways of knowing and doing. When opportunities arise researchers should embrace children's innovations - doing so provides deeper insight into the life world of a child and honors children's agency in the process.

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Exploring the Intersection of Beliefs toward Outdoor Play and Cold Weather among Northeast Minnesota's Formal Education and Non-formal EE Communities

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ABSTRACT

In a notoriously cold-seasoned region, this paper explored how our formal education and non-formal environmental education (EE) gatekeepers of Northeastern Minnesota regard the importance of outdoor play and cold weather for young students. This research study explored the relationship between participant gatekeepers' beliefs of the benefits outdoor play and beliefs toward cold weather. Using online survey research, this descriptive study found both formal and non-formal EE educational communities to have overall, positive beliefs toward the benefits of outdoor play, however, significant differences between formal education gatekeepers and non-formal EE gatekeepers' beliefs toward cold weather emerged. Results from this study point toward differences between the institutional influence of formal and non-formal EE, and invite discussion for possible implications on early childhood students' opportunities for outdoor play in cold weather. Strategies for educational gatekeepers were also presented to support early childhood opportunities for outdoor play in cold weather, fostering year-round well-being and resilience of young students.

Keywords: outdoor play, winter, cold weather, early childhood, formal education, non-formal environmental education, gatekeepers

When children are asked about their favorite subject in school, their answers are most often "recess." Though quite possibly an act of academic defiance, studies suggest that outdoor play such as recess actually produces equally important cognitive, socio-emotional, and physical benefits as classroom schooling and academics (Murray & Ramstetter, 2013). As proven complementary to children's whole development, play provides a "vehicle for children to both develop, and demonstrate knowledge, skills, concepts, and dispositions" (Little & Wyver, 2008, p. 33). Across literature, it is agreed that play is a scaffold of development for children (Brown & Vaughan, 2009; Brockman, Fox, & Jago, 2011; Copeland, Sherman, Khoury, Foster, Saelens, & Kalkwarf, 2011; Little & Wyver, 2008; Vetich, Bagley, Ball, & Salmon 2006).

Parents, educators, and educational administrators alike, who are outdoor play gatekeepers by providing and administering outdoor opportunities for young children, all respond positively to the numerous benefits to children's outdoor play (Copeland, Kendeigh, Saelens, Kalkwarf, & Sherman, 2012a; Ginsburg, 2006; Rothe, Holt, Kuhn, McAteer, Askari, O'Meara, & Dexter 2009). Whether obesity prevention, gross motor skill development, increased self-efficacy, stress relief, decreased sedentary activities and social conflict, and improved mood and attention, there

is a consensus from these adult gatekeepers who positively acknowledge the benefits that outdoor play provides. This consensus, however, is called into question based on current and ongoing research that suggests that children's outdoor play gatekeepers are not providing adequate outdoor play opportunities for young children.

Despite the broad developmental and health benefits, children's opportunities for outdoor play are declining, and children are spending less time playing outdoors than previous generations (Tandon, Zhou, & Christakis, 2012). Whether increased built environments that limit green space to play in, decreased sense of community in neighborhoods, heightened concerns of safety, or intensified academic pressures, children are confine to play in smaller spaces and in more controlled activities (Brockman et al., 2011; Little & Wyver, 2008; Slater, Nicholson, Chriqui, Turner, & Chaloupka, 2012). For many young children, childcare or school recess are the only time children are given to engage in outdoor play (Copeland et al., 2011; Tandon et al., 2012).

Implications of seasonal climate and weather conditions on children's outdoor play

Throughout this decline of adequate outdoor play opportunities for young children, a significant and consistent barrier looms overhead among outdoor play gatekeepers—adverse weather (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009; Chan, Ryan, and Tudor-Locke 2009; Humpel, Owen, Iverson, Leslie, & Bauman, 2004; Kos & Jerman, 2013; Mitra & Faulkner, 2012; Stanley, Boshoff, & Dollman, 2012). Whether extreme heat, extreme cold, or wet conditions, children's opportunities for outdoor play are reduced in these perceived unfavorable conditions (Mitra & Faulkner, 2012). Seasonal climate and adverse weather conditions, such as cold weather, seem to receive less attention in literature because it is unalterable and comes with varying human perceptions (Mitra & Faulkner, 2012).

Despite the consensus that many gatekeepers feel that outdoor play is important, outdoor play in winter "paradoxically decreases" (Rothe et al., 2009, p. 735). Kos and Jerman (2013) studied the frequency and duration of time spent outdoors in Norwegian and Slovene preschools. For both countries, teachers allotted significantly more outdoor time in warm months than cold months.

For many regions with distinct seasonal variation in climate, it is not clear as to how young children's opportunities for outdoor play are affected by weather condition within extreme seasons like cold weather (Mitra & Faulkner, 2012). The term "cold" as defined by Merriam-Webster, is defined dually as an environmental weather condition of "relatively low temperature," as well as a human perception of "temperature that is uncomfortable" ("Cold," 2014). For the purpose of this study, these dual definitions are important to consider, as human perceptions of cold differ based on many factors.

Though children's opportunities for outdoor play are commonly determined by environmental opportunities, it is of interest to explore how gatekeepers' seasonally-specific norms of climate and weather conditions may affect children's opportunities for outdoor play. Copeland et al. (2011) suggested further research is needed to understand how gatekeepers' beliefs about cold weather intersect with "decisions about outdoor play" (p. 440).

The intersection of gatekeeper belief and outdoor play opportunity

As young children's outdoor play experiences provide a "developmental perspective," it is of particular interest for this study to research outdoor play in cold weather as a catalyst for young students' "year-round well-being" (Ergler, Kearns, & Witten, 2013, p.183). The growing seasonality of outdoor play may more strongly and predictably limit children's opportunities for physical, cognitive, and socioemotional development (Ergler et al., 2013; Copeland et al., 2012a). Because it is unclear how children's opportunities for outdoor play are influenced by children's adult gatekeepers, Copeland et al. (2011) proposed more research is needed to understand how gatekeepers' beliefs about weather have the potential to influence decisions about outdoor play opportunities for young children.

Beliefs toward cold weather. According to Österholm (2010), a "belief can be seen as a type of knowledge that is subjective, experienced-based, and often implicit" (p. 157). Beliefs are a "personal judgement formulated by

experiences" under a cultural dimension (Österholm, 2010, p. 157). In this study, the construct "beliefs toward cold weather" are compartmentalized into four sub-constructs: cognitive, affective, self-efficacy, and normative beliefs.

Cognitive beliefs toward cold weather. Cognitive beliefs toward cold weather are those beliefs that comprise an individual's worldview and determines how one "abstracts, filters, and structures information received from the world" ("Cognitive belief system," 2017). Cognitive beliefs, then, are the structural framing of how outdoor play gatekeepers interpret and act cold weather.

Affective beliefs toward cold weather. Affective beliefs toward cold weather are those beliefs that comprise of an individual's experience of feeling or emotion. Affective beliefs, then, are the emotional states of how gatekeepers feel about cold weather, such as like and dislike.

Self-efficacy beliefs toward cold weather. Self-efficacy beliefs toward cold weather are an individual's capability to produce effects in cold weather. That is, self-efficacy beliefs determine how gatekeepers may think, motivate themselves, and behave during cold weather (Bandura, 1994).

Normative beliefs toward cold weather. Normative beliefs toward cold weather are an individual's beliefs about how other people, who are important to them, think they should or should not perform a particular behavior (Flay, 2014). Especially in the research of educational communities, whose structure and framework have heavy social ties, normative beliefs are a significant sub-construct to include.

Personal and gatekeeper beliefs*.* The scope of this study also included formal educational and non-formal EE communities' personal and professional beliefs toward cold weather. This dual inquiry explored the difference between and individual gatekeeper's beliefs toward cold weather from a personal lens as well as a gatekeeper lens of personal beliefs and gatekeeper beliefs. "Personal beliefs toward cold weather" refer to participants' beliefs that are developed and nurtured in participants' non-professional lives. "Gatekeeper beliefs" refer to those beliefs that incorporate participants' professional, supervisory role among their students, as well as fellow staff and administration.

This complex belief construct was chosen to thoroughly explore the potential belief intersections, where cold weather beliefs have the potential to compromise young students' outdoor play opportunities. Since weather continues to be a leading barrier of outdoor play among gatekeepers, it is the intention of this study to explore how a gatekeeper's individual viewpoint may have the possibility to subjectively limit young students' outdoor play opportunities in cold weather, which in Northeast Minnesota is a significant portion of the academic year.

The parallels between formal education and non-formal Environmental Education

Institutionally, it was of interest to include outdoor play gatekeepers from two educational institutions, formal education and non-formal environmental education (EE). Formal education, as defined by Ellinger (1997), is "institutionally sponsored, highly structured, and classroom-based" (p.38). Learning objectives of formal educators are controlled by the institution, and require specified, hierarchical levels of training, licensure, certification, and degree for teachers and administrators alike. Such formal programs often reflect what the institution views as appropriate structure (Heimlich, 1993). It is important to note that formal education is an extensive experience, as students matriculate from childhood into adulthood.

Non-formal EE, on the other hand, refers to "settings and methods that are considered non-traditional" (Taylor & Caldarelli, 2004, p. 452). Within this institution, the outdoors is a primary setting for student learning, and play is a vehicle for learning. Non-formal educators use natural areas as a classroom and emphasize a learner-centered, present-time focused, less structured, and typically non-hierarchical environment (Taylor and Caldarelli, 2004, p. 452). Since audience, environment, time, and expectations are dynamic to every class, non-formal educators are encouraged to develop awareness to respond more readily to the needs of the audience as well as the environmental conditions. Such dynamic environmental challenges also contain elements of inherent risk (Taylor & Caldarelli, 2004,

p. 465). As a value of non-formal environmental education, risk-taking, whether controlled or inherent allows students to expand their worldview and develop self-efficacy (Little & Wyver, 2008).

Within the area of focus for this study, formal education and non-formal EE are intermingled across the region and exhibit complementary, yet contrasting educational settings for children. Both educational institutions are deeply connected to early childhood development, and both are experiencing the effects of shrinking outdoor play opportunities. For the scope of this study, including both formal education and non-formal EE was significant to investigate the recognized benefits to outdoor play and beliefs toward cold weather between educational settings, but also highlight the continuing need to bridge institutional practices to enhance and expand early childhood outdoor play opportunities, especially in cold weather.

Area of focus: Northeast Minnesota

For the state of Minnesota, its natural and cultural histories are rooted in the changing seasons, and known for its below-freezing, long winters. With such distinct seasonal differences, there is much to be explored when it comes to the "complexities of play across both seasonality and locality and its consideration of implications for children's well-being" (Ergler et al., 2013, p. 183). As Minnesota has approximately five months of winter (November through March), educational gatekeepers may have more potential of influencing students' opportunities for outdoor play during cold weather months.

Demographic Considerations

In terms of demographics, ethnicity and income are primary predictors when it comes to participation in outdoor activities (Brewer & Kimbro, 2014; Kukaswadia, Pickett, & Janssen, 2014). Income and ethnicity disparities to outdoor play are attributed to weather conditions, climate of origin, access to quality facilities and necessary equipment, perceived safety in neighborhood, resource constraints, and health concerns (Brewer & Kimbro, 2014; Copeland et al., 2011; Rothe, et al., 2009). For the purpose of this research, disparities of ethnicity and income are acknowledged when it comes to gatekeepers' decisions on children's outdoor play and how gatekeeper attitudes may affect how weather-related decisions are approached for diverse student bodies, however ethnic and income demographics were not directly researched in this study.

PURPOSE

The purpose of this research was to describe the beliefs regarding the benefits of young children's outdoor play, as well as the beliefs toward cold weather among Northeast Minnesota's formal education and non-formal EE communities with early childhood grades (K-3). This research also explored the degree to which the importance of children's outdoor play and gatekeeper beliefs toward cold weather were related within formal education and non-formal EE gatekeepers.

Rationale

With the growing literature and community support regarding outdoor play's contribution toward early childhood students' academic success, cognitive development, physical development, socio-emotional development, overall health and wellness, and development of appreciation for the environment, it is significant to be cognizant of early childhood educational gatekeepers' influence on young students' opportunities to outdoor play, especially if outdoor play opportunities are becoming more exclusive to a student's formal school day. With the declining opportunities to play outdoors, there is a need to revisit young children's educational gatekeepers, whose beliefs regarding the benefits of outdoor play and beliefs toward cold weather may reflect how individual gatekeepers and educational institutions might conditionally influence opportunities for outdoor play.

Minimal research of this nature has been conducted from the field of Environmental Education (EE), as well as Early Childhood. This research is significant for several reasons. First, this research supports EE's mission of addressing children's nature deficit disorder, and advocating for young children to experience the outdoors and cultivate

integrated physical, cognitive, and socio-emotional development in all seasons. Second, as heightened concerns of safety and liability infiltrate our society, particularly in unmodifiable terms of adverse weather, it is of significance to research how gatekeepers of different educational setting personally and professionally, as a gatekeeper, perceive cold weather, and consider how they may influence young children's outdoor play opportunities. Similarly, with the formal school community being a major audience and customer of non-formal EE programs, this research intends to offer insight on the beliefs of these two complementing, yet contrasting educational settings in order to begin a dialogue to support young students' cold weather, outdoor play opportunities.

Ultimately, this research described a region's educational communities' beliefs toward the importance of early childhood students' outdoor play and cold weather, in hopes to continue the conversation of supporting their year-round well-being and resilience between formal education and non-formal EE communities. Due to lack of empirical research, this research study also aimed to lay groundwork of strategies and present avenues for future research on children's cold weather and outdoor play opportunities (Copeland et al., 2011).

Research Questions

The primary research questions were threefold:

(1) What are the beliefs regarding the benefits of students' outdoor play among Northeast Minnesota's formal education community and non-formal EE community?

(2) What is the difference of beliefs toward cold weather between Northeast Minnesota's formal education community and non-formal EE community from a personal and gatekeeper perspectives?

(3) How are formal education community gatekeeper beliefs related to beliefs regarding benefits of outdoor play? How are non-formal EE community gatekeeper beliefs related to beliefs regarding benefits of outdoor play?

RESEARCH METHODS AND DESIGN

Using quantitative methods, this research used an online survey design, as it aimed to "generalize from a sample to a population so that inferences can be made" (Creswell, 2014, p. 157). This design was chosen for its advantages to both the researcher and population of interest including electronic accessibility, confidentiality, inexpensive distribution, and timely survey duration. Stratified sampling was used to reach each participant group at the discretion of educators' respective administrators through online survey research. Online survey research intended to not only capture a large sample size, but also produce descriptive assertions about the population of interest (Babbie, 2011). Self-administered online questionnaires were issued using CampusLabs™, an online survey tool.

Participants

The population of interest for this study was educators and administrators of formal and non-formal EE institutions, who pose a gatekeeping role in outdoor play for Kindergarten (K) through third grade (3) students (typically age five through eight). The accessible population was formal and non-formal educators and administrators from Northeast Minnesota, whose respective institutions and employment positions included early childhood grades K-3.

Formal Education and Non-formal EE Participants. For this research, formal education and non-formal EE communities, including administrators and educators, were significant to survey, as they bring similar and contrasting teaching styles, settings, beliefs, and outcomes for students (Taylor & Caldarelli, 2004). Among the formal education participants are formal education administrators and K-3 teachers. Among the non-formal EE participants are EE administrators and EE educators

***Formal education administrators*.** Within formal education communities in Northeast Minnesota, formal administrators were individuals at the administrative professional level, who take part in decision-making and policies regarding outdoor play at public and charter schools. Formal education administrators included public school

principals, charter school directors, and district superintendents. Forty-seven formal education administrators from twenty school districts in Northeast Minnesota were initially contacted via email and phone to participate in the online survey in April 2015. At the completion of the first solicitation in June 2015, a total of 23 of the 47 (48.9%) formal education administrators from 18 of the 20 school districts in Northeast Minnesota completed the online survey.

***Formal K-3 teachers*.** Within formal education communities in Northeast Minnesota, formal K-3 teachers were individuals who directly teach grades Kindergarten through third grade students in public or charter schools. It was estimated that there were 240 K-3 teachers within public or charter schools in Northeast Minnesota. This population was reached through stratified sampling through formal education administrators who responded and consented to the research of their K-3 teachers. Approximately 240 K-3 teachers made up the accessible K-3 teacher population in Northeast Minnesota, whose formal education administrator had consented to the research of their respective teachers.

At the completion of the first solicitation in June 2015, a total of 23 of 240 (9.5%) K-3 teachers had completed the online survey. With the significantly lower response rate, a second solicitation of the online survey was sent again in September 2015. Approximately 240 K-3 teachers were directly invited to participate in the online survey. At the closing of the second solicitation in October 2015, an additional 36 K-3 teachers responded, totaling to 59 K-3 teachers (24.6%).

***Non-formal EE administrators*.** Within non-formal EE communities, EE administrators were individuals at the administrative, professional level of EE organizations, who take part in decision-making and policies regarding outdoor play. EE administrators included educational program directors and executive directors, who oversee educators, programming, and policy at Residential Environmental Learning Centers (RELCs), nature centers, and adventure education centers. Six non-formal EE administrators of three RELCs, one nature center, and one adventure education center Northeast Minnesota were invited to participate in this study. At the completion of the first solicitation in June 2015, five of the six EE administrators from three of the five EE organizations completed the online survey.

***Non-formal EE educators*.** Within non-formal EE communities, EE educators were individuals who directly teach environmental education to students in an outdoor setting at an EE organization. EE educators included full-time and part-time, permanent and seasonal programming staff at EE organizations in Northeast Minnesota. This population was reached through stratified sampling through EE administrators who responded and consented to the research of their EE educators. Forty-one EE educators made up the accessible EE educator population in Northeast Minnesota, whose EE administrator had consented to the research of their respective educators. At the completion of the first solicitation in June 2015, a total of 16 of 41 (39.0%) EE educators had completed the online survey.

Participant Demographics. At the completion of the second solicitation in October of 2015, a total of 92 participants completed the online survey of the estimated 333 possible sample (27.6% response rate). Of the educational communities, 73 formal education participants responded (22 out of 47 formal administrators and 51 of 240 K-3 teachers), and 19 non-formal EE participants responded (four out of six EE administrators and 15 out of 41 EE educators). Eleven surveys were removed from the data set due to survey abandonment or incomplete responses, (e.g.: identified teaching students outside of early childhood ages), resulting in the total number of participants' analyzed to be n=92 (formal education administrators, n=22; K-3 teachers, n= 51; EE administrators, n=4; EE educators, n=15).

Of the formal educational community, eighteen of the twenty public school districts of Northeast Minnesota were represented in this sample. Of the non-formal EE community, three of three EE organizations of Northeastern Minnesota with early childhood grade configurations (K-3) were represented in this sample.

In contrast to the formal setting, it is important to note that each of these non-formal EE organizations has staffing configurations that vary seasonally. Similarly, environmental education programming is typically designed to be

adaptably delivered to students of various ages, grade levels, and abilities. Organization 1 is K-12, and serves 501 to 1,000 students in one academic year; organization 2 is prekindergarten-12, and serves over 10,000 students in one academic year; and Organization 3 is K-12, and serves over 10,000 students in one academic year.

***Participant Groups' Professional Histories*.** Table 1 presents each educational communities' participant groups' professional histories. Generally, formal administrators and EE administrators had similar length of experience in an administrative position, however K-3 teachers were more experienced than EE educators.

Table 1
Participant groups' professional histories in years in an administrative role

		Years in administrative or educative role				
	N	Mean (SD)	Median	Mode	Min	Max
Formal Administrators	22	11.09 (6.53)	10.50	9.00	1.00	22.00
K-3 Teachers	51	18.06 (10.41)	18.00	25.00	3.00	44.00
EE Administrators	4	11.75 (3.30)	12.00	-	8.00	15.00
EE Educators	15	6.27 (8.75)	2.00	1.00	1.00	29.00

Measures

Questionnaires. Because each participant group (formal education administrators, K-3 teachers, EE administrators, and EE educators) had differing roles as outdoor play gatekeepers, four questionnaires were developed for each participant group to measure the constructs of beliefs regarding the benefits of student's outdoor play and beliefs toward cold weather. These questionnaires consisted of approximately forty question items, which were developed by the researcher, as well as adapted from literature (Brockman et al., 2011; Copeland et al., 2011; Larson, Green, & Castleberry, 2011; Ernst & Tornabene, 2014; Miles, 2008; Murray & Ramstetter, 2013; Rothe et al., 2009; Schultz et al., 2004, p. 31). Before the survey was distributed, it was reviewed by a committee of experts to verify face, content, and criteria validity. The committee was composed of three individuals with expertise in survey research, residential environmental learning centers, and K-12 formal education. After a field test in February 2015, amendments were made and sent on to the Institutional Review Board (IRB) for approval of distribution.

Across each questionnaire, there were 10 items that were designed to be participant-specific question to gain more information on a participant's professional history and institutional information. For example, EE administrator were asked, "How many years have you worked as an administrator of an environmental education organization?" (Q77), and formal education administrators were asked, "Q75. How many years have you worked as an administrator? (Q75).

***Beliefs regarding the benefits of outdoor play*.** Five items measured participants' beliefs regarding the benefits of outdoor play (Q12-Q18). Potential perceived benefits include academic performance, cognitive development, socio-emotional development, physical development, overall health, and environmental appreciation (Ernst & Tornabene, 2012). This construct was measured as participants' extent to which participants agreed with five statements regarding potential benefits of outdoor play for young children on a 5-point Likert scale, and reported as a composite score (p. 656).

***Beliefs toward cold weather*.** In this study, "beliefs toward cold weather" were divided and measured in four sub-constructs: cognitive, affective, self-efficacy, and normative. Cognitive beliefs were measured with semantic-differential items to report participants' reaction to stimulus words toward cold weather. Affective, self-efficacy, and normative beliefs were measured with a 5-point Likert scale to report participants' feelings and emotions, self-confidence, and social influences when it comes to cold weather. Within these cold weather belief items, participants asked to respond to similarly worded items, which had personal and professional gatekeeper vernacular; Item #28, stated, "I think cold weather is good/bad," and item #43 stated "For my students, cold weather is good/bad."

***Temperature Threshold*.** These sub-constructs are further supported with personal and gatekeeper responses toward personal and gatekeeper cold-temperature-thresholds. The questionnaires also included four items for participants to enter a temperature in degrees Fahrenheit (°F) for various temperature thresholds through their personal and gatekeeper lenses.

Data Collection Procedures

The questionnaire was distributed in April of 2015 via email to six non-formal EE administrators and 47 formal school administrators (district superintendents and school principals). With administrative consent, principals and EE administrators were invited to forward the survey hyperlink to their K-3 teachers or non-formal EE educators, respectively. Reminder emails to participate in the online survey were sent to all participants two times at one week intervals. A phone-call was made to formal and non-formal EE administrators after 10 days from the first initial email if there was no survey response. Reminder emails to forward the link to respective educators were made once, one week after completion of the survey.

At the completion of the first solicitation, the response rate of K-3 teachers was determined to be lower than what was representative of the possible sample. In September 2015, the survey was directly re-distributed to K-3 teachers in schools where principals provided consent.

Data Analysis

Microsoft Excel® and International Business Machines Corporation's (IBM) Statistical Package for the Social Sciences (SPSS®) were used to analyze survey data. Response rate was calculated, along with other descriptive values of mean and standard deviation. Composite scores were compared between educational settings (formal and non-formal EE) using independent-samples t-tests. Correlational analyses were conducted to investigate the relationships between participants' beliefs regarding the benefits of students' outdoor play and cognitive, gatekeeper beliefs toward cold weather. The data reporting of the correlation analyses were adapted from Hollenhorst and Ewert's (1985) Importance-Performance Matrix. Significance was determined to be at the $p<.05$ level, meaning for results that were significant, there was a 95% certainty that the true population's mean scores fell within the confidence interval.

RESULTS

Beliefs Regarding the Benefits of Students' Outdoor Play

Table 2 presents the central tendencies (mean and standard deviation) of participant groups' composite beliefs, as well as item scores regarding the benefits of students' outdoor play. Overall, both formal education and non-formal EE communities reported positive in their beliefs toward the benefits of outdoor play.

An independent-samples t-test was used to compare recognition of benefits to students' outdoor play by formal and non-formal educational community. Results are reported in Table 2. Beliefs regarding the benefits of outdoor play for developing students' environmental appreciation differed significantly between formal and non-formal EE participants, with non-formal participants in stronger agreement as to this important benefit of outdoor play than formal participants, $p=.022$.

Beliefs toward Cold Weather

Table 3 depicts formal and non-formal EE educational communities' personal and gatekeeper beliefs toward cold weather, compiled into four composite scores: cognitive beliefs, affective beliefs, self-efficacy beliefs, and normative beliefs. Of both personal and gatekeeper beliefs toward cold weather, non-formal EE participants generally reported more positive than formal education participants.

Independent samples t-tests were used to identify significant differences between formal educational and non-formal EE settings' personal and gatekeeper beliefs toward cold weather composite scores. As seen in Table 3, non-

formal EE participants' personal beliefs toward cold weather were statistically different than formal education participants in all four composites: cognitive, affective, self-efficacy, and normative beliefs. Non-formal EE participants' gatekeeper beliefs toward cold weather were also statistically different than formal education participants in cognitive and self-efficacy belief composite score.

Table 2
Independent samples t-test of formal education and non-formal EE participants' beliefs regarding the benefits to students' outdoor play by item

	Mean[a] (SD)			
Item	Formal	Non-formal EE	*t*(90)	*p*
Academic Performance	4.55 (.91)	4.74 (.56)	-.858	.393
Cognitive Development	4.51 (.94)	4.84 (.37)	-1.511	.134
Socio-emotional Development	4.52 (.96)	4.74 (.45)	-.953	.343
Physical Development	4.66 (.93)	4.95 (.23)	-1.341	.183
Overall Health	4.70 (.91)	5.00 (.00)	-1.441	.153
Environmental Appreciation	4.36 (1.10)	4.95 (.23)	-2.326	.022*
Composite of Items	**4.54 (.88)**	**4.87 (.20)**	**-1.575**	**.119**

Note. 5-point Likert scale. [a]1= Strongly disagree; 5= strongly agree. *denotes statistical significance, p< .05

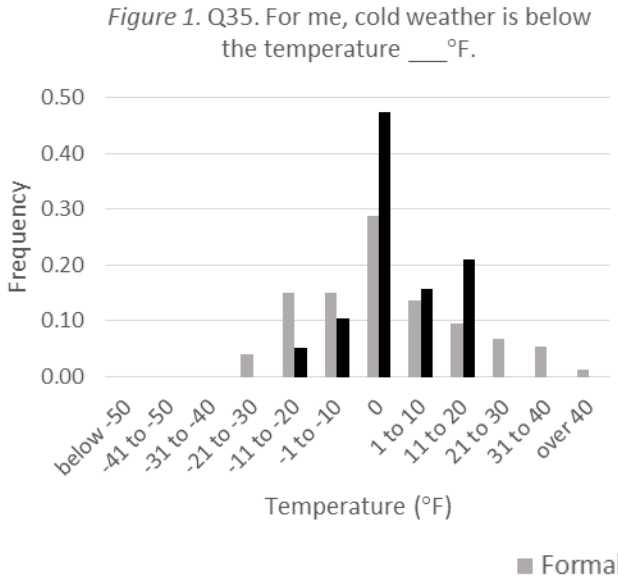
Table 3
Independent samples t-test of formal education and non-formal environmental education participants' personal and gatekeeper beliefs toward cold weather

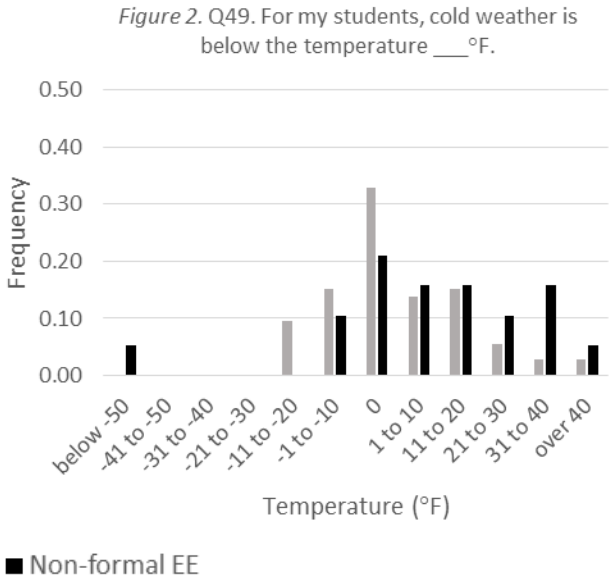
		Mean (SD)			
	Composite	Formal	Non-formal EE	t (90)	*p*
Personal Beliefs toward Cold Weather	Cognitive	3.11 (.77)	4.16 (.60)	-5.554	<.001*
	Affective	3.17 (1.11)	4.61 (.46)	-5.510	<.001*
	Self-Efficacy	4.30 (1.09)	5.00 (.00)	-2.785	.007*
	Normative	3.55 (.98)	4.27 (.56)	-3.074	.003*
Gatekeeper beliefs toward Cold Weather	Cognitive	3.06 (.66)	3.85 (.48)	-4.894	<.001*
	Affective	3.60 (.74)	3.81 (.71)	-1.126	.263
	Self-Efficacy	3.91 (.88)	4.79 (.42)	-4.192	<.001*
	Normative	3.68 (.53)	3.86 (.45)	-1.315	.192

Note. *denotes statistical significance, p< .05

Personal and Gatekeeper Perceptions toward Cold Temperatures

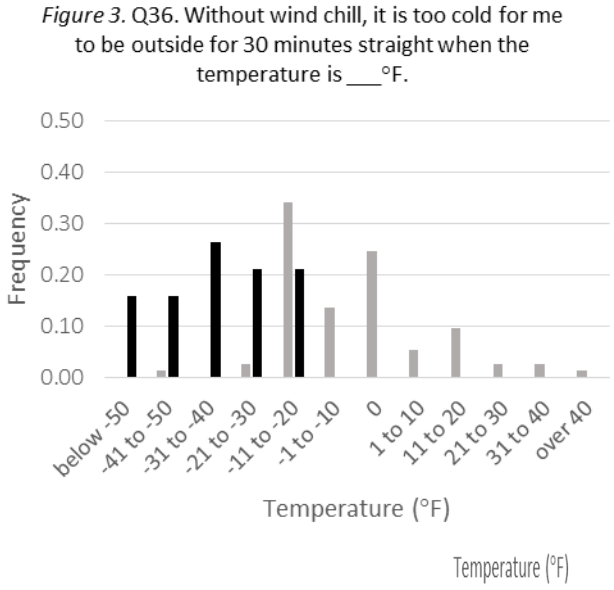
Figures 1-4 describe formal and non-formal EE participants' responses on personal and gatekeeper perceived temperatures (°F). Figures 1 and 2 depict similarities between educational settings' perceived temperatures of the threshold of what they personally and professionally constitute as a "cold weather" temperature.

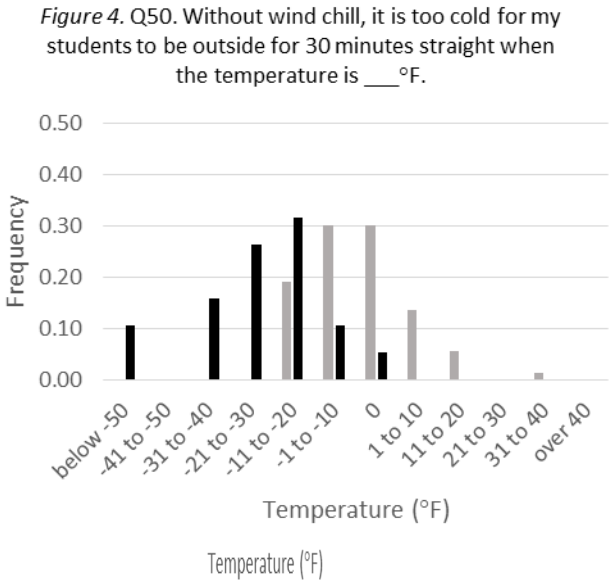




Figures 1 and 2. Frequency of formal and non-formal participants' personal (Figure 1) and professional (Figure 2) cold weather temperature threshold (items Q35 & Q49).

Figures 3 and 4, however, are generally more skewed, in that non-formal EE participants' responses show generally lower temperature thresholds than formal education participants, and similarly perceive their students' thresholds.





Figures 3 and 4. Frequency of formal and non-formal participants' personal (Figure 3) and professional (Figure 4) cold weather extreme temperature thresholds (items Q36 and Q50).

Relationship between Beliefs regarding the Benefits of Students' Outdoor Play and Cold Weather

For this section, Pearson's correlations are presented between educational communities' beliefs regarding the benefits of students' outdoor play and cognitive, gatekeeper beliefs toward cold weather.

Two Pearson's product moment correlations were computed to determine the relationship between the beliefs regarding the benefits of students' outdoor play and the composite score of cold weather, gatekeeper beliefs. As seen in Table 4, non-formal EE participants had a significant, positive correlation, r= .560, p=.013.

Adapted from Hollenhorst & Ewert's (1985) Importance-Performance Matrix, Figure 5 describes how each educational community responded in their beliefs regarding the benefits of students' outdoor play and cognitive, gatekeeper beliefs toward cold weather. Items in the positive, positive quadrant are rated highest in both constructs, suggesting gatekeepers may be successfully providing developmental opportunities for students in cold weather outdoor play. Items in the positive, negative; negative, negative; or negative, positive quadrants suggest students' developmental opportunities in outdoor play may have potential to be compromised in cold weather due to negative beliefs toward outdoor play and/or negative cognitive, gatekeeper beliefs toward cold weather.

Table 4
Pearson's product moment correlation of beliefs regarding the benefits of students' outdoor play and cognitive, gatekeeper beliefs toward cold weather

Participant Group	Beliefs regarding the benefits of Student's Outdoor Play		Cognitive, Gatekeeper Beliefs toward Cold Weather		Paired Samples Correlations	
	M	SD	M	SD	r	p
Formal	4.55	.88	3.06	.66	.202	.086
Non-formal EE	4.87	.20	3.85	.48	.560	.013*

Note. 5-point Likert scale. [a]1= more negative; 5= more positive. *denotes statistical significance, p< .05

Generally, both educational communities were positive in their beliefs regarding the benefits of outdoor play, though significant differences were present when it came to cognitive, gatekeeper beliefs toward cold weather.

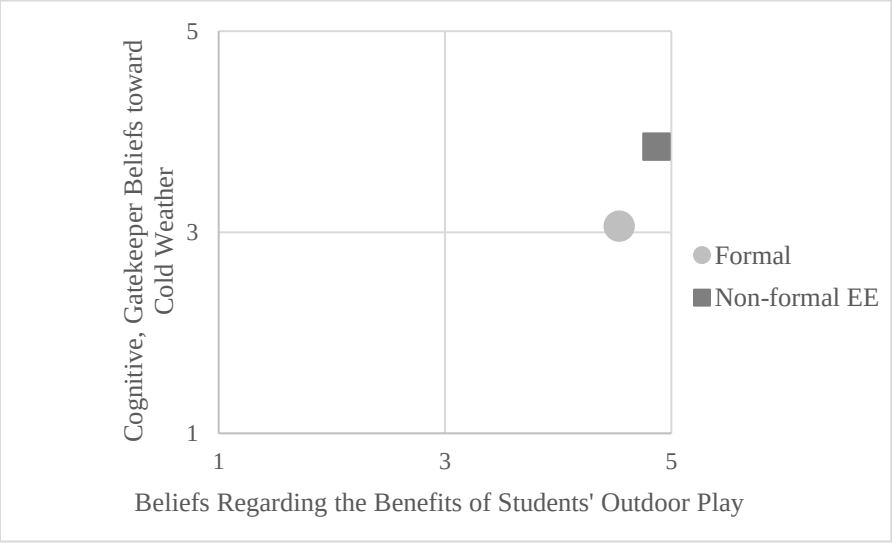


Figure 5. Scatterplot of the formal education and non-formal EE communities' composite scores of the beliefs regarding the benefits of students' outdoor play and cognitive, gatekeeper beliefs toward cold weather. The points

are as follows: Formal educational participants (4.54, 3.06), non-formal EE education participants (4.87, 3.85). Adapted from Hollenhorst and Ewert's (1985) Importance-Performance Matrix.

However, it is of significance to the author to exhibit these results by individual participants within each educational community. Figure 6 depicts how individuals from all four participant groups rate the benefits of outdoor play and their respective cognitive, gatekeeper beliefs toward cold weather. Twenty-eight (38%) of formal education participants and 20 (89%) of non-formal EE participants were in the positive, positive quadrant. Forty-five (62%) of formal education participants were in a positive, negative quadrant and negative, negative quadrant. Two (11%) non-formal EE participants were on the cusp of the positive, negative quadrant.

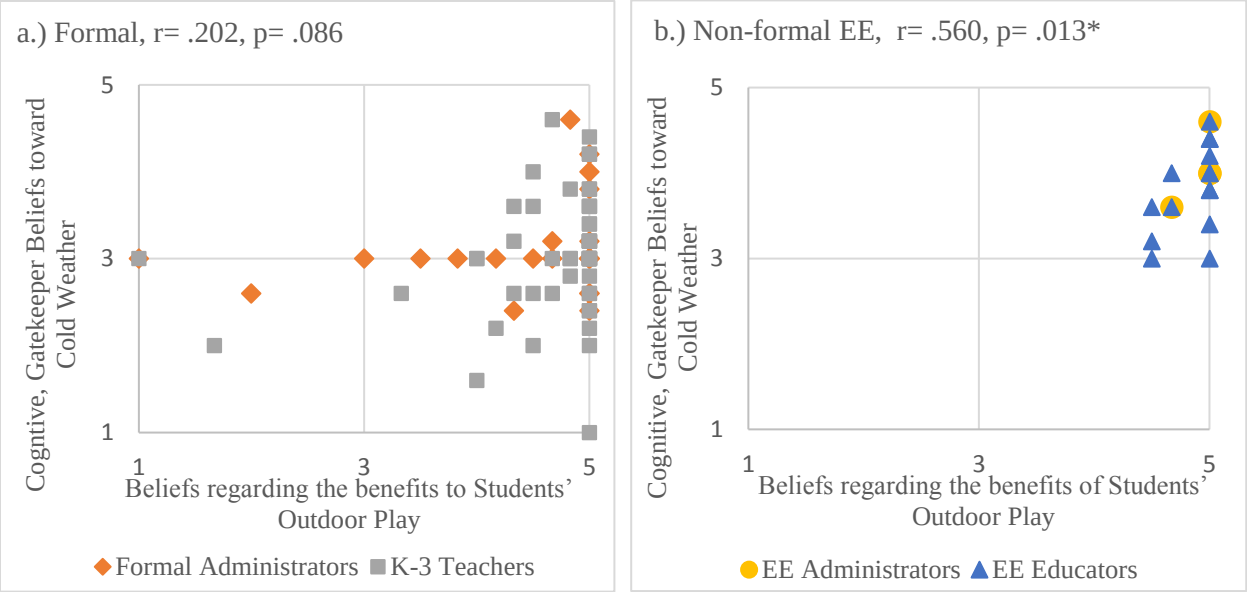


Figure 6. Scatterplot of each formal (a) and non-formal EE (b) participant groups' beliefs regarding the benefits of students' outdoor play and cognitive, gatekeeper beliefs toward cold weather. The Pearson's correlations are as follows: Formal administrators (r=.233, p=.297), K-3 teachers (r= .217, p= .127), EE administrators (r= .728, p= .272), EE educators (r= .526, p= .044*). *denotes statistical significance, p<.05. Adapted from Hollenhorst and Ewert's (1985) Importance-Performance Matrix.

DISCUSSION

This section discusses the emergent themes found in data analysis, and suggests supported implications of institutional gatekeepers' potential influences on the access to cold weather, outdoor play opportunities among students in early childhood.

Participant Demographics

Though eighteen of twenty public school districts, and 3 of 3 non-formal EE organizations with early childhood grade levels were represented, the sample population was not indicative to all formal education and non-formal EE communities in Northeastern Minnesota and therefore results are not and should not be generalized beyond this study. Careful suggestions of potential implications are shared.

Beliefs Regarding the Benefits of Students' Outdoor Play

For beliefs regarding the benefits of students' outdoor play, both formal and non-formal groups had overall, positive belief toward each benefit domain associated with outdoor play, suggesting that formal and non-formal gatekeepers

of this study positively recognize outdoor play to be an important vehicle for child development (Little and Wyver, 2008, p. 33). The positive rankings of positive benefits suggest formal and non-formal gatekeepers alike recognize that the domains of outdoor play benefits, which are perhaps, "interrelated and interdependent" (Dagli, 2012, p. 17).

Additionally, it is significant to note that one item, environmental appreciation, showed significant difference between formal and non-formal participants, as seen in Table 2. This finding suggests that perhaps non-formal EE participants perceive the professional emphasis that encourages students' environmental appreciation through outdoor play. As framed by their institutional influences, outdoor play may be characterized differently between formal and non-formal EE communities. The beliefs regarding the benefits of students' outdoor play, then, may be considered as more of a vehicle to achieving the varying institutional and developmental goals between formal education and non-formal EE communities.

Disparities between formal and non-formal EE participants' beliefs toward cold weather

When it comes to beliefs toward cold weather, generally, formal education participants' four composite scores, of both personal and gatekeeper beliefs, were less positive than non-formal EE participants' scores. As seen in Table 3, all four composite scores in personal beliefs toward cold weather and two composite scores in gatekeeper beliefs toward cold weather reported significant differences between educational communities in the independent-samples t-test. These findings can perhaps be better explained by other variables including, institutional influence, professional histories, weather-related play policies, and personal histories.

Institutional influence. As seen in Table 3, independent-samples t-tests revealed non-formal EE participants to be significantly different in personal cognitive, affective, self-efficacy, and normative beliefs, as well as cognitive, gatekeeper and self-efficacy beliefs compared to their formal education counterparts.

EE organizations in Northeast Minnesota are four season, year-round operations, with the academic year typically being the most marketed toward formal school community groups. Programs are typically rooted in students' outdoor experiences, whose educators have ample training and certification to do so in the elements. Each organization carries its own "unique conceptions of practice," where perhaps teaching in any element is emphasized within the non-formal EE culture, and therefore adopted as an attitude for that organization (Taylor & Caldarelli, 2004, p. 463). This may illuminate the findings from this study, in that non-formal EE administrators and EE educators are personally accustomed to cold weather, outdoor experiences, as well as are surrounded by peer and institutional influences, who have similar outdoor values and habits. Similarly, non-formal EE participants may also have more frequent, professional opportunities to facilitate and witness students' experiences in cold weather than formal education participants. The significant difference between self-efficacy, gatekeeper beliefs toward cold weather, then, may be due to non-formal EE's culture and training to teach students in outdoor, cold weather conditions.

Perceived Cold Temperatures. These differences in institutional influences between formal and non-formal EE communities can also be supported by the observations in Figures 4 and 5, in which non-formal EE participants reported lower perceived temperatures of what constitutes as "too cold." On the contrary, formal school institutions typically are more indoor-centric learning venues, with the outdoors used as active breaks or to support learning. Because of the locational differences, non-formal EE participants, perhaps, perceive themselves to be more positive and confident in cold weather, as their institutional influences in training and teaching may call for them to facilitate student learning in many types of outdoor experiences. Formal education participants, then, may have had fewer personal or gatekeeping outdoor opportunities in cold weather, as their institution calls for them to facilitate most student learning opportunities indoors.

Weather-related, outdoor play policies. Within institutional influences, policy for weather-related, outdoor play should also be reviewed. In this study, 14 formal administrators reported of having a minimum temperature in their weather related policies; the range of temperature was between 0° F and -18° F, and the average was -10.4° F. Of those 14 formal administrators and their respective schools and districts, there was a significant correlation between their professionally perceived temperature (Figure 4) and the minimum temperature policy of their school or district,

r= .859, p< .001, as seen in Figure 7. This finding invites future research to investigate how formal administrators perceive cold temperatures for their students and how minimum temperature policies are influenced and created.

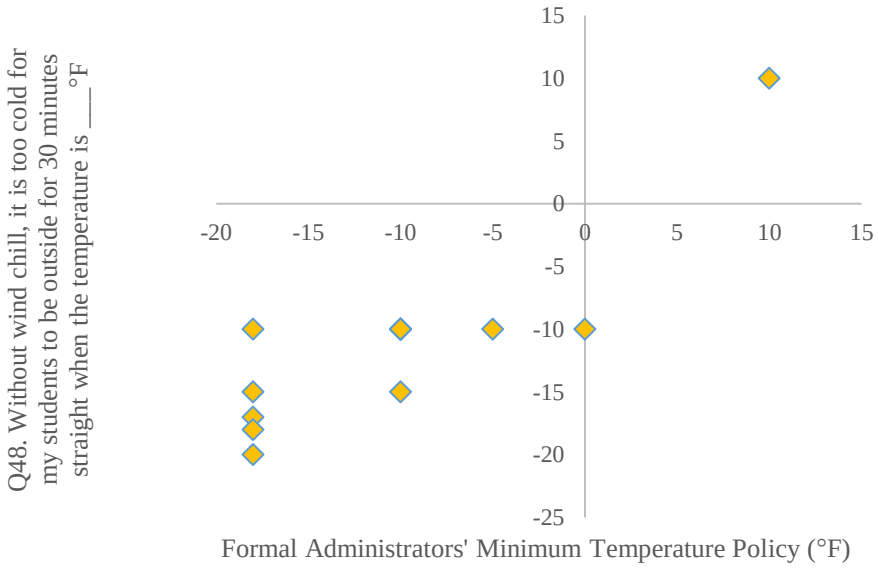


Figure 7. Relationship between formal administrators' minimum temperature policy and perceived temperature that is "too cold for students" (Q48). r=.859, p< .001

Within weather-related play policy, ideally, the number of days cancelled due to weather-related policy should reflect the temperature at which the policy is set. For example, a School with a -15°F policy would likely have fewer days of cancelled recess, compared to a school with a 15° F, during the average winter Northeast Minnesota. In this study, there was no significant difference between the number of days that recess was cancelled due to weather related reasons and the minimum temperature policy, r= .399, p= .158. This finding presents future studies to explore other site-specific considerations and influences that schools use during cold weather-related decision making.

For non-formal EE administrators, weather-related policies were varied, as were the number of days cancelled by the EE administrator or altered by the EE educator. Though contrasting policies and alternative requests, these findings are corroborated by Taylor and Caldarelli (2004), who stated,

> non-formal EE educators are called to reflect upon an "array of contextual factors, such as the audience, the environment…, time, institutional guidelines and expectations, and the weather and how they can often both compliment and conflict" with the visiting formal schools' attitudes and beliefs about cold weather outdoor play (p. 466).

This suggests that though weather-related policies may be in place for the formal school communities, and adapted to their institutional preference. Non-formal EE organizations, then, may be more often called to make alterative schedules and adjustments based upon individual school community's requests. Instead of overriding policy based on their beliefs or perceived cold temperatures, perhaps non-formal EE organizations are overriding their personal beliefs or professional policies to accommodate the visiting formal school community's beliefs, perceived cold temperatures, and policies.

Professional histories. Similarly, professional histories between formal and non-formal participant groups could also shed light on the differences between gatekeeper beliefs toward cold weather of formal and non-formal EE participants. Though K-3 teachers reported as more seasoned in years as an educator compared to EE educators,

there were no significant correlations between any participant group's years of experience in their educational role and the four gatekeeper cold weather belief composite scores, as seen in Table 5. That is, the longer a gatekeeper is in an administrative or educative position was not related to their beliefs toward cold weather.

Table 5
Relationship between years in an administrative or educative role and gatekeeper beliefs toward cold weather

		Gatekeeper beliefs toward Cold Weather			
		Cognitive Beliefs	Affective Beliefs	Self-Efficacy Beliefs	Normative Beliefs
Formal Administrators	Pearson's *r*	-.286	-.331	-.111	-.100
	p-value	.197	.133	.622	.658
K-3 Teachers	Pearson's *r*	.127	.111	.159	.075
	p-value	.375	.440	.266	.600
EE Administrators	Pearson's *r*	.648	.541	.353	.020
	p-value	.352	.459	.647	.980
EE Educators	Pearson's *r*	-.127	-.361	.252	-.391
	p-value	.652	.187	.364	.150

On a contrary note, this study did not survey participants on their professional histories in the opposing educational setting, such as a K-3 teachers' professional experience in the non-formal EE setting, or vice versa. More research on participants' professional histories in various educational settings may illuminate other variables that may influence beliefs toward cold weather.

Personal histories. Another suggestion of these disparities between educational communities' cold weather beliefs could also be explained by personal histories, such as time spent outdoors as a child, climate of origin, adult outdoor habitus, and so on. Though personal histories were not researched in this study, it is of significant to note the many possible variables, personal and professional, that may have influenced participants' cold weather beliefs (Rothe et al., 2009).

Gatekeepers' possible influences on early childhood students' cold weather, outdoor play

Adapted from Hollenhorst & Ewert's (1985) Importance-Performance Matrix, Figure 6 describes participants' possible strengths as a cold weather, outdoor play gatekeeper based on their beliefs regarding the benefits to students' outdoor play and cognitive, gatekeeper beliefs toward cold weather. As mentioned above, items in the positive, positive quadrant are rated highest in both constructs, suggesting gatekeepers are likely to successfully provide opportunities for cold weather outdoor play. Items in the positive, negative; negative, negative; or negative, positive quadrants suggest young students' developmental opportunities in outdoor play may have potential to be compromised in cold weather due to negative beliefs toward outdoor play and/or negative cognitive, gatekeeper beliefs toward cold weather.

Generally speaking, both educational communities' mean scores of beliefs regarding the benefits of outdoor play, and cognitive, gatekeeper beliefs toward cold weather fell in the positive, positive quadrant, suggesting that perhaps typically, formal and non-formal gatekeepers are positive gatekeepers for young students' outdoor play in cold weather, as seen in Figure 5. However, it is significant to note that participant group averages do not supersede an individual whose gatekeeping score may lie in the caution quadrants: positive, negative; negative, negative; or negative, positive.

In Figure 6, 45 formal education participants' (62%) and two non-formal EE participants' (11%) gatekeeping recognition fell in caution quadrants, positive, negative; negative, negative; or negative, positive, indicating the possibility of a cold weather, outdoor play gatekeeper who may have the potential to conditionally compromise young students' outdoor play based on cognitive, gatekeeper beliefs toward cold weather. Twenty-eight formal

education participants' (38%) and 20 non-formal EE participants (89%) fell in the positive, positive quadrant, and may be considered stronger cold weather, outdoor play gatekeepers, as they may have a lesser likelihood to conditionally or subjectively limit outdoor play based on their beliefs toward cold weather.

Though generally lacking weather-related policies, EE organizations' willing, confident, and inherently mandatory nature of teaching outdoors in the elements sparks a significant discussion: How can the non-formal community accommodate their customers from the formal school community who may have significantly less positive personal and gatekeeper beliefs toward cold weather?

Though perhaps countless, variables influence these beliefs of the formal education participants, a large, and growing body of literature are reiterating that children, especially of the early childhood level may not only be limited to their formal institution for outdoor play, but also may have limited opportunity to reap the development and resiliency benefits of outdoor play because of minimization measures made by their adult gatekeepers (Copeland, Sherman, Kendeigh, Kalkwarf, & Saelens, 2012b; Ergler et al., 2013; Little & Wyver, 2008). As winter in Northeast Minnesota may account for half of the academic year, it is significant to address the importance of all gatekeepers' influences on young students' opportunities for outdoor play in cold weather.

Strategies for Educational Gatekeepers

As gatekeepers' beliefs toward cold weather may influence development opportunities for students, what strategies can be taken to ensure those potential influences are geared toward positive opportunities for students' cold weather, outdoor play (Copeland, et al., 2011)? That is, how can gatekeepers, especially who may fall in those positive, negative; negative, negative; or negative, positive quadrants of potentially and conditionally limiting student's cold weather, outdoor play, be wholly encouraged and empowered to support young students' outdoor play, especially in cold weather? The following strategies are presented below of how gatekeepers can support young students' cold weather, outdoor play. Accepting the challenge to support young students' cold weather, outdoor play, not only enables the formal and non-formal environmental education fields to "contribute more effectively to reform," but also affords these fields to revisit their values (Wade, 1996, p. 16).

Investigate gatekeepers' perceptions and realities of students' risk management in cold weather. It is recommended that both school districts and EE organizations facilitate discussion to decipher between perception and reality when it comes to risk management in cold weather, and how to positively intersect beliefs and policies with outdoor play opportunities for students (Copeland, et al., 2011, p. 97). In cold weather outdoor play, gatekeepers can use these opportunities to introduce and reinforce positive risk taking, which provides numerous "opportunities for challenge, testing, limits, exploring boundaries, and learning about injury-risk" (Little et al., 2011, p. 115). Having the essential safety precursors of appropriate cold weather clothing addressed, students can have "access to and benefit from a wide range of stimulating and challenging outdoor play experiences" in cold weather (Little & Wyver, 2008, p. 39). And with ample and equitable opportunities in all four seasons of outdoor play, then, children can gain and apply "practical knowledge of how to behave within localities and seasons" (Ergler et al., 2013, p. 183; Copeland, et al., 2012a).

It is also recommended that non-formal EE communities host professional development opportunities regarding cold weather teaching and safety for parents, caregivers, and formal or non-formal gatekeepers, so they can learn to distinguish perceived and real risk when it comes to spending time outdoors in cold weather. Having the outdoors and elements as the classroom, the non-formal EE community can use their expertise in teaching in cold weather, as well as provide adequate safety training for weather-related decisions, or assessing weather-related illnesses or injury. As risk is an inherent feature of the outdoors, both the formal and non-formal EE communities can have valuable discourse in creating and upholding opportunities for students' cold weather, outdoor play.

Reclaim outdoor play in the formal school day. As outdoor play opportunities decline, perhaps this is a louder call to formal education communities to take the responsibility of supporting recess, which may be students' only active, outdoor time, especially in winter, when at-home activity levels tend to drop. It is encouraged that the formal school communities recognize and evolve with the growing pressures and need to provide outdoor recess, which may be a

student's single, daily opportunity to be outdoors (Beighle, Erwin, Morgan, & Alderman, 2012, p. 106). Thus, young students' outdoor play should not just be viewed as a vehicle to enhance physical fitness, but rather a means to shape their "year-round well-being" and resiliency, among other identified benefits (Ergler, et al., 2013, p. 183; Ginsburg, 2006).

Establish weather-related policies in pragmatic, scientific research. Especially working with early childhood students, weather–related outdoor play decisions may be influenced by not only gatekeepers' beliefs toward cold weather, but perhaps more by student demographic considerations, such as access to cold weather clothing. "Approaches to policy need to draw a distinction between excessive risk and positive, healthy risk" (Little et al., 2011, p. 127). As early childhood students may be more dependent on their families to provide the necessary equipment for cold weather outdoor play, it is recommended that educational communities implement equitable resources and opportunities for all students to feel and be safe in cold weather, and thus, be mentally and physically equipped to reap the benefits of outdoor play.

With the use of a pragmatic weather-related outdoor play policy based around an index that provides a scientific and safety standard, gatekeeper's conditional decision-making may be more strongly regulated to increase students' opportunities for outdoor play in cold weather, and decrease the potential for gatekeeper to supersede the institution's policy based on personal beliefs, while positively increasing both gatekeepers' and young students' cognitive, affective self-efficacy, and normative beliefs toward cold weather outdoor play.

CONCLUSION

To date, this area of study has received limited research attention from the field of environmental education and early childhood, though has drawn on a number of publications across various disciplines. The findings from this study open up a number of avenues for further research.

This study presented the potential disparities between young children's outdoor play gatekeepers within the formal education and non-formal EE communities. The parallels between formal education and non-formal EE are strong foundation of value in early childhood development, where both communities recognize the benefits of outdoor play for young children. However, the intersection at which individuals' cold weather beliefs and benefits of outdoor play meet are cause for further investigation, especially within the formal education community.

Because growing evidence suggests students' outdoor play is limited to a child's school day or childcare, further research is needed to understand how weather-related, outdoor play policies in schools and childcare institutions are created, and if they are based on an index that has both scientific and public safety credentials, or left to a gatekeeper's discretion. In corroboration of other studies, more research is also needed to understand how parent beliefs about how cold weather may influence children's opportunities for outdoor play (Copeland et al., 2011, p. 5).

Since this study was limited to the Northeast region of Minnesota, restrictions are imposed on the study's external validity, and thus, is unable to make generalizations of participants in other regions or of the state of Minnesota. Replication of this study in similar 4-seasons areas is needed to understand how gatekeepers' beliefs toward cold weather in other regions may influence students' opportunities for outdoor play. Similarly, a study on gatekeeper beliefs toward other extreme weather conditions like hot, dry, or wet will also illuminate how gatekeepers perceive a variety of extreme conditions for their young students' outdoor play compared to cold weather.

Outdoor play opportunities cultivate long-term results for young children "that can be transferred to adulthood" (Eyler, et al., 2010, p.327). For a temperate, four season climate like Northeast Minnesota, it is encouraging given that the majority of participants of this study reported positive beliefs regarding the benefits of young students' outdoor play. However, over half of all participants in this study had more negative, gatekeeper beliefs toward cold weather, which suggests the subjective limitation of young students' outdoor play opportunities for a significant portion of the academic year. As an influential determinant of outdoor play, weather is not a modifiable factor, but perhaps individual perception about weather could be changed (Chan, C., Ryan, D., Tudor-Locke, C. 2006). If students' outdoor play opportunities are to be supported, then all gatekeepers and their respective institutions are

strongly encouraged and challenged to contribute more effectively to students' year-round, outdoor play opportunities. Ultimately, for students to reap the interrelated and long-term benefits from year-round, outdoor play opportunities, gatekeepers and institutions must individually and collectively, critically and repeatedly, advocate for early childhood outdoor play opportunities, especially in cold weather, to build lifelong resiliency (Ginsburg, 2006; Little & Wyver, 2008; Wade, 1996).

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"It vapors up like this": Children Making Sense of Embodied Illustrations of Evaporation at a Swedish School

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ABSTRACT

Recent educational legislative acts and public debates in Sweden stress the importance of preschools providing playful and meaningful activities to enhance early experiences in environmental and natural science (e.g., Ministry of Education and Research, 2016). The present study investigates three 5–6 year old children making meaning of the concept of evaporation during an environmental water-theme. Illustrations, in which the participants own bodies were used to explain this concept were selected for further analysis and scrutinized with respect to Vygotsky's (1987) theories of how spontaneous and scientific concepts are linked together. The results tentatively suggest that the teacher's producing and the children's reproducing of embodied illustrations were beneficial for the children's emerging scientific sense making. By sticking to the play-based and theme-oriented preschool tradition the teacher avoided adopting a subject-oriented, school-like way to deal with an environmental phenomenon.

Keywords: preschool education; emerging environmental science; embodied illustrations; meaning-making; multi-modality

The importance of meetings with and enjoying emerging science is gaining terrain in contemporary preschool and prekindergarten education (see e.g.,Brenneman, 2011; Ministry of Education and Research, 2016). It has been argued that it is reasonable to assume that motivating *science* learning experiences in early years may result in an increase in students' engagement and achievement in science in the long run (see, e.g., [the US] National Research Council, 2005). In Sweden there is stronger emphasis than before on the importance of early experiences in school subjects like natural and environmental science both in recent educational legislative acts (e.g., Ministry of Education and Research, 2016) and in public debates, as an answer to a decreased interest in applying to technological and natural science tracks in, for instance, upper secondary education. This emphasis on early experiences increases the demands on the role of preschool for providing young children with opportunities to deal with common environmental and scientific concepts. The Swedish preschool curriculum (Ministry of Education and Research, 2016) states that the preschool should strive to ensure that children "develop their understanding of science and relationships in nature, as well as knowledge of plants, animals, and also simple chemical processes, and physical phenomena" and "their ability to distinguish, explore, document, put questions about and talk about science" (p. 10). However, the necessity of meaningful and playful activities based on the flow of the child's thoughts and ideas, has since long been stressed by both researchers and authorities (Asplund Carlsson & Pramling Samuelsson, 2008; Ministry of Education and Research 1998; Socialstyrelsen, 1987) although sometimes missed in science education by preschool teachers (Thulin, 2011, Larsson, 2016).

Early years environmental and natural science education in both pre- and primary schools typically uses explanatory illustrations such as pictures, models or animations as teaching aids to introduce, concretize, clarify, or repeat

complex scientific phenomena (e.g., Helldén, Lindahl & Redfors, 2005). Such illustrations are often multi-modal in the sense that they involve more than one mode for presenting the information. Kress (1997) has described young children as being spontaneously multi-modal and using whatever is at hand, when creating, interacting or making meaning in a particular situation. Lemke (2000), on his part, has maintained that a wide range of multi-modal materials presupposes that children can handle visual, verbal and physical affordances at the same time, when grappling with the conceptual and factual content of a lesson. However, only accepting existing illustrations is not enough. Pupils need to engage themselves in using models as well as in making their own. In Lemke's (1990, p. 24) words, pupils have to talk science in their own ways and not only repeat explanations they have not made sense of.

When presenting illustrative educational aids, teachers and producers of study materials often seem to take for granted that children make sense of illustrations in an intended way. However, a number of scholars have claimed that the understanding of illustrations cannot be assumed to be universal or transparent, but rather is dependent on the person doing the interpretation, the situation as such, and the actual cultural context (e.g., Kress, 2003; Kress & van Leeuwen, 2006; Meira, 1998; Pintó & Ametller, 2002; Rogoff, 1990, 1995). An example from preschool environmental education has been presented by Ljung-Djärf, Åberg-Bengtsson, Ottosson and Beach (2015). These researchers found that the children in their investigation had great difficulties in interpreting some very commonly used pictorial symbols in an adequate way.

The study by Ljung-Djärf et. al. (2015) represents an area that still lacks research, in that it deals with illustrations used in natural science in preschools. A particularly neglected domain of research within this larger field is the use of embodied (i.e., bodily-based) illustrations and gestures in early science education. The present study, focusing on preschool children when handling and making meaning of embodied illustrations of evaporation, addresses this with the intention to contribute knowledge in an area where research is so far quite limited.

Previous research

A substantial body of research has been conducted about illustrations and how they are made sense of in educational settings. Most scholars in this field have conducted studies with older children or teenagers. In addition to research specifically directed towards preschool children, studies of older children and teenagers were also reviewed as they addressed areas of common interest for the present study. The review starts with the use of gestures in sense making processes. Some research on the use of images and equipment as teaching aids follows thereafter.

Crowder (1996, p. 174) explored how sixth-grade students used gestures when making sense of scientific phenomena and found that gestures may well "serve alongside verbal language as essential tools for sense making". She maintained that gestures not only assist in the construction of insights but also communicate scientific insights and assist in the construction of those insights. Wells (2008) is another researcher who has studied sixth-graders. In his case, the students were dealing with the concept of friction and the relationship between momentum and distance. Reporting on two boys, who used gestures as well as their own words when trying to report their findings, Wells stresses:

> It is notable that neither boy used the technical term 'momentum', although it had been used by the teacher and some students on several occasions in previous lessons. However, it seems clear that each was thinking with the aid of such a concept. (Wells 2008, p. 339)

Wells assumes that when the verbal language (or maybe the lack of certain words) sometimes holds up a conversation, other forms of communication can come handy.

A number of researchers have investigated the assumption that images in textbooks always support understanding. Some such studies indicate that this cannot be to be taken for granted (see e.g., Wennås Brante, 2014). Åberg-Bengtsson, Ljung-Djärf and Beach (2015) investigated 7–9-year-olds in Sweden, when trying to make sense of images in a reading material for early readers. Their results suggest that not even seemingly self-explanatory and relatively simple pictures may "by themselves without further explanations in text and guidance from teachers be interpreted in expected ways" (p. 17). This is in line with arguments by Ferlin (2014), who stresses the necessity for teachers to

guide children in their interpretations of the increasing amount of illustrations in textbooks.

Although textbooks are not common in preschools, illustrations for explaining scientific phenomena are. There are, however, relatively few studies of meaning making of illustrations among young children. Ljung-Djärf, Åberg-Bengtsson, Ottosson, and Beach (2017) reported how 4–5-year-old preschool children had problems with assigning the intended meaning to seemingly transparent iconic symbols. Magnusson (2013) investigated preschool children when handling graphical symbols and concluded that the teacher has an important role in supporting children to develop symbolic skills. She argues that building on the children's previous experiences as well as giving them new challenges is important.

Fleer (2009) studied preschool children using different kinds of equipment during free-play activities. She noted that the first impression was that the children in their play seemed to learn about materials in a scientific way but that on closer analysis they were actually primarily acting on a spontaneous level concerning "what does the equipment do", rather than focusing on "materials and their properties" (p. 294). Fleer states that providing (more) materials without teacher input would therefore only promote everyday conceptual development. Leaning on Vygotsky, she argues that the playful context in her study "supported the interlacing of everyday concept formation and scientific concept formation" (p. 302) and provided conceptual spaces for the intertwining of the two. She stresses that this is only fruitful if teachers engage as mediators in these activities. This is similar to results presented by McClain (2016), who also points out the importance of teachers' guiding as well as their facilitating of children's collaborative scientific reasoning. In McClain's study, this was accomplished when the children were sharing their findings and hypotheses with peers and teachers, when exploring their environment in small groups.

Previous research on children making sense of the concept of evaporation. Research on environmental education in preschool, to a great extent, seems to deal with issues like sustainable development (e.g., Hedefalk, Almqvist & Östman, 2015; Ärleman-Hagsér, 2014), outdoor settings as learning environments (e.g., Ernst 2014; Ernst & Tornabene, 2012; Maynard & Waters, 2007; Moser & Martinsen, 2010) or young children's own ideas about their environment (e.g., Klaar & Öhman, 2014; Madden & Liang, 2016; McCain, 2016), with only a few studies being conducted on how particular environmental concepts are presented to and illustrated for young children. As already foreshadowed, this study investigates preschool children when exploring evaporation. However, I have not found much research that relates to pre-schoolers' encounters with this concept, but some investigations of primary school children are close enough to be of interest.

In longitudinal study Tytler and Peterson (2004) followed two Australian children from Kindergarten (age 5) to grade 3 (age 9) in order to trace their learning patterns, when dealing with evaporation. The findings showed a complexity in these patterns and dependence on the science learning-context as well as on the children's individual narrative context. According to the authors, motivational or affective state influenced the meaning making. For instance, one of the children was very concerned about not finding the right term for evaporation and constantly corrected her previous ideas, as it seemed, for "pleasing the adults", while another other child used narratives in a more self-confident way, to illustrate his ideas of the general evaporation-principles, which allowed him to more freely extend his ideas into new situations. The authors argue that the meaning making of a phenomenon is varying, depending on the situation as well as on the individuals.

In a study by Johnson (1998), 11–14-year-old students explored evaporation and condensation as a "change of state" (e.g., liquid turning into gas, as when there are bubbles in boiling water). Johnson maintains that although some of the children had noticed condensation before (e.g., when boiling water), very few of them had on their own given it any thought. When, in one part of the study, the pupils were left alone with their devises, they encountered great difficulties when trying to make sense of the concept.

In some studies pupils' dealing with evaporation comes in as a part of research on other hydrologic phenomena. For instance, Forbes, Zangori, and Schwarz (2015) investigated Grade 3 pupils' model-based explanations for the water cycle. They found, among other things, that the children in their models "emphasized water movement (…) more so than the forms of water (…) and water-Earth materials" (p. 911). Furthermore, the results revealed that, overall, in their representations, the children focused upon "the processes that change water from a liquid to a gas and gas to

a liquid such as evaporation and condensation, rather than consider the forms as separate from the processes" (p. 911).

Sträng and Åberg-Bengtsson (2010) studied communication patterns between teachers and 8–10-year-old pupils talking about the water cycle in a follow up to a period of theme studies of water. Even though the focus of this study was not specifically on evaporation, it is evident that the children who came closest to accounting for the cycling of water, tended to use words like "it goes up and down". Typically though, the children did not use the term "evaporation", even though some of them talked about "steam".

Purpose of study

In my search for previous research on how environmental and natural scientific concepts are illustrated in preschool education, I found that studies of this kind seem to be extremely rare. Thus, in an attempt to contribute to this domain, the overall aim of the present study was to investigate, by the example of evaporation, how a teacher and a group of preschool children used embodied illustrations when talking and doing science.

Two questions were posed:

(1) How is the concept of evaporation bodily illustrated by the teacher? and
(2) How do the children handle and make meaning of the embodied illustrations?

This means that the focus was on how the concept of evaporation was embodied and communicated and on what seemed to be important in/for the children's sense-making and not on the concept per se.

Theoretical assumptions

This section deals with the theoretical perspectives that frame the analysis. First I present some Vygotskian and sociocultural views and thereafter multimodal approaches to meaning making.

In Vygotskian theory (e.g., Vygotsky 1987), language is central not only for communication, but also when trying to make sense of the world, for example, when forming scientific concepts. Vygotsky argued that such forming, is a process that takes place on two levels. Children initially use concepts in a spontaneous and functional way. They talk and act upon experiences on everyday basis, and natural phenomena are intuitively and spontaneously handled. These everyday concepts form the basis for the learning of scientific concepts. In educational settings and over time, everyday experiences pave the way for forming more abstract scientific concept. These two levels of concept formation are intertwined and also mutually dependent. Too strict a focus on the scientific level leads to the connection of the concepts with everyday world being lost. On the other hand, without gradually moving towards the scientific level, the spontaneous concepts might not be useful in other contexts than the present. Thus, in order to develop abstract reasoning, the children need various kinds of practical experiences. By participating in educational contexts dealing with environmental and natural scientific issues, children are allowed to discover and talk about scientific phenomena, not primarily for being taught particular pieces of factual knowledge, but for being offered various activities linking the everyday concepts to the scientific concepts.

Wells (2008) draws attention to the importance of offering various experiences of a concept beyond classroom learning, as a way to enhance scientific meaning-making. He claims that scientific concepts should not be regarded as something (mentally and) individually owned, but instead as cultural artifacts transforming in accordance with their *use* in different situations. He suggests that teachers' efforts should focus on selecting appropriate activities as well as on offering proper forms of guidance. This aligns with Vygotsky's (1987) claim that collaboration between teachers and children are crucial for the formation of concepts, in that the teacher "explains, informs, inquires, corrects, and forces the child himself to explain. All this work on concepts, the entire process of their formation, is worked out by the child in collaboration with the adult in instruction" (p. 215).

As pointed out above, language is the most central mediating tool (or in the words of Vygotsky "sign system") in Vygotskian theory. From a Vygotskian perspective the term language does not refer to spoken or written language

only, but also to sign systems like algebraic symbols, diagrams, maps and other conventional signs (Vygotsky, 1981). *Gestures* are simply *"writing in the air"* (Vygotsky, 1978, p. 107).

Drawing on sociocultural perspectives assumes that illustrating as well as interpreting illustrations takes place in a historical, cultural and social context or, as stated by Wartofsky (1979), is something we do in that specific situation. Paraphrasing Wartofsky on models, it can be argued that nothing *is* an illustration of something, until we agree upon it to be one. Consequently, both the construction and the use of an illustration belong to a certain context and one particular illustration is not used or interpreted in the same way elsewhere (Engebretsen, 2012; Jewitt, 2008; Kress & van Leeuwen, 2006; Meira, 1998; Rogoff, 1990, 1995).

In multimodal perspectives, verbal language is considered as one mean among others in meaning making processes (Kress, 2010). It means regarding a non-verbal mode like an illustration as a full communicational resource, rather than a duplication of meanings already made in speech or writing (Kress, 2014). Further, a gesture can operate and bear meaning independent of other modes, for example, speech (Bezemer, 2014). Language then becomes but one part of an ensemble of modes (speech, gesture, text, sound, 3D, colour, and so on), which individuals need to choose between and orchestrate when construing and/or making sense of a situation (Jewitt, 2008; Kress, 2014; Kress & van Leeuwen, 2001; Kress et al., 2001; Lemke, 2000). Thus, the attention shifts focus from verbal language, towards the use and potentials of modes in a specific situation and further offers a "possibility of seeing meaning as embodied – as in our bodies" (Kress, 2010, p. 83). This implies that what can be handled with the help of, for instance, images in one situation is better handled with, for instance, gestures in another. In other words, modes have different meaning potentials both in relation to one another and to the context of which they are a part.

Kendon (1997) maintains that gestures are often regarded as something light-weighted, unimportant or positioned in the marginal. However, according to Kendon, gestures play an important role in symbol formation and communication practice by providing a culturally related meaning beyond speech. He states that even if it is difficult to draw a line between what is a gesture and what is not gestures can still "provide a visual representation of things that can be observed" (1997, p. 112). Kendon draws our attention to how gestures are shaped and influenced by historic, social and cultural traditions and circumstances. In other words, gestures (as well as other forms of communication) differ from one culture to another and we should not take for granted that a gesture is commonly understood.

Method

Three preschools participated in a large project dealing with embodied illustrations, which has resulted in several studies. In this section I present how I collected data at one of these preschools and conducted the analyses.

Collection of data

I collected the present data during a visit to a preschool with pronounced emphasis on environmental issues presented in hands-on and playful ways. The preschool was located outside a relatively large Swedish city and included four units about 70 children 1–6 years of age. One of these units was carrying out a yearlong theme of experiencing water.

I studied a group of children consisting of three 5–6-year-olds (Nora 6y, Kim 6y and Adéle 5y) and their teacher, when they investigated, in different ways, the phenomenon of evaporation in two consecutive outdoor sessions during the same day. The teacher had selected these children as they had shown a particular interest for a previously set up, closed-looped-system (described in the next section). I used a handheld camera to video-record the sessions. These recordings offered opportunities to capture not only the children's body movements, language, and facial expressions, but also their grappling with the illustrations in the context of the activity (e.g., Flewitt, 2006). In addition, I wrote down impressions from the sessions later the same day.

The studied activity was not a single isolated experiment, but one in the series of events relating to a yearlong environmental water-theme. During this theme the children dealt with water in different settings. Among other

things they had explored different states of water. All activities were initiated in connection to genuine questions from the children such as: Why do water puddles disappear? What is a cloud? Do outdoor plants need to be watered?

Three weeks before the collection of the present data, an experiment with two plants had been launched, one secluded in a glass jar (a closed-looped-system) and one planted in an ordinary pot (Figure 1). The children had repeatedly during these weeks, been encouraged to observe the two plants to see what happened. In particular, the three girls in the present study had noticed and posed questions about the large number of water drops on the inside of the glass jar. To address their questions, the teacher had prepared a number of outdoor experiments, which were selected for the purpose of this study.

Figure 1: The potted plant and the closed-loop system as they were placed in a window

Analysis

A number of assumptions have guided the analysis. Firstly, illustrations are not universal and thus not necessarily transparent but construed, agreed upon and used in a specific context (e.g., Kendon, 1997; Kress, 2003; Kress & van Leeuwen, 2006; Meira, 1998; Pintó & Ametller 2002; Rogoff, 1990; 1995). Considering this, I analyzed the illustrations with respect to what modes were used well as to the situation as such. In this analysis I regarded both verbal and non-verbal interaction as important expressions of possible meaning making. Secondly, scientific concepts are formed through two dialectically related and thus equally important levels, namely the everyday or spontaneous and the scientific levels (Vygotsky, 1987). This drew attention to whether and, if so, how these levels were linked together in the studied activity.

In line with Jewitt (2012) and Flewitt (2006), I would argue that the analysis started already at the time of data collection, as doing a video recording as such involves a selection of interesting situations and so does the choice of what to document in field notes. All verbal interaction from the video recorded sessions was transcribed verbatim in a first phase and, thereafter, selected parts were complemented with body movements, gestures, gazes etc. I went through the video recordings as well as the transcripts a number of times, and highlighted passages relating to the aims and the theoretical framework of this study. This process resulted in the identification of a number of situations with different embodied illustrations of evaporation. In a next step, I analyzed these situations with

respect to Vygotsky's suggestions of how concepts are formed by linking the spontaneous and the scientific levels of concepts together.

Results

In the analytic process, I identified three subgroups of situations, namely those with: illustrations related to the spontaneous level; illustrations that seemed to link the spontaneous and the scientific level; and illustrations used to bodily express and communicate scientific meaning. The results are presented below under three headings based on these three identified subgroups. The first heading, focuses upon how the concept of evaporation was explored, the second on how the term evaporation was introduced and linked to the children's experiences, whereas the third deals with how the children expressed and communicated meaning.

Exploring the concept of evaporation

The teacher started the outdoor activity by asking the children to carry out some tasks that were meant to illustrate the concept: to drink a glass of water, to use a spray bottle to create mist, and to put on a plastic glove (and leave it on throughout the whole activity). The children fulfilled these tasks willingly, even though the teacher neither connected the tasks to one another, nor related them to the concept in focus (evaporation). Instead they were told that these tasks "are part of the experiment" that will be explained later on. The teacher then turned the attention to the plant in the glass jar and the regularly potted plant, both of which she had brought out into the yard. She held the closed-loop system up while asking Adéle, Kim and Nora if they remembered what it was:

Excerpt 1:

TEACHER:	Do you remember this?
ADÉLE:	Yes, we locked that one up!
TEACHER:	We locked that one up. But why?
NORA:	'Cause it's not supposed to get any more water.
TEACHER:	And why is that? Isn't that kind of mean? 'Cause what do plants need to survive?
CHILDREN:	(In one voice) Water. And sun!
KIM:	And soil.
NORA:	Soil.
TEACHER:	Ok, but what does it [the plant] look like now?
ADÉLE:	Goooooood!
TEACHER:	Is it still alive?
ADÉLE:	Yeeeeees!
	[…]
KIM:	It's green.
TEACHER:	It's green. What would it look like if it was dead?
NORA:	It would have been wilted. Brown. Lying down sleeping.

On this occasion, the teacher did not use the term evaporation at all. Instead she posed questions about plants in general and about the plant in the jar and in the pot. She offered the children various ways to experience the concept by providing illustrations relating to water or moist (the secluded and potted plants, a spray-bottle, and plastic gloves) and encouraged them to explore and discover diversity. However, at this point the children did not get any further explanations to how and why there were differences between the plants.

After agreeing that the sealed plant did not show any signs of being "dead" even though no one had watered it since the closed-loop experiment started, the teacher continued the dialogue by asking why the plant in the jar had not dried out.

Excerpt 2:

TEACHER:	But how can this one [the plant in the jar] manage when it's trapped inside?
ADÉLE:	It has a lot of water.

KIM: It had a lot of water. In the soil.
NORA: Yeah the soil.
TEACHER: The soil? And it got a lot of water before we closed it in?
[Adéle nods her head.]
TEACHER: But why doesn't it dry out? This one [the ordinary plant], I've had to water it ten times since we planted it. And I still have to water it! But never this one [the plant in the jar]!
[The children giggle.]

The children's answers might indicate that they related the question to what they actually had done at the time when they closed up the plant (viz. "it had a lot of water"). None of the children seemed to have any ideas as to why the plant had not dried out now a couple of weeks later. For a further comparison, the teacher now encouraged the children to look at the moisture on the leaves (inside the glass jar) and to feel the dryness of the soil (in the ordinary plant pot).

Excerpt 3:
TEACHER: Can you put your finger in the soil to see if it feels wet?
[Adéle puts her finger in the potted-plant soil.]
ADÉLE: Dry!
TEACHER: A bit dry?
[Adéle nods her head.]
TEACHER: And what does *this one* look like [she holds the glass jar closer to the children].
ADÉLE: Wet!
TEACHER: Isn't this weird! This [the plant in pot] feels dry [Nora and Kim feels on a leaf of the potted plant] even though it had water ten times, but this [in the jar] looks wet without getting any water!
[The children smile at the teacher.]
KIM: Should we take a look then! [Taps on the jar lid] Inside, if there is water!
TEACHER: You have to look from the outside. I don't want to end that experiment. Does it seem to be any water in there?
[Nora takes the jar and holds it up. Nora and Kim look closely at the inside of the jar.]
NORA: YES! On the glass. There [tapping her finger on the jar lid].
KIM: YES! It's lying there. [Points at the top of the glass jar]. On the glass.

In all of the above examples the teacher guided the children to explore and discover the moisture on the inside of the glass jar. At this point she chose not to introduce them to the term evaporation. All three of them actively participated in the dialogue and were very eager to touch the soil and the leaves when investigating the water status of the potted plant. They also looked closely at the plant inside the jar, which they even suggested to open. However, none of them actually had any ideas as to *why* a sealed plant did not dry out. The teacher gave them hints on what to observe or explore but she did not serve them a full answer.

Linking experiences to the scientific term

After the initial, brief, exploring part of the activity, the teacher introduced the term "evaporation". Once again the plant in the jar was centered upon in the dialogue.

Excerpt 4:
TEACHER: If this one [in the jar] can live and it even becomes water in there, I think this is something I've read in a book. This is something called evaporation. Have you heard about evaporation?
CHILDREN: No, no, no.
TEACHER: Evaporation.
TEACHER: This one. [She raises the bottom of the jar up a bit.] Can you see, it has roots here at the bottom?
[The children nod their heads]

TEACHER: It [the plant] soaks up water with the roots here in the soil. And it goes up. Look here. In the leaves!
[The children look closely into the jar.]
TEACHER: It kind of squirts out like this from the leaves. [She sprays with the spray bottle towards Adéle, who giggles.]
TEACHER: So. When it soaks up water, it comes out through the leaves. It evaporates.

At this point the children were quietly listening to the teacher, when she talked about roots soaking up and leaves squirting out water. They were already familiar with the fact that plants need water and soak it up with the roots, but according to the children, the term "evaporation" (and as it seems also the fact that "water comes out of the leaves") was new to them. In a next step, the teacher proceeded by initiating another experiment illustrating evaporation, in which she linked the familiar jar-illustration (that was usually kept indoor) to something that actually takes place outdoors "in nature" (water cycles; evaporation from plants and trees).

Excerpt 5:
[The teacher brings out a small, clear plastic-bag and a plastic clip.]
TEACHER: Let's do this. If this plant [in the jar] can evaporate, do you think we should try if any other leaf say… over there, can do it? [Points to a nearby tree.]
CHILDREN: YES!
[The group runs to the tree.]
NORA: Or a flower? Can I take a leaf?
TEACHER: Let's see. We're gonna put it.
ADÉLE: [Holding up a single leaf] I've found one!
TEACHER: But we're gonna wrap it around the whole branch.
[Adéle drops the leaf on the ground.]
TEACHER: [puts the bag around a branch/leaves and secludes it with a clip, *Figure 2.*]
[The children are standing close to the teacher while she's wrapping the tree branch.]
TEACHER: But oh my goodness, poor thing! What will happen?
NORA: Eeeeporate..
TEACHER: Do you think there will be evaporation?
ADÉLE: Yes!
TEACHER: How'll we see that?
ADÉLE: Wet. In the bag.
TEACHER: Ok. Wet in the bag. Cause it pff pff or? [Makes a squirting sound and finger movements.]

Figure 2: The plastic bag wrapped around the branch and leaves

The children were very eager to carry out the task and ran to the tree. However, thereafter it showed that the teacher had not been very clear about what she actually meant them to do. “Any other leaf … over there”, could of course be interpreted as *any* leaf (or flower) lying around. Referring to and picking up a single leave from the ground might indicate that there was, at least so far, no agreement on the link between the plant in the glass jar and the tree in front of them. However, after the plastic bag had been tied around the branch, both Adéle and Nora talked about evaporation (“eeeeporate”) and an expected outcome (“wet in the bag”). All three children showed an apparent interest in finding out what would happen inside the plastic bag.

At the end of the excerpt above, the teacher illustrated how water is evaporating from leaves by rapidly opening and closing her hands as if “squirting” water. In doing so, she relates to the children’s previous squirting with the spray bottle. In the next excerpt another bodily-based illustration is introduced, when the teacher tells the children a short story about raindrops.

Excerpt 6:

TEACHER: And this other day, raindrops fell to the ground. And one sunny day, they disappeared. Do you know what happened?
NORA: Nope!
TEACHER: They [the drops] evaporated and went up, up. [She raises her hands up slowly, *Figure 3*]. Where do you think they went when they went up to the sky?
ADÉLE: To the clouds!
TEACHER: To the clouds! And what happens up there, when it gets too crowded?
ADÉLE: It pours down!
TEACHER: Go check the mirror where you sprayed some water earlier. Still a lot of water on it?
CHILDREN: Noo!
TEACHER: Is it less!? What do you think happened to the drops?!
[Nora, Kim and Adéle lift their hands silently, *Figure 4.*]

Figure 3: Teacher raising her hands up to illustrate water ascending (at the right)

Figure 4: The children raising their hands when using the same illustration of evaporation as their teacher

The teacher illustrated how water ascends from leaves and up into the air by slowly lifting her hands up (Figure 3). The children immediately copied this embodied illustration (Figure 4). This contrasts to the illustration in Excerpt 5, when the teacher in her reference to evaporation added a squirting finger movement – a gesture that the children did not imitate. Obviously, and in line with other observations in the present data, the girls here seem to have made an adequate meaning of the concept of evaporation, but adopted the embodied illustration with the lifted hands rather than the scientific term to express themselves.

At the beginning of the outdoor activity, the children had another opportunity to use their bodies for experiencing evaporation, when the teacher initiated the putting on of the plastic gloves. In the next episode the time has finally come for the children, to take the gloves off.

Excerpt 7:

TEACHER: Ok, if you take off your gloves now. Wait a minute, listen. Ok, so you drank some water [in the beginning of the activity] so there was water inside your bodies. What if, what if people also evaporate? What would it be like inside the gloves?
CHILDREN: Water!
TEACHER: Ok, try it out!
KIM: It's wet in mine!
NORA: This is wet too!
TEACHER: Is it wet inside?
KIM: Here it is totally wet!
TEACHER: So, when you drink water and wear a glove, you will like…evaporate, or?
[The children laugh.]

From a strict scientific perspective, it is, of course, incorrect to suggest that people (or plants) evaporate, as this term actually refers to the process by which water changes from liquid to gas or vapor. However, as the activity as such had started with the children's own questions about "disappearing" water puddles, among others, the teacher chose to focus on the phenomenon of evaporation and not, at this early stage, to mention the term transpiration (i.e., the process where water is carried through a plant or a human being) as well.

To sum up, the children were offered three different ways of experiencing evaporation: spraying water onto the mirror and into the air and seeing it fade away; drinking water, putting on plastic gloves and getting damp hands; tying a plastic bag around a branch of a tree and feeling the moisture inside the bag. During these sessions the teacher introduced the term "evaporation" and also bodily illustrated the concept by lifting her hands upwards. It seems reasonable to assume that these embodied ways of meeting the concept were important for the children's possibilities to make meaning and to talk about the concept. The next subsection supports this assumption.

Expressing and communicating meaning

The children's eagerness to participate in the activity, their willingness to come up with their own ideas and to listen to those of their group mates, might be regarded as parts of the meaning-making process.

In the present data, there are only two examples when the children actually tried to use the scientific term "evaporation" spontaneously, when talking about water ascending from the leaves. Instead all three children explained evaporation by slowly raising their hands, just as the teacher had frequently done, when illustrating her verbal explanations about how the water evaporated. Leaning on several indications from different parts of the activity, I dare suggest that these children had, nonetheless, made some meaning of the concept in that they used the teacher's embodied illustration when explaining and talking about it. The next example, taken from the summing up before lunch, is further strengthening my tentative suggestion.

Excerpt 8:

TEACHER:	When we watered the plant, there were no water drops on the inside walls of the glass jar. Why are there drops there now? 'Cos we watered it down there right [point to the soil]?
ADÉLE:	It has eeepored.
TEACHER:	So where did the evaporating come from then?
ADÉLE:	The roots.
TEACHER:	The roots? In the bottom? But there's drops up here too [points to the top of the jar]. Does evaporation comes come from anywhere else?
ADÉLE:	It, it vapors up like this [lifts her arms straight up].
TEACHER:	It vapors up?
ADÉLE:	[Nods her head.]
TEACHER:	Ok. Adéle says like this, that she thinks that the water in [the glass jar] here comes from the roots, but there are no roots in this bag [wrapped around the tree branch]. So we will see if there is any evaporation […] coming from leaves as well.
NORA:	Wiiii [lifts her hand straight up]

As can be notice, at one instance Adéle tried to use the term but she remembered it just vaguely and instead, some lines further down she used the expression "it vapors" and in addition lifted her arms in an upward gesture.

After lunch the researcher and the three children came to talk about the closed-loop system, which now was standing at the middle of a table. The researcher asked the children where it usually was placed.

Excerpt 9:

NORA:	We put it in the window. So it can live anyway.
RESEARCHER:	It [plant in glass jar] is still alive. But how?
NORA:	But it had a lot of water and that, that thing we talked about before. Can't remember what it was called. What was it called, Kim?
KIM:	Well … don't know!
ADÉLE:	I don't remember either.
KIM:	[Turns to the researcher] Can you?
RESEARCHER:	Let's see. What are you thinking of? Explain, can you explain it to me?
NORA:	Y'know this. With the roots. Soaking up water. From roots.
RESEARCHER:	Soak up water, from the roots, eeh and what happens to the water, when?

NORA: [Interrupting eagerly] What's it called again?
KIM: It flies up like this [lifts her hands].
ADÉLE: Like this [lifts her hands].
NORA: Flies up and becomes a cloud [lifts her hands, Figure 5]
KIM: With that glove.
RESEARCHER: The glove? Are you thinking about evaporation?
CHILDREN: Yes!

Figure 5: The children talk about evaporation: "It flies up like this"

In the above example, the children were participating in a dialogue about evaporation. When talking about "roots soaking water", water that "flies up" (i.e., rises upwards) and "becomes clouds", they all used the embodied illustration (Figure 4) that the teacher had demonstrated in the previous outdoor activity (Figure 3) Kim also related this to the previous outdoor activity "with that glove" and used the hand-lifting illustration to explain the phenomenon. The children's eagerness to participate in the activity as well as their willingness to come up with own ideas and to listen those of their group mates, might be regarded as parts of the meaning-making process. Such eagerness was observed on several occasions during the studied sessions.

Later in the afternoon three hours after their first visit, the group were about to return to the tree with the plastic-wrapped branch. The teacher gathered them just outside the preschool and asked them about their ideas of what might have happened.

Excerpt 10:
TEACHER: But, what will it look like if the leaves evaporated. What would it look like in the bag?
KIM: [Lifts her hands up.]
NORA: Then it'll be wet!
ADÉLE: Wet!
[The children run off to the tree. They watch the plastic bag closely.]
ADÉLE: [Shouting] There has been evaporation!!

KIM: Yes!!
NORA: Yeeeh! It's foggy in here [points to the bag].
ADÉLE: Foggy, foggy!
TEACHER: Foggy foggy. So the leaves did squirt some water then?
ADÉLE: Yeah!
[…]

Kim used the embodied illustration of evaporation (lifting her hands straight up) to express her idea of evaporation. Nora and Adéle described the outcome of the experiment verbally and declared that is was "wet" in the bag. However, Adéle also once used the term "evaporation".

At the end of the afternoon session, the teacher summed up the activity, by linking Adéle's initial suggestion about evaporation ("it comes from roots") to the outcome of their tree-branch experiment.

Excerpt 11:
TEACHER: So this means there was evaporation. Good. And you Adéle said that it comes from roots and now we say both roots and leaves, right?
ADÉLE: [Nods her head.]
TEACHER: I think it's time you all feel inside [the plastic bag] with your hands!
[The children put their hands inside the bag, *Figure* 6.]
CHILDREN: [Screaming] Oiiiiiii!
TEACHER: So it's true? Is this worse than inside your plastic gloves?
KIM and ADÉLE: YES!

Figure 6: The children put their hands in the bag (to feel the moisture inside)

Throughout this last part of the activity, the children jumped around giggling. Especially the moisture inside the plastic bag seemed particularly exciting (Figure 5). Their joy of being a part of this experience was evident.

Discussion

The aim of the present piece of research was to investigate, by the example of evaporation, how a teacher and a group of preschool children used embodied illustrations when talking and doing science. In order to explore this issue an empirical study was conducted in a preschool setting, when a preschool teacher and three 5–6-year-old children were observed and video-recorded in situ, when exploring evaporation during an environmental theme about water.

Two research questions were posed. The first of them concerned how the teacher illustrated the concept of evaporation. It showed that the teacher had prepared three bodily-based experiments for the children to carry out: to feel and observe the moisture when spray bottle was used; to put on a plastic glove and feel the moisture forming inside; and to tie a plastic bag around a small branch and after two hours feel the moisture on the leaves and inside the bag. In addition, she spontaneously used illustrative gestures.

The teacher first presented the concept of evaporation to be explored in an everyday and playful way, but this early she did not introduce the children to the very term “evaporation”. In this part of the activity, the she also asked why the plant in the closed-loop system from a previous theme-related experiment did not dry out. At this point the children seemed to relate to what they had done when they had sealed the plant into the jar. The reply “it had a lot of water” might be interpreted as a result from interacting directly with the every-day world, where spontaneous ideas (and concepts) are being formed (see, e.g., Fleer 2009). When the teacher shortly thereafter introduced the term “evaporation”, all three children said that they had never heard it before. At their age, this word is probably seldom used in their every-day life (unlike other concepts, e.g., “temperature”). From a Vygotskian (1987) perspective, the embodied illustrations present mainly related to the spontaneous level, but in the ways the children used them, they also seemed to link the spontaneous and the scientific levels together. This will be further discussed below.

The second research question dealt with how the children handled and made meaning of the embodied illustrations. From the present results, it may tentatively be concluded that the investigated activity, in which the teacher produced and the children reproduced embodied illustrations to handle the concept, was beneficial for the children’s emerging science. Even though the children, as a rule, did not use or tried to use the term “evaporation” spontaneously, their gestures indicated that they still seemed to have made some meaning of the phenomenon. It appears plausible that their bodily experiences of the concept had also contributed to their readiness to talk science. The teacher’s role in this linking of the everyday and scientific levels was crucial, which is in line with Vygotsky’s (1987) theories. By giving the children playful and varying every-day tasks and questions in combination with a fair amount of time to explore, experience, and communicate through embodied illustrations, she created a conceptual space in which a foundation for the formation of the scientific concept of evaporation was offered (see also, Fleer, 2009).

Offering children embodied illustrations, as was the case in the present study, could be one way of inviting them to participate in conversations about complicated processes without being forced to use specific terms or to answer for certain facts. Lemke (1990, p. 24) has stated that the children’s “talking science” in their own ways as well as doing science, is important for their making of meaning. This would suggest that, in an emerging science context, it is advisable to allow children to freely explore concepts without the limitations of being forced to apply a scientific vocabulary or verbally checked for achievement afterwards. We must keep in mind that we have to do with very young children meeting with complicated scientific phenomenon that will be further elaborated in forthcoming education. In the present study, the children did not try to explain evaporation only in words, but rather “talked science” by using their bodies as well (cf. Crowder, 1996). This resembles the observation in Wells’ (2008) study, when two somewhat older boys dealing with momentum seemed to be thinking with the aid of the concept in question, even though they did not use the technical term.

In line with Wartofsky (1979) on representations, I have suggested previously that nothing is an illustration before we agree upon it to be one. This means that the use of particular embodied illustrations in the present study is related to the particular preschool situation in which they were created. Stated differently, embodied illustrations (as well as other illustrations) are not to be regarded as universal or transparent, but understandable only when used and interpreted in their historic, social and cultural context (e.g., Engebretsen, 2012; Jewitt, 2008; Kress & van Leeuwen, 2006; Meira, 1998; Rogoff, 1990, 1995). Someone outside this particular group of children and their teacher might not, for instance, have understood arms lifted towards the sky as an expression for evaporation.

The studied activity initially emanated from children noticing and wondering about the water on the inside of the glass jar in the closed-loop system. This system, in its turn, was made when the children asked about clouds, rain and if outdoor plants needed to be watered. Based on the children's spontaneous curiosity, the preschool teacher thus initiated the experiments and guided the children towards a new scientific concept. In doing so, she focused on what there was to observe and experience, and carefully introduced the term "evaporation" but did not insist upon that the children themselves should use the word. By building on embodied illustrations during the prepared activity, she stuck to the play-based and theme-oriented, preschool tradition, where teachers are free to work in multi-subject and multi-modal ways. Thus, she avoided falling into the trap of adopting a subject-oriented and school-like way to deal with an environmental phenomenon.

The results presented in this article emanate from a small study with only three children and their teacher exploring the concept of evaporation. Thus, far-reaching conclusions should not be drawn. The study still highlights the role that embodied illustrations may play, when introducing emerging scientific concepts in preschool. I have previously identified a shortage of research both on illustrations and, to a large extent, also on how the concept of evaporation is handled in environmental education in preschool. Hopefully, this article has, in spite of its limitations contributed to our knowledge within a relatively neglected field of research.

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Preschool children's biophilia and attitudes toward nature: The effect of personal experiences

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ABSTRACT

Regular engagement outside may promote healthy physical and psychological development as well as a respect and appreciation for nature. This exploratory study compared biophilia and attitudes toward nature between young children living in an urban area to those in a rural area. Urban and rural areas may offer different opportunities for exposure and engagement with elements such as water, plants, and animals. A comparison between young children in these settings may determine if experience in these different environments affects their attitudes and biophilia. Thirty-six children (urban *n* = 27; rural *n* = 9) participated in one-on-one structured interviews about their attitudes toward and being in nature. Results revealed no significant difference in biophilia between children by geographical area. Common themes in children's attitudes emerged: 1) young children define nature by identifying specific elements; 2) young children are aware that their actions have consequences for the condition of the natural environment; and 3) children understood that the expectations guiding behavior in the natural environment apply to everyone. Preschool children's level of cognitive maturity and individual preferences may be better predictors of biophilia and attitude than location alone. Authors suggest implications for teachers and parents.

Keywords: biophilia, preschool children, child development, nature

Playing outside, climbing trees, and throwing rocks in lakes may bring forth many fond memories for adults; however, the current generation of children may not have the same opportunities. Richard Louv, author of *Last Child in the Woods* and child and community advocate, explains a phenomenon called "nature deficit disorder" (Louv, 2005, p.10). While this phenomenon is a condition that is not medically diagnosable, it reflects the effects that nature alienation has on humans, more specifically children (Louv, 2005). A review of the literature reveals, however, few empirical studies about the "disorder".

In a multidisciplinary synthesis of empirical literature, Tremblay and colleagues (2015) conclude a consistent relationship exists between engaging in nature outside and healthy child development and suggest play in natural environments is more complex and diverse, gender neutral, and promotes more occurrences of moderate to vigorous physical activity. Spending time outside has positive effects on children's cognitive, physical, emotional well-being, mental health, creativity, problem solving, self-regulation, resilience, and language (Evans, 2006; Louv, 2005; O'Brien & Murray, 2007; Tremblay et al, 2015; Wells, 2000). Nature can be a form of therapy for physical as well as psychological conditions (Louv, 2005). Studies involving childhood issues such as physical fitness and depression suggest a relationship between time outside and a decrease in these childhood concerns (Frost, 2006; Sallis & Glanz, 2006). Researchers have also examined the restorative effects on attention among children with

attention deficit hyperactivity disorder (ADHD) after having contact with nature (Taylor & Kuo, 2009; Taylor, Kuo, & Sullivan, 2001).

Despite the increasing awareness of the physical, social and mental-health benefits of being in natural environments, researchers express concern that children are losing their connection to the natural world that surrounds them (Beyer et al., 2015; Klesges, Eck, Hanson, Haddock, & Klesges, 1990). Parental and community concerns about child safety (not only related to stranger abductions but liability related to playground injuries) has its own consequences including increased indoor sedentary behavior (resulting in increasing type-2 diabetes, cancer, negative mental health and heart disease), consumption of unhealthy foods, and increased time and exposure to video violence and cyber bullying (Tremblay et al, 2015). The current "wired generation" of children is not exploring the outdoors as extensively as children formerly did, hence diminishing their engagement with and appreciation for nature (Louv, 2005; O'Brien, Jones, Sloan, & Rustin, 2000). In a review of the extant literature on the relationship between children and nature, Munoz (2009) suggests children see home as safe and hold fears to being outside in public places and natural spaces. The percentage of green space in urban environments has a positive relationship with perceived health, particularly among youth and the aging and the development of green spaces should have priority position in spatial planning policy (Maas, Verheij, Groenewegen, de Vries, & Spreeuwenberg, 2006). However, city planners, in an effort to accommodate the growing population, may place less importance on maintaining child-friendly outdoor environments (Moore, 1997). The consequence of this limited engagement outside is "diminished use of the senses, attention difficulties and higher rates of physical and emotional illnesses" (Swiderski, 2006, p. 96).

Previous studies about appreciation of nature reveal distinct differences based on age, among other factors. For instance, children under six years of age label categories of animals and may be fascinated by them, but show fear of or a hesitancy to explore the natural world (Kahn, 1997; Kellert, 1996, Rivkin, 1995). As children progress into their adolescent years, they begin to express concern for the well-being of animals, treating nature and animals with newly-found moral considerations (Kahn, 1997; Kellert, 1996).

Exposure to nature provides opportunities to develop a positive and supportive attitude toward nature. Results from a study on children's connection and attitude toward nature found that "connection to nature is a strong predictor of children's interests in environmentally friendly practices" (Cheng & Monroe, 2010, p. 45). In other words, children's affiliation with nature may predict their ecological behaviors such as conservation.

Biophilia is a hypothesis that "asserts the existence of a fundamental, genetically based, human need and propensity to affiliate with life and lifelike processes" (Wilson, 1984; Kahn, 1997, p. 1). Wilson proposes that people have a natural, almost intuitive, need to be around other living things (1984). Humans have this innate need to connect with nature, and Kahn suggests that biophilic connections can be both positive and negative. These connections to nature are expressed based upon the early experiences children have with nature (Chawla, 2009). Kahn (1997) concluded from studying biophilia among children and youth in varying contexts, that negative affiliations with nature may turn into a "life-affirming orientation" (p. 53). For example, a child fearful of dogs from an aggressive encounter may, with adult-guided experience caring for a dog, develop a deep sense of responsibility to feed and care for all animals, a life-affirming orientation.

Urban areas may offer fewer opportunities for engagement with green space outside for a child, thereby minimizing the extent of experience and exposure to the natural environment (Moore, 1997). The denser traffic found in urban areas "limits children's knowledge of the community environment—including its natural characteristics and components" (Moore, p. 204; O'Brien et al., 2000). Research by Lindsey, Maraj and Kuan (2001) suggests that children of racial and ethnic minority status in urban environments are particularly disadvantaged with respect to access to natural areas. Rural areas with lower population density as well as minimal traffic may offer higher exposure to green space for the child, such as access to ranch land with farm animals, fields with crops, forests, creeks, or grasslands. A rural town may provide children potentially greater exposure to nature in their daily life, and such exposure may be reflected in children's attitudes toward nature. While children in urban areas may be at risk of becoming de-natured adults, children who are exposed to and engaged with nature show an awareness and appreciation for it (Louv, 2005). Similarly, Cheng and Monroe (2010) suggest that children who spend more time in nature establish a stronger relationship with it.

The purpose of the present study was to compare children's exposure to nature (among children in urban and rural settings) on two characteristics: (1) children's biophilia, and (2) children's attitudes towards nature. We hypothesized that children living in a rural area would be more likely than their urban counterparts to demonstrate an understanding of the need to protect and respect nature. Similarly, we hypothesized that rural children would demonstrate a higher level of biophilia than their urban counterparts would. These hypotheses are based on the proposition that exposure to natural environments nurtures understanding, respect, and biophilia, and that because of their geographic location, preschool children in rural areas may have greater exposure to nature than children in urban settings.

Method

Participants

Urban participants. Children in the urban setting attended preschool in a city of over 54,600 people (U.S. Department of Commerce, United States Census Bureau, 2010). This city provided natural places including more than ten parks, a zoo and nature trails, as well as a variety of popular chain restaurants, and the convenience of diverse commerce for shopping. Eleven public schools and three private schools (preschool, elementary, high schools) were located in the area. Due to distance from their homes and traffic, parents often choose to drive their children to preschool rather than walk. At the time of this study, no public transportation was available, thus potentially minimizing access to areas of the city in which children could experience green space.

The preschool included two part-day inclusive (Division of Early Childhood/National Association for the Education of Young Children [DEC/NAEYC], 2009) classes and two full-day classes participating in a larger study in which parents were surveyed about their children's experiences with nature (70 surveys distributed; *N* = 37 received; 53% response rate). Researchers interviewed 27 of the 33 children with informed consent [*n* = 12 females; *n* = 15 males; *M* = 49 months; range 35-65 months; 74% White/Caucasian, 4% African American; 11% Asian/Pacific Islander, 11% mixed race]. Six children did not give assent or were not present the day of the interview. The number of children with disabilities was unknown; however, all participating children demonstrated comprehension and the ability to articulate coherent responses.

Rural participants. Children in the rural setting attended a preschool affiliated with the public school district in a town of 741 people (U.S. Department of Commerce, United States Census Bureau, 2010). This agricultural community contained small family-owned restaurants, a variety of businesses and two parks. One park was large, peripherally located, and poorly maintained. The second park was smaller with less playground equipment and located on a high traffic street. Cattle feedlots and fields of corn and wheat surround the town. Citizens must travel to the nearest city about 65 miles away for a variety of groceries and clothing. One building housed all grades from preschool through high school. Parents drove their children to school and buses transported children living over two miles away. Otherwise, children who lived closer to the school building rode their bicycles or their parents walked with them.

The part-day preschool included separate morning and afternoon classes. Four children were enrolled in the English as a Second Language (ESL) program. A survey and informed consent form in Spanish were sent to the non-English speaking parents (21 packets distributed, *N* = 10 received; 48% response rate). Researchers conducted nine interviews (*n* = 4 males; n = 5 females; range 60-69 months; *M* = 65 months; 89% White/Caucasian, 11% Hispanic). The number of children with disabilities was unknown; however, all participating children demonstrated comprehension and the ability to articulate coherent responses.

Measures

Researchers did not specifically define the term *nature* for children for this study. Rather, the focus was on understanding how children perceive, understand, and interact with nature. Nature, therefore, was an inclusive term pertaining to children's outdoor experiences, including their interactions with the natural elements such as soil, wind, temperature, water, plants, and animals.

Biophilia. Children's biophilia was measured using the biophilia interview by Rice and Torquati (2013). The interview consisted of eleven questions. Researchers presented two identical, gray stuffed squirrels holding an acorn, each representing one of the given options, to the child (biophilic and non-biophilic). It was important to have identical puppets when presenting questions to children so that children's responses were not influenced by unique characteristics of puppets, such as clothing or facial expression. The gender of the squirrel was the same as the child's gender. For example, "This *boy* likes to play outside (biophilic). This *boy* likes to play inside (non-biophilic). Which *boy* is more like you?" The child would then point to the squirrel that best represented his or her preference. A code of 1 was given for a biophilic answer, 2 for a non-biophilic answer, and 3 for a child who felt both answers suited him or her. For analytic purposes, responses of "both" (3) were recoded to biophilic (1) because the child endorsed both and did not reject the biophilic response. The presentation of options (biophilic on the child's right and non-biophilic on the child's left) was reversed mid-interview and at the end, such that the non-biophilic choice was presented first to minimize a response set by the child. The squirrel on the child's right then represented the non-biophilic choice.

Attitudes toward nature. Children's attitudes toward nature were measured with the conservation interview (Kahn, 1999) adapted for this study and administered after the biophilia interview. The full semi-structured interview included 14 multi-part questions (Appendix A). After each question, children were asked "why" to give them the opportunity to illustrate or explain their response. If a child chose not to respond, a "no response" was noted. Children's explanations revealed their thinking on, knowledge of, and judgments about what is important in nature and to themselves. Asking children to explain their ideas draws from a constructivist pedagogical approach in which children utilize language to "construct' their understanding reflective of their level of logic (DeVries, Edmiaston, Zan, & Hildebrandt, 2002; Vygotsky, 1986).

Procedure

Before interviewing, the researcher spent between 30 and 45 minutes in each classroom each day for four days to become better acquainted with the classroom setting and the children. This enabled the researcher to understand the classroom experiences of the children and for the children to become comfortable with the researcher and transition to the interview. The lead teacher extended the invitation to the child to interview by asking the child if he/she would like to go with the researcher to answer questions. The researcher and child walked to a separate research room with a two-way mirror for supervision. The recorded interviews lasted between five and 15 minutes and began with the researcher asking the child for his or her assent to participate. The first author transcribed the labeled audio files. The (blinded) Institutional Review Board reviewed and approved this protocol (#5377.1).

Data Analysis and Coding

Coding quantitative data. Children's demographics and responses to the biophilic interview were entered into SPSS (IBM, SPPS 2012). Data analysis compared urban and rural interviews using nonparametric statistics including cross tab analysis with chi square to determine significance between the responses of urban and rural children.

Analysis of qualitative data. Researchers conducted a systematic review of children's explanations in response to the questions (Creswell, 2007). Researchers offer a description of the analysis process here to provide a framework for comparison and confirmability. The first two authors engaged in an iterative process wherein each author read the transcripts separately identifying repeated phrases, terms, and emerging ideas within each question on the protocol as well as by the overall question. Researchers met to discuss the emerging themes after which each worked independently again to review and verify. This process continued until researchers reached consensus and prepared a summative document.

Results

Children's biophilia

A 2 by 3 (urban vs. rural; biophilic, non-biophilic, and uncertain) cross-tabular analysis was conducted comparing the frequency of responses on one question (#7) and a 2 by 2 (urban vs. rural; biophilic vs. non-biophilic) cross-tabular analysis was conducted on the remaining questions. Results revealed no statistically significant differences on any question suggesting that children's biophilia was not differentiated by whether or not they live in a designated urban or rural area (see Table 1).

Children's attitudes toward nature

Three interrelated themes emerged across the interview regarding children's attitudes toward nature: 1) young children defined nature citing concrete examples; 2) young children were aware that their actions had consequences for elements of nature; and 3) children understood that the expectations guiding behavior in the natural environment apply to everyone.

The first theme was that children define nature by identifying specific elements of nature drawing from their experiences. When asked, "Do you think about nature?" 59% of urban and 44% of rural children said yes and referred to plants including sticks and flowers, stars, familiar animals such as dogs, rabbits, kitties, and chickens as well as wild animals including lions, cheetahs, zebras, animals not found naturally in the child's geographic area. Children in both urban and rural areas (56% each) considered pets as part of nature as illustrated by comments including, "you have to take care of them [pets] or they will die;" and "because you have to feed them." Among those who noted pets were "not important" one child supported this response by commenting: "because they are not." Although wild animals were identified as elements of nature, only 33% of children in the rural area and 41% in the urban area agreed they were important. For example, children used the terms "mean" and "dangerous" to describe them; however, children also observed that wild animals "need to live," and "I like to pet them if they're gentle." Both children in urban and rural areas agreed plants were important because "you have to water them," "they need water and sun," and "they need to grow." Children who said plants are not important to them reasoned that "they don't have fur," and "you have to do nothing." Children in both areas agreed that parks were important stating, "You get to play there." Other children shared, "Important. Because I like to go to them if they're open; if they're closed we do not go to them;" and "Because parks you can play on and we like to play."

Children were aware that people's actions have consequences for nature. More children in the urban area (63%) than rural area (22%) responded affirmatively in that they knew of problems that might hurt the environment. Among those in the urban area, several stated that fire and smoke were problems. Two children commented on deforestation and illegal hunting: "People are cutting down trees and killing some animals: crocodiles, snakes, and monkeys." Children in both urban and rural areas commented on picking plants; for example, one child noted that if one "picks the petals off [the flowers]" it hurts the plant and "if you pull on a baby tree, obviously it's trying to grow." However, about half of the children in both urban (48%) and rural (55%) areas offered personal examples of how they protect the environment. Children stated actions such as watering plants, putting a fence around a garden, helping mom feed the plants, and feeding the birds. One child shared, "I turn off the lights when I go [on a] trip so I won't waste the batteries."

The third emerging theme was that children understood rules to protect nature apply to everyone. In response to the series of questions about a fictitious situation in which people throw trash into a familiar lake, 100% of children in the rural area and 81% of children in the urban area indicated it would be "bad" for a person to throw trash into the lake because it would "kill the animals," "make the sea die" and "animals in the lake might eat it and die." When asked if it was acceptable if "everyone" threw trash in the lake, children in both urban and rural areas (89% each) agreed it was not acceptable citing possible consequences, in order of frequency: killing fish and animals, littering, making the earth/ocean sick, because it is "bad" and making the water un-swimmable. For example, one child said "Because the animals…will be killed again." However, children also referenced settings that were imaginary or uncharacteristic of their area to explain their thinking: "Cause of the same thing: a mermaid got stuck when someone

threw trash in the ocean;" "cause the crocodile might eat the trash away;" and "cause it would make the rainbow fish die or the sea horses. I like sea horses."

Table 1
Comparison of Urban and Rural Children's Biophilic Attitudes

Question	Rural	Urban	X^2	df	p*
1) Likes to play outside.	9	23			
Likes to play inside.	0	3	1.13	1	0.28
2) Likes to dig for worms.	3	10			
Does not like to dig for worms.	6	16	0.75	1	0.78
3) Likes to jump in puddles.	5	20			
Does not like to jump in puddles.	4	6	1.50	1	0.22
4) Likes to watch birds.	7	17			
Does not like to watch birds.	1	9	1.44	1	0.23
5) Likes to catch bugs and look at them.	3	17			
Does not like to catch bugs and look at them.	6	9	2.80	1	0.09
6) Likes to watch animals like squirrels and rabbits.	6	20			
Does not like to watch animals like squirrels and rabbits.	3	5	0.65	1	0.42
7) Likes to play in creeks and lakes.	4	14			
Does not like to play in creeks and lakes.	5	10	0.89	2	0.64
Uncertain		1			
8) Likes to play with sticks, leaves and pinecones.	7	19			
Does not like to play with sticks, leaves and pinecones.	2	5	0.01	1	0.93
9) Likes to listen to birds singing.	7	18			
Does not like to listen to birds singing.	2	7	0.11	1	0.74
10) Likes to look at the stars and moon at night.	5	16			
Does not like to look at the stars and moon at night.	4	9	0.20	1	0.66
11) Likes to learn about wild animals.	6	15			
Does not like to learn about wild animals.	3	10	0.13	1	0.72

Non-biophilic response is in italics; Rural n = 9; Urban n = 27; Children's nonresponse to a question was coded as missing; *asymptotic significance (2-sided)

Again, when asked if it would be all right for people in the neighboring town to throw trash in a lake, 78% of rural and 78% of urban children agreed it was "not all right." A pattern emerged across the questions in which the majority of children agreed that trash in the lake would negatively affect the fish, water, and people, and that it mattered to them, individually, that fish, water, and people would be affected this way, repeating that fish will die or people will get sick. Birds, however, were an exception. Children from urban (52%) and rural (44%) areas agreed that throwing trash in the lake would affect the birds and all responding children in both geographic areas agreed it would be "bad" for the birds as articulated by one child, "Because they couldn't go in to the water and get their food." However, a minority in each group noted it mattered to them that birds were treated this way (11% rural and 33% urban).

Discussion

The purpose of this study was to compare preschool children's biophilia as well as attitudes toward nature by the geographical area in which the children live (classified as either urban or rural). We expected that preschoolers living in rural areas would have greater exposure to nature in their day-to-day routines compared to their urban counterparts and hypothesized that they would demonstrate higher levels of biophilia. The results from this initial study, however, are not supportive. Rather, results suggest there is little difference in biophilia between preschoolers living in urban and rural areas indicating a weak biophilic relationship with children's location at this age. These findings are similar to those of Rice and Torquati (2013) who found no relationship between the biophilic attitudes of preschoolers enrolled in programs with natural green spaces and those with few or none of these elements.

Researchers also hypothesized that preschoolers living in rural areas would express greater positive attitudes about nature than their urban counterparts. Consistent differences did not emerge to support this hypothesis. Children's responses in the conservation interview suggest that children in both urban and rural areas have similar ideas and judgments. Children spontaneously demonstrated a narrow understanding of nature, identifying predominantly animals and plants; but not elements such as water, weather, or insects, other common elements each child would have likely also experienced. Children's examples appear to draw upon their daily experiences (such as caring for pets and watering plants), and what they have learned through popular media and/or books. These experiences have a noticeable (significant) impact on children's biophilia and relationship to nature (Chawla, 2009). Young children demonstrated the ability to articulate a basic causal relationship: that people's behavior (throwing trash in a lake) may negatively affect the natural environment (dirty water and fish will die). Additionally, among these children, nature was characterized as something needing care or death will result.

Children in both locations frequently used the words *die*, *kill*, *dead*, and *take care of*, as descriptors or explanations of nature. Slaughter (2005) suggests that understanding life and death is related tightly to cognitive maturity. Drawing from a domain-general cognitive perspective (e.g. cognition is understood as one global structure where all knowledge is interdependent), Slaughter concluded that the overall developmental trajectory for understanding death is highly robust irrespective of the child's socio-cultural background and individual experiences. Consequently, the lack of inter-individual differences between urban and rural areas revealed in this study may not be surprising.

These findings may also be understood from a domain-specific perspective (e.g., cognition is structured by uniquely defined, independent areas of knowledge). Wellman and Gelman (1992) suggested that intuitive biological knowledge is one of three "core" or specific domains of understanding (the remaining two are intuitive physics and intuitive psychology). Research on intuitive biological thinking examines change over time in children's knowledge of living things and their related processes (Slaughter & Lyons, 2003). Carey (1985) studied extensively children's understanding of the domain of intuitive biology and concluded that prior to the age of 10 years, children determine an entity's biological status by its similarity with human beings. Consequently, it may be developmentally appropriate that children in this study initially identified animals (domestic and wild) as nature over insects and rocks. Additionally, Slaughter (2005) suggests that children begin to understand death as a biological event around the age of 5 or 6 years and, consistent with their cognitive maturity, death may be a temporary state represented by concrete behaviors such as eyes closed or being still. Young children struggle with understanding its finality (the dead cannot wake up or come back). Therefore, we may conclude that these preschool children are utilizing their early and emerging understanding of life and death as a way to understand nature, i.e., death is a biological event

in nature. The preschool children in this study also displayed high levels of concern for the proper care and well-being of pets/animals, which is consistent with the findings of Myers and Saunders (2002) that young children's concern about animals moved children to care about nature.

These results contrast with Kellert's (1996) study exploring nature-appreciation differences among people of various ages. Kellert found that children under the age of six tend to express a fear of the natural world, showing little to no concern regarding animals. Overall, this was not the case with these children; however, one child in each group did express discomfort with nature including a dislike for animals, worms, being outside.

These responses to nature derive from our family values, according to Cheng & Monroe (2010). Parents control where their family lives and, as a result, may determine the physical distance between children and natural areas as well as ease of accessibility. Not only is the location reflected in children's attitudes toward nature, but also the parents' own attitudes and behavior or modeling affects how children feel about nature (Cheng & Monroe, 2010). These "nature values" are transferred to children through their parents' actions (Chawla, 2009). As children grow exposed to these different values, they develop their own environmental identity. This identity allows children to "define themselves as part of nature and caring for nature as part of their role in the world" (Chawla, 2009, p. 10). For further study, a measure that includes parents' perspectives and a focus on their familial values on nature would widen the scope of how children's own attitudes towards nature develop, as they grow older.

The role of the family as the primary nurturer of the child's environmental education allows children to develop a relationship with nature first. White & Stoecklin (2008) suggest that children develop the emotional connection and values of nature before they even begin to think logistically about nature. The early experiences with nature that allow a child to form values and sentiment towards living things, creates a solid foundation for future rational and academic perspectives about nature (White & Stoecklin, 2008).

Perhaps urban children will not grow up to be the de-natured individuals that Louv (2005) warned about in high-populated areas. Louv suggested that children who are exposed to nature and have interactions with outdoor environments tend to show a higher awareness and appreciation for nature. Clearly, the preschool children in this study have the ability to form their own ideas about nature despite having more access to television and video media than ever before (2005).

As an initial comparative study, the generalizability of the results is limited by the small sample size as well as the interview process, comments from which may be influenced by the child's immediate context, the presence of an unfamiliar interviewer and the general context of the environment on that day. Additionally, our study suggests that children draw from personal experience to understand nature; consequently, they may not be able to generalize beyond their own experiences. Replication of this study with a larger sample of children as well as including children from a more densely populated urban area than the one used in this study may reveal a point at which differences emerge because of geographical exposure. More importantly, following children over time may further document the relationship between early attitudes and experiences and later attitudes and behaviors. Further research with young children should also include additional sources and measures of the time spent in nature children's behaviors in order to triangulate the data, establishing greater trustworthiness. Such measures could include direct observations of children's behavior, which may be more objective and measurable, and parent observations or reflections on children's activity outside as well as exposure to a wide range of media sources.

These results suggest that children 3- to 5- years of age are beginning to form their own ideas about nature and how to interact with it. Consequently, preschool is an appropriate time to engage children in nature-related experiences with adult guidance. Early childhood experiences may be foundational to developing a lifetime appreciation for nature as well as understanding of the relationship between their actions and nature's well-being.

Implications for Practitioners

Implications of these findings for teachers, parents, and other adults suggest that young children are in the process of creating their personal "folk theory" (Slaughter, 2005) of nature and biology constructed from discrete pieces of information, not yet a coherent, integrated understanding of representing the inclusivity of nature. Children are able to identify some elements of nature and the relationship between one's behavior and the quality of environment. A primary role of the teacher and other adults, therefore, is to provide not only a wide range of experiences with a variety of natural elements to integrate knowledge (Wilson, 1993; 2012) but also developmentally appropriate conversations with children asking them to observe and explain their ideas (NAEYC, 2009). Drawing from these explanations, adults can identify children's current levels knowledge and provide provocative opportunities to gradually elevate the child's thinking to a more sophisticated and integrated level of understanding (Vygotsky, 1986). Indeed, Slaughter & Lyons (2003) demonstrated that young children can be taught about vitality successfully thus suggesting adults (teachers, parents and others) play a vital role in helping children develop logical connections between their actions and nature's outcomes.

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Appendix A

Conservation Interview Conducted with Children

1. Do you think about nature? What kinds of things do you think about when you think about nature?
2. Do you think pets (domestic animals) are important or not important? Why?
3. Do you think wild animals are important or not important? Why?
4. Do you think plants are important or not important? Why?
5. Do you think the parks and gardens around the city are important or not important? Why?
6. Do you know about any problems that might hurt nature or the environment? Which ones?
7. Do you do anything to protect or take care of the environment?
8. Let's say there is a person who threw trash into [name] Creek. Is that all right or not all right? Why? What if everybody in [area] threw trash into [name] Creek. Would that be all right or not all right? Why?
9. Do you think that throwing trash into the lake might affect the fish? If yes, would it be good or bad for the fish? Does it matter to you that the fish would be affected I this way?
10. Do you think that throwing trash into the lake would affect the water? If yes, would the trash be good or bad for the water? Does it matter to you that the water would be affected in this way?
11. Do you think throwing trash into the lake would affect the birds?
12. Would it be good for the birds or bad for the birds? Does it matter to you that the birds would be affected this way?
13. Do you think throwing trash into the lake would affect the people who live near the lake? If yes, how might it affect the people near the lake? If bad, does it matter to you that the people would be affected this way? Why?
14. Let's say that there is another city next to the different lake much like [blinded] creek and there was a law that said it was okay to throw trash into the lake. Would that be aright or not alright? Why?

(Kahn, 1999; Rice & Torquati, 2013)

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"Trees have a soul too!" Developing Empathy and Environmental Values in Early Childhood

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ABSTRACT

Coping with environmental crisis cannot but presuppose a change in the values adopted by modern man. Both ecocentric values associated with creating a caring relationship with nature, and the development of empathy, can become vehicles of transformation towards a society based on ecological principles. In connection with these issues, an Environmental Education program for preschoolers was designed and implemented in the classroom. The evaluation shows that preschool children can be interested in non-human beings, can feel the need to protect them, and ascribe them intrinsic value.

Keywords: environmental values, empathy, preschool environmental education

What accords Environmental Education its dynamic character - and marks its difference from environmental studies - is the dimension of critique, relating to the identity of the active citizen who - through studying and clarifying attitudes and values, rejects the prevailing standards, and who, by seeking alternative ways of being, modifies his actions accordingly, and consequently transforms society and the environment (Sterling, 1993). A special case of such a process involves the anthropocentrism - ecocentrism dichotomy and all the movements in between that have emerged over the last decades (Attfield, 2014). More specifically, the technocentric-anthropocentric approach is part of a traditional moral framework which does not question the dominant role of humankind, does not ascribe ethical values to non-human beings and bases the protection of the environment on an economic- administrative approach and on its instrumental value[i]. On the other hand, the ecocentric approach is developed through the concept of the abolition of the separation of human from his environment, as we are in unity with the rest of the world who contributed in our creation (Taylor, 2011). Awareness of this fact impels modern human beings to attribute intrinsic value[ii] to non-human beings, and to entire ecosystems (Norton, 1982; Regan, 1983; Taylor, 2011; Nash, 1989).

Ecology is interested in improving the relationship between humankind and nature. If people accept the indisputable scientific fact of their interrelation with the natural world, then they will regard it with respect and love (Leopold, 1949; Taylor, 2011; James, 2015).

From another perspective, the ecofeminists are committed to establishing caring relationship with the environment (Gilligan, 1982; Warren, 2000). The perception of the "self in relationships" provides the basis for the review of our relation with nature[iii] in a way that people are considered part of a relationships network. In this context humans take care of the land selflessly, without expecting anything in return, just as the mother looks after, and provides for the needs of her child. Such a relationship does not allow for an instrumental value to be attributed to nature. These features bring women very close to a holistic, organic moral philosophy, according to which every being has its role and is worthy of respect and dignity (Dodson, 1982).

Other researchers and philosophers concentrate on creating deep empathic relationship between humankind and nature (Silva and Phillipi, 1998; Wahlstrom, 1998), whose focal point seems to be the resignation of human from the position of sovereign ruler and the acceptance that he is only one link in an endless chain, whose overall needs have priority over those concerning a single link.

Empathy

Humans could not have survived as a species if everyone cared only for himself (Hoffman, 2001, p. 1). Empathy is the interpersonal ability to discard egocentric impulses, while focusing on the needs of the other, or "the knowledge of the state of mind of another person and the spontaneous emotional response to it" (Hoffman, 1975) or "an affective response more appropriate to another's situation than one's own" (Hoffman 2001, p. 4). Empathy is found in new-born-infant's response cry, which has been verified by experiments and observations (Nakao and Itakura, 2009), among apes (Clay και de Waal, 2013, Yamamoto και Takimoto, 2012) and generally in nature (De Waal, 2010). Although empathy is a capacity that young children possess inherently (Denham, 1998; Nakao and Itakura, 2009), it is also a social capacity, which requires cognitive achievements and therefore can be developed.

Role-Taking as a precondition for empathic arousal. The ability to take on roles, that is the development of the perspective of the other, seems to develop in parallel with empathy. At the age of two years children perceive others not only as separate physical entities, but as beings with their own thoughts, feelings, perceptions and intentions (Hoffman, 1988)[iv]. This is the initial step in the ability to take on roles, which is considered as the main precondition for the development of empathy (Omdahl, 1995). Role-taking is a term that refers to the person's ability to see the world through the eyes of another, to understand their needs and desires as being different than those of oneself, and understand the relationships between individuals. The three types of role-taking (affective, perceptual, cognitive[v]) require the subject to come into conflict with his own perspective and to overcome it. The element that is of particular importance in early childhood is the ability of affective role-taking.

Children in their socializing display an empathic approach, perceive the feelings, perspective and cognitive functions, emotional concerns of other children, show interest, provide care and assistance and develop altruistic behavior (Borke, 1975; Hoffman, 1975; Radke Yarrow, Zahn-Waxler and Chapman, 1983; Radke-Yarrow and Zahn-Waxler, 1984; Stewart and Marvin, 1984; Pearl, 1985; Dadds, Hunter, Hawes, Frost, Vassallo and Masry, 2008; Gilbertson, 2012; Chomey, 2014; Gregoire, Bruneau-Bherer, Morasse, Eugène and Jackson, 2016).

The empathic reactions, when they start early in human life, can later contribute to the adoption of ethical principles (Damon, 1988). Growing, the child will be able to get in touch with the three related but quite distinct aspects of empathy, namely, experience sharing, mentalizing and prosocial concern (Li and Yu, 2015), therefore will seek and construct corresponding ideologies (Hoffman, 1984; Hoffman, 2001), given the fact that enhancing children's emotion understanding may facilitate the development of the cognitive dimension of empathy (Li and Yu, 2015). The emotional and cognitive traits, although separately developed, constantly interact and are experienced together (Hoffman, 1988). Ethical principles are thus accompanied by an emotional charge that contributes to their most effective compliance.

Empathy is considered a prerequisite for the development of moral thinking by Kohlberg himself (1969), although he sided with the traditional research trend in empathizing with ''cold'' cognitions rather with the ''hot'' affect in making judgments of ethicality, therefore he focuses his ethical orientation on the concept of justice and ignores the emotional side of morality, and the motives of behavior. Nevertheless, recent work has begun to add greater balance to affective reactions and showed that "both cognition and affect are important, but more research is needed to determine how they work together"[vi] (Fortin, Nadisic, Bell, Crawshaw and Cropanzano, 2016).

The ethical orientations of justice and care are based on diametrically opposed types of experiences and interpersonal relations and are different ways of organizing the basic elements of moral judgement. While initially Gilligan (1982) considers both orientations totally opposed, in subsequent approaches she negates the strict dichotomy by stressing the relativity of things. She believes that the two kinds of ethics are complementary between them. Along with the ethics of care, general principles and rules are needed (Crittenden, 1990).

Acquiring the feeling of care (i.e. being receptive to what another has to say, and open to possibly hearing the other's voice more completely and fairly- Thayer-Bacon and Bacon, 1996) and responsibility is complementary to the ethical thinking, that is why researchers have been arguing about the "need for a pedagogical framework to productively incorporate the role of emotions in (…) ethics teaching" (Gillam, Delany, Guillemin and Warmington, 2014).

The above described personal sense of empathy with other people can be extended into empathy towards the natural environment which is one of the main variables for responsible environmental behavior (Hungerford and Volk, 1990; see also the empathetic representation of nature in an anthropomorphic manner that enhances action efficacy, Tam, 2014). People who put aside their personal interests and give priority to the needs of nature tend to protect it and adopt environmentally friendly values.

The development of environmental altruism is related to creating a caring relationship, love and respect for the environment. In this framework then, empathy towards the non-human world means recognizing the needs of animals, and nature in general, the importance of their survival and displaying an interest in their wellbeing (Berenguer, 2010) [vii].

In accordance with Brabeck (1988) and Noddings (2002) who proposed the designing of educational programs for the development of attention, care and sympathy towards near and distant others, plants, animals and the environment, and in order to study the possibility of developing in preschoolers empathy for non-human beings and nature, an environmental education program was designed and prepared which is presented in this research work.

The educational intervention

The research program took place at the 60th public Kindergarten School of Thessaloniki in the academic year 2001-2002, and it was the main part of a PhD thesis dissertation. In that research program, the educational intervention effect towards cultivating environmentally friendly attitudes and values was examined. Seventeen five years old preschoolers participated in the experimental group. Through the thematic unit 'Forest', the program aimed to develop the perspective of non-human beings, and the emotional sensitization of preschoolers to them. Integrating environmental philosophy, namely the respect and care towards other forms of life and our kinship with them, constitutes a basic core. Children come into contact with the idea that animals have intrinsic value, and that they are part of a large extended family of human and non-human creatures sharing the natural world. Empathy in this educational design is not an end in itself but is chosen as the developmentally appropriate tool for forming ecocentric environmental values at preschool age.

In an early childhood educational program the integration of environmental ethics with the rest of the activities can be done as described in Table 1 (Lithoxoidou, 2006):

Table 1
Linking environmental ideas in the program

ENVIRONMENTAL IDEAS	⇨	LINK IN THE PROGRAM
Unity Humans - Nature	⇨	We care about the other forms of life as our mother cares for us. We are one family.
Relationships networks	⇨	We take care of forest trees and animals. Their well being depends (among other things) on our behavior towards them.
Ascribing intrinsic value	⇨	Organisms like plants and animals have a good of their own.
Biodiversity	⇨	Organisms like plants and animals support the life of the whole ecosystem.
The Ecosystem – Habitat	⇨	The forest is the home of animals. That is where they sleep and eat.

The proposed program aims at fostering environmentally friendly attitudes through:

- the acquisition of knowledge,
- creating sentiments, feelings of care and developing a sense of responsibility for other beings,
- forming values and rules of pro-environmental behaviour, which the children will voluntarily follow, and
- the strengthening of environmentally friendly action.

The introduction to the topic was a discussion concerning the children's past experiences from their trips to the forest. The discussion was followed by a narrative tale, as a trigger for an interdisciplinary approach to knowledge, reflection and exchange of views.

The content of the program involved four main modules (see Table 2):

Table 2
Thematic program units

Unit 1: A. "Trees" • The parts of a tree -the biological needs of the tree • Similarities with humans • The trees as natural resources • Managing of trees-paper • The forest is the animals' shelter	Unit 2: B. "Animals" • The biological and emotional needs of animals • The concept of "home" - habitat • Similarities with humans • Interdependence Unity: The relationship humans- animals
FOREST	
Unit 3: C. "The risks to the forest" • The lighting of fire • Tree cutting • Real estate development • Hunting • Endangered species • Scenario: "How would our life be without forests? "	Unit 4: D. "The protection of the forest • Standards of environmentally friendly behavior • Creating environmentally friendly behavior rules • Participation in environmentally friendly activities

A. "Trees": The purpose of this section is to demonstrate first that the trees have their own lives with biological needs similar to those of humans (explored through simulation games). Reference is made to the value of the tree

as a natural resource, both for the preservation of human health and for utilitarian objects produced by it (delivered through children's literature, role playing and discussion), with the main aim being the development of the concept of sustainable management of this resource (experienced through educational visit - field trip, puppetry, texts, ethical dilemmas, crafting with waste materials). Finally, emphasis is given to the value of the tree, and the forest as habitat, since these provide the environment in which many species of animals, birds and insects find shelter (with simulation games and constructing a model of a forest).

B. "Animals": This unit aims to underline the similarities of animals with humans, through highlighting the biological and especially the emotional needs of the animals (delivered through matching games, discussions, naming, imitation). The animals, like man, need a home (ecosystem) to survive. The concept of ecosystem leads to the development of the concept of interdependence, and the elaboration of the relationship between humans and animals (through experiential games). Unity and interaction between them within a network of relationships is one of the main purposes of this section (for the achievement of which the children came in contact with Indian poetry).

C. "The risks to the forest": In this section the risks to the forest as a whole, such as fire, logging and real estate development, but also especially to animals, such as hunting, are presented through children's literature texts (narrative, drama, puppet shows). Both the causes (indifference, overconsumption/waste, the desire of wealth, greed) and the consequences (destruction of tree life; death of animals) are illuminated. Finally, a scenario of our life without forests is presented.

D. "The protection of the forest": In this part the main objective is to create environment friendly rules of conduct for the children and take protective action (planting trees, paper consumption reduction, recycling, cleaning of the forest) and dissemination/persuasion (posters, interview, demonstration). Furthermore, environmentally friendly actions are presented directly to the children (inviting professionals and volunteers into school) and indirectly (through children's literature texts and showing relevant films).

The children were divided into four groups, corresponding to the four sections of the subject, in order to write the information gathered in a newspaper. The program included seventy five designed activities and fifteen emerging activities. The program started in January and finished in June 2002. The completion of the program took the form of a celebration where the children dramatized the story they wrote, presented a role-playing game and displayed their artistic works.

During this intervention we focused on techniques promoting feelings, especially empathy, which plays a key role in shaping attitudes during early childhood (Gassin, 2002) and is therefore deemed to be an emotional state which can be nurtured (Pickens, 2009). The lived experience of observing a “person” in need makes empathy to spring out; therefore, it was necessary for the children to be in direct contact with the natural environment. There, they had the opportunity to participate in outdoor activities, to mobilize their attention, provoke their interest and stimulate them emotionally. The acquisition of experiences in nature is an extremely crucial factor in building children’s relationship with nature (Louv, 2008), promotes prosocial behavior towards nature and peers (Acar and Torquati, 2015), increases empathy to nature (Palmberg and Kuru, 2000; Tanner, 1980; Chawla, 1998; Palmer et al., 1998a; Palmer et al., 1998b; Clark and Yu-Fai, 2007), and intensifies the sense of common bond of life with other living beings around us and develops our interest in the needs and the benefit of other creatures (Drissner, Haase, Wittig and Hille, 2014).

Within this context, at the start of the program, the children made an excursion to the suburban forest of the city and participated in a variety of experiential games (listened to the sounds of the forest, embraced tree trunks, built piles of leaves etc.) in order to feel a connection with the world of the forest.

Through literature and role-playing, trees or animals were perceived as persons, disclosing information about their situation to the children, helping them in this way to understand their feelings and to relate to their position (Hoffman, 1988). Consequently, pupils develop an understanding of their perspective and identify with them. More specifically, literature (Simpson, 1988; Elting, 2015; Clement, 2013, p. 4-5) and role-playing (Verducci, 2000; Fischer and Sarah, 2002; Janusheva and Pejchinovska, 2011) can serve as vehicles transferring information and in that way

bridging the spatial and temporal distance between the subject and its direct personal experience. In that way they promote a universal kind of empathy, to include whole groups and categories of beings, approaching the notion of a “universal consciousness” (Rifkin, 2009, p. 128).

Children's literature describes natural objects as human beings with human appearance, behavior, etc (anthropomorphism), in order to make them appear more familiar. Through those anthropomorphic features and the use of human names the environment turns into an entity which the children recognize as similar to themselves, with common needs for survival. Through this process sound environmental attitudes are developed (Mallet, 1974), since anthropomorphism is related to empathy (Tam et al., 2013, Apostol et al., 2013, Chan, 2012) and leads children to ascribe intrinsic value to trees and animals.

Role-playing sensitizes pupils to the thoughts and feelings of others. Moreover, the use of language in the process of playing has a significant impact on the acceptance of new ideas (Iannotti, 1978).

Based on the above, during the program the children came in contact with several children's literature texts, in which the heroes (trees or animals) carried and communicated information on their situation. Very often dramatization of stories followed in which children took roles, and developed the perspective of other creatures (see Figure 1).

In order to facilitate role-taking, educational activities (narrative and dramatization of stories) were employed with background music capturing attention, magnifying awareness and triggering emotions, so that the stimulus was strong, and thus efficient. Research shows that when children play an active role in forming their learning experience, and are involved both cognitively and emotionally, their level of involvement will be more fundamental (Farveh, 2014).

Figure 1: Children dressed in masks dramatized what animals and trees of the forest experience when people *come by.*

Activation of empathic skills in children is achieved by highlighting the innocence of the "victim", in other words, by helping children understand that this creature (tree, animal) is not responsible for the difficult situation it finds itself in. According to the theory of *causal attribution*, this ‘re-living’ stimulates their sense of justice, which in turn activates the emotions of empathy in children (Taylor, Peplàu, and Sears, 1994).

Employing this theory in practice becomes part of the program activities when working with children's literature. For example, if our goal is to prove the innocence of a nonhuman being who suffers, and emphasize the injustice, we need to ask children the following questions: "If you were the blackbird (or other animal) whose forest was burned, what would you like to tell us? How do you think you would feel?"

It is important to identify our common needs with someone in a difficult situation (Reykowski, 1984), as we care more for those with whom we recognize similarities and perceive to have links with ourselves (Warnock, 1996, Lian and Mathis, 2016, p. 614; Parsons, 2016). It is not by accident that animal rights activists "emphasize our similarities [to animals] in order to break down the human–animal divide" (Cherry, 2016, p. 79).

The connection of children with other beings was sought to be enhanced through poetry relating to the Indian worldview and games. The similarities with humans were emphasized with activities, which included:

> Similarities between man - tree: Look at your body and compare it to your tree: "As we stand, our feet and our toes keep us firmly on the ground. The roots of the tree are in the ground. Our skin protects our internal organs and keeps germs out. So does the bark of the tree. Also, under the bark, the sap goes to all parts of the tree, just like the blood in our veins. Our body is similar to the trunk of the tree, straight and tall. Our hands are like branches. Leaves grab the sun as our fingers grasp an object".

Empathy development techniques also included the strategy of inductive discussion[viii], which is proposed by the cognitive-social theory and aims to develop interest in the welfare of others, as it places emphasis on the emotions and desires of other people, and connects their needs with the actions of the individual (Staub, 1971, 1981). Inductive discussion refers to all elements of ethics: emotions, knowledge, judgment, behavior (Shaffer, 1989), and provides a cognitive network that assists the child in role-taking and the development of the perspective of others.

The analysis of the consequences of the child's acts to others, as well as providing advice on the appropriate conduct in each particular case, helps the child to realize the consequences of his actions on others, understand and ultimately internalize moral norms.

During the course of the program, questions were regularly asked to prompt discussions on the consequences of children's behavior towards forests, trees and animals. For example, "what happens to the trees if we misspend/waste paper? What happens to the birds in the forest if you shout loudly? What problems do we cause to animals by throwing garbage in the forest?"

The program is also enriched with other teaching strategies originating from the Values Education approach (Caduto, 1985; Huckle, 2015, p. 81), which are considered developmentally appropriate for preschoolers (Mackey and de Vocht-van Alphen, 2016). Applying the techniques for building empathy skills is adopted by the strategy of moral growth, which is an offshoot of the cognitive development theory (Piaget, 1932), as empathy is considered a precondition for the development of moral thinking (Kohlberg, 1969).

The teacher's aim is to strengthen the moral judgment of the child, through the introduction of new (under investigation) values, bringing him to a position where the child is faced with a cognitive conflict. Children play an active role in creating the rules stemming from the new values that have occurred (and which they have discussed), and the emotions they have experienced. The rules, namely, are not stated as absolute truths, but as issues for judgment, since the objective is the autonomy of children.

With the aim to explore the qualities related to the intrinsic value of nature, namely respect, caring, responsibility, and to create the necessary rules of behavior, children, in groups of two or three, dramatized different scenes, for example:

- We uproot flowers, cut branches and leaves.
- We eat sandwiches, drink juices and throw away our waste and rubbish.
- At school when we have to write our name, we are not careful and do scribbles, throwing away paper, one after another.

After each activity one of the children who viewed the scene de-constructed it. We judged the actions of the main characters, we talked with them about their choices, and we shed light on the values of respect, of care, responsibility, the intrinsic value of nature. We reflected about whether we are interested or not in paying attention

to the issues highlighted in the dramatized scenes. Children decided on the rules they will require to achieve the desired outcome. One of the children in each group made a drawing for each rule. On the drawings showing the desired behavior, we added the corresponding caption - rule.

Behaviorist teaching strategies like values inculcation, imitation of models and reinforcement of behavior (Kirschenbaum, 1995; Grace, David and Ryan, 2008; Gentile and Gentile, 2008, p. 130, 138; De Corte et al.,1996, p. 492 as referred in Greer, 2009, p. 150; Iscan and Senemoglu, 2009, p. 3; Kumar, 2014; Tan and Tan, 2014) are derived. More specifically inculcating values refers to the direct transfer of messages.

During the program several environmental messages were presented to children through literature, puppet shows, posters, toys, etc.

Providing role models for empathic imitation was performed through the thematic unit "*People who help and protect the forest*". Examples of empathy were identified in literary and television heroes, but also in real life, in the classroom and in our school. We talked about the forester, firefighters, simple children, nature lovers, and we were informed about the various environmental organizations.

The 'reward' received by the child for his environmentally sound behavior is best linked to his self-image (Kochanska, 1984), and not to external rewards. Awards with titles such as "the friend of the forest" or "friend of the earth" were chosen as the most appropriate method of reinforcement after the environmental activities in which children were involved.

Learning through action is another method of values education associated with the active participation of students in the protection of the environment. The children's activities relate to eco-management, anti-consumerism and actions to convince the community (Volk, 1998). Those kind of activities were shown not only to boost the pupils learning and development through their parents and family involvement (Fantuzzo, Tighe and Childs, 2000; Goodwin, 2005) but also to educate the whole of community (Vaughan et al., 2003) through cooperative children-parents learning and reach a point where the community and the school collaborate (see a relative literature review in Ma et al., 2016). The more the task of assistance to other forms of life is demonstrated to be important and meaningful, the more the involvement is effective (Zelezny, 1999).

During the program, the children had the opportunity to participate in eco-management actions, such as cleaning the forest, recycling at school and planting trees in a municipal park in the city of Thessaloniki, North Greece.

Furthermore, the element of action in the community was accomplished by us organizing a protest in the school playground where we used our prepared placards, we interviewed older children from the primary school and we displayed the posters we had created.

Evaluation method of the educational intervention

To investigate the development of empathy in the preschoolers who participated in the program, a research project was designed and implemented. This combined qualitative with quantitative approaches, with elements from experimental research and action research.

The convenience sample was chosen because of the easy access to it (one of the researchers was their teacher at that period of time). Moreover all of the seventeen pupils experimental group, despite the fact that they were living near the forest, they very rarely used to visit it. Due to the fact that they didn't have until then any previous kindergarten experience on the environmental issues they were more than willing to participate to the specific program. Of course, the results of the present research work are not generalisable since our sample does not represent the population as a whole.

Measuring attitudes and values, which are the dependent variables, was based on a semi-structured interview before (autumn 2001) and after the implementation of the program (summer 2002) for both the experimental group

and the control group. The children were asked to choose the environmental attitude that they considered correct (positive or negative), based on eight pairs of images which referred to paper management issues and the forest ecosystem as a whole (fire and garbage in the woods), but also to attitudes and behavior issues towards the plants and the animals of the forest. The questions are open (e.g. why do you prefer to collect garbage into a bag rather than throw it away in the forest?) so that the respondent, with flexibility and freedom, will give his own interpretation and develop his own arguments. All interviews were audio recorded in order to allow the detailed analysis and study of the content that the interview data underwent.

Results and Discussion

During the content analysis of the interviews, an attempt was made to make the categories mutually exclusive (Holsti, 1969), but this was not feasible. The theme was determined as the unit of analysis and the presence or absence of specific attitudes, values and ideas were investigated. In the present research, the categorization of the children's responses refers both to the stages of ethical-emotional development of preschool children and to the main currents of Environmental Ethics and Philosophy. After indexing the responses, subcategories emerged, resulting from the material gathered during the interviews, as mentioned in Table 3.

Table 3
Categories and subcategories of child responses

MAIN CATEGORIES Productive categorization		SUBCATEGORIES Inductive categorization
A. EGOCENTRIC ORIENTATION		A1. Avoiding punishment A2. Consequences to oneself A3. Hedonism A4. Practical interests
B. SOCIETY - CENTERED ORIENTATION		B1. Interest in other people B2. Stereotypical environmental rules
	C.I. ANTHROPOCENTRISM	C.I.1. Instrumental value - Natural resource C.I.2. Health C.I.3. Recreational - Aesthetic value
	C.II. ECOCENTRISM	C.II.1. Interest in the needs of other forms of life C.II.2. Intrinsic value C.II.3. Empathetic relationship

After implementing the program, the categories of environmental orientation were mostly preferred by the pupils of the experimental group. "Ecocentrism" (C.II) presents the most impressive increase in the number of responses among all categories[ix]) while it is observed that the categories of egocentrism and society - centered orientation are reduced, occupying the last two positions in the preferences. The desire of children to derive personal pleasure regardless of the consequences of their actions on others (egocentricity) is highly reduced, and replaced by concern for the environment.

These findings seem to contradict to the basic thesis of Piaget (1932), according to which children younger than six or seven years cannot "decenter"[x] and therefore behave in an "egocentric" way. The perceptual role-taking on which Piaget was based (1932) best illustrated in the famous experiment with the three mountains designed to prove the above point of view, however, is not a prerequisite for the understanding of the internal situation of another person. Research data of a later time (Crittenden, 1990, Svetlova, Nichols and Brownell, 2010; Thompson, 2012; Zahavi, 2015) shows that the young child can get in the position of another person more easily than what was considered by Piaget, and attribute children's "decentering" difficulty to the lack of interpersonal motivations - which facilitate

the desired understanding -from the experimental planning of Piaget (Donaldson, 1987). Researchers who took these factors into account when planning their experiments reached results that differ from those of Piaget (Borke, 1975; Hughes, in Donaldson, 1987; Astington and Hughes, 2013; Carpendale and Lewis, 2015). In other words, in a context of interpersonal motivation the difficulty of "decentering" attributed by Piaget to young children is in no way demonstrated. On the contrary, young children are able to take into account the views of others, if the experimentations in which they participate are more suitable for their age, and even more if these are observed during physical activities (during their play) and not in artificial laboratory conditions.

In addition to the preschoolers inefficiency related to perceptual role-taking, Piaget (1932) based his egocentrism concept on the children' s egocentric speech, according to which the child "makes no attempt to place himself in the position of the listener". However, there is research evidence to refute this position on egocentrism (Cole & Cole, 1993; Woodward, 2009; Wagner, Greene-Havas and Gillespie, 2010; Abbot-Smith et al., 2016). Preschool children can take into account the perspective of the listener. For example, they use simple speech when talking with younger children, but they do not do the same when talking with peers and adults (Hoffman, 1988; Syrett and Kawahara, 2014; Saylor, Baird and Gallerani, 2006).

Viewing ethical orientations of justice (Kohlberg) and care (Gilligan) combined with the multifactorial approach of empathy (cognitive and emotional factors in complementary relationship) the dominant perception of ethical development of preschool children is weakened. While, namely, in Kohlberg's terms of *moral judgement* preschoolers are placed in the pre-conventional stage as "not ethical ", conversely, in terms of care, children are characterized as "ethical". Preschool children, who meanwhile have attained the cognitive skills of distinguishing themselves from their environment, of role-taking, especially emotional role-taking, have the ability to take the perspective of others, to feel their emotions and express interest in their condition.

These findings support the view that preschool children develop the ability to diverge from egocentrism, opposite to what was the dominant view for many years. More specifically regarding the categorization of the sample's responses, the answers that fall into the category of *Environmentally Anthropocentric Orientation* are in favor of environmental protection for anthropocentric reasons. The environment must be protected because it has instrumental value, it is a natural resource:

> "*Do not spend paper. ... I do not want to spend paper because the forest will not have trees. There will be no apples for the children to eat*" (B10) (because human health and the preservation of life depends on it)

> "*I would get a bag and put them in the bag [the garbage], because when the forest becomes dirty we will not have oxygen*" (G2).

The pleasure offered by the natural environment and its beauty are additional non-utilitarian reasons to protect it:

> "*It is better to hear a little bird sing than have a cassette player scream. The birdies will get scared because that is not their own sound. ... It is bad for us because it will frighten them, they will leave and we will not have birdies. And for them it is also bad because then they will not be able to sing*" (B3).

The simultaneous presence of two subcategories in a child's answer occurs both in the initial interview and the final interview where the value of the natural resource (C.I.1) is combined with the value of health (C.I.2) (also see table 3):

> "*I don' t want to waste paper, I don' t want to waste trees. They bring fresh air, all the good things, a lot of good things they bring*" (B8).

In quantitative terms, in the initial interview the subcategories C.I.1, C.I.2 and C.I.3 of Table 3 show very low frequency in the total of 147 responses. In the second interview subcategory C.I.1 remains stable, C.I.2 increased more than sixfold its answers and C.I.3 increases them considerably, as shown in Figure 2.

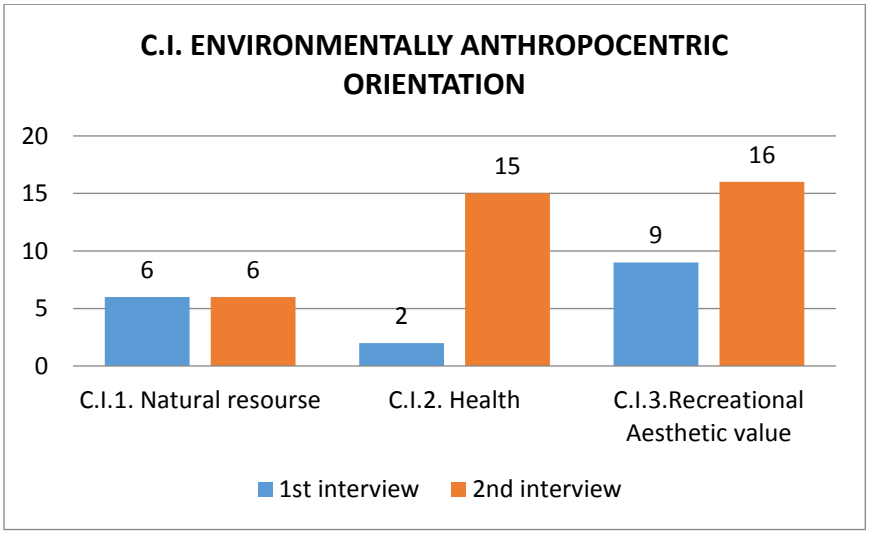

Figure 2: Anthropocentric Orientation, experimental group

In qualitative terms, the responses of the other two subcategories differ in their content in relation to the initial interview, i.e., they are much more comprehensive in the final interview. For example, subcategory C.I.3 (referring to the Recreational- Aesthetic value) included answers concerning human interests such as:

> ”It is not right to throw them on the road. The whole field will become dirty. If it is dirty, we cannot sit down to play” (initial interview, B6).
>
> Which was transformed as follows:
>
> “I do not want to throw down rubbish and make the forest dirty. I want to go with my parents, see the animals, eat and throw them in the rubbish bin, not down” (final interview, G3).

There was a significant increase of anthropocentric orientation responses in the final interview, especially in the subcategories "Health" and "Recreational-Aesthetic value". The development of anthropocentric values, we reckon is due to the attainment of the cognitive objectives of the program, which were incorporated in the planning in order to support the emotional goals. For example, the increase of the number of responses referring to "Health" is associated with the realization that the quality of human life depends on the quality of the wider environment. That realization came after the children were informed on the consequences of a potential environmental impact.

The *Environmentally Ecocentric Orientation* is the category which refers to recognizing the needs of non-human beings and to expressing interest in satisfying those needs by the children. In this category, associated with the main objectives of the program, responses that support the protection of the environment for reasons connected with the environment itself are included, such as interest in the presence of other forms of life (see Table 3 - C.II.1):

> "[*I don’t waste paper in order] to have trees, [because] there, the nests of birds are*" (B9),

recognition of the inherent value of non-human forms of life (see Table 3, C.II.2):

"*I do not want to step on ants because they also have a heart, a little one*" (B10), and

development of empathic relationship with non-human forms of life, emotional arousal and intention for personal action (see Table 3, C.II.3):

> "*I must not play music loud and deafen the animals. Because it is not very good to scare all the animals when we play loud music. It matters, when we frighten the animals, this means that something bad comes to the animals... and I don't want that*" (B6).

The simultaneous presence in the same answer, of two different responses which were classified in two different sub-categories was very common in this category, especially in the final interview answers. The most common such combination was when the interest towards other forms of life is expressed through emotional statements (C.II.1-C.II.3), such as:

> "I wouldn't play music because it's scary for the birds, because I love them a lot" (B4).

The intention to take action is often associated with identifying the intrinsic value of other beings (C.II.2-C.II.3):

> "*It's a pity to step on the little animals and the little flowers, then they wouldn't have lives*" (B3).

> "*It is not good to kill little animals and flowers, we water them, we feed them. I want to take care of them*" (B6).

The simultaneous presence of both the intrinsic value of non human beings and the interest in other forms of life (C.II.1-C.II.2) is also frequent:

> "*I like to do lots of flowers on a few papers so I don't spend paper, because then the trees will cry. I care because they have a soul too*" (G6).

The "interest towards other forms of life" was quite common to begin with (C.II.1 in Table 3) and it attracts twenty three responses before the implementation of the program, followed by forty-four responses at the final interview. The ability of preschool children to take into account the perspective of other forms of life (ie. the visual, cognitive, and affective aspects of life- see a relative review of the perspective taking in Mori and Cigala, 2016) and show interest[xi] in their situation is one of the key findings of this research, which is consistent with other recent research (Radke-Yarrow & Zahn-Waxler, 1984; Pearl, 1985; Eisenberg, 1989; Denham, 1998; Karniol, 2012; Gunindi, 2015[xii]; Hergovitch et al., 2002[xiii]). The literature review justifies the belief that young children, although they may have difficulty in differentiating between the needs of others and their own, when assisted to realize it, they can develop an altruistic behavior (Pearl, 1985; Herot, 2002, p. 173; Cigala, Mori and Fangareggi, 2015; Bhavnagri and Willete, 2011; Webster-Stratton and Reid, 2003). The survey by Stewart and Marvin (1984), which concerned the interest expressed by three-year-olds and four-year-olds and the care for their baby brothers and sisters, shows a positive correlation between preschool age children understanding the perspective of babies and care offering (see also Thompson and Thompson, 2015; Hinnant and O'Brien, 2007).

Preschool children can empathize with other people (Sallquist et al., 2009), learn to identify the feelings of others (Mortari, 2011) and be more socially sensitive (Findlay, 2006), as they express concern and interest in the feelings and perspectives of others (Baldwin, DaRos-Voseles and Swick 2003; Goleman, 1995; Ornaghi, Brockmeier and Grazzani, 2014).

Moreover, the ability of young children to care for other beings (human and nonhuman) appears to be an emotional skill which can be cultivated. This of course is clear from the responses of the experimental group and the control

group in the final interview. Especially in regard to the subcategory "interest in other forms of life" the two groups differ significantly, not only quantitatively but also qualitatively.

The intensity of interest and the emotional involvement that is expressed from one side by the children of the experimental group and from the other with moderate statements by the children of the control group become apparent in the examples described in Table 4.

We observe that the control group is interested in the proper functioning of the ecosystem and the physical needs of other beings. This is unlike the experimental group where the children's interest extends to the emotional needs of other beings. Also the intention to take action, the emotional activation of children and the emergence of the value of the ecosystem arise[xiv].

Table 4
Qualitative differentiation E.G. - C.G. in C.II.1 after the intervention

Experimental group	**Control group**
[I prefer not to light up fire to barbeque in the forest] for several reasons, [I want] to have flowers and water them, we will not have oxygen [if the forest is burned], (…) [birds] they have no nest, they will cry the whole winter, we don't want them to cry (B9).	I do not want to destroy the flowers because bees go in and take their pollen.
Because the birds will have nowhere to build their nests (G8).	In order not to cut the trees, to let them grow.
In order not to disturb the animals because I love them too (G3).	For the little birds to not leave.

In the final interview, all subcategories of "Ecocentrism" exhibit a high frequency and contain many more responses than those of the initial interview, as shown in Figure 3.

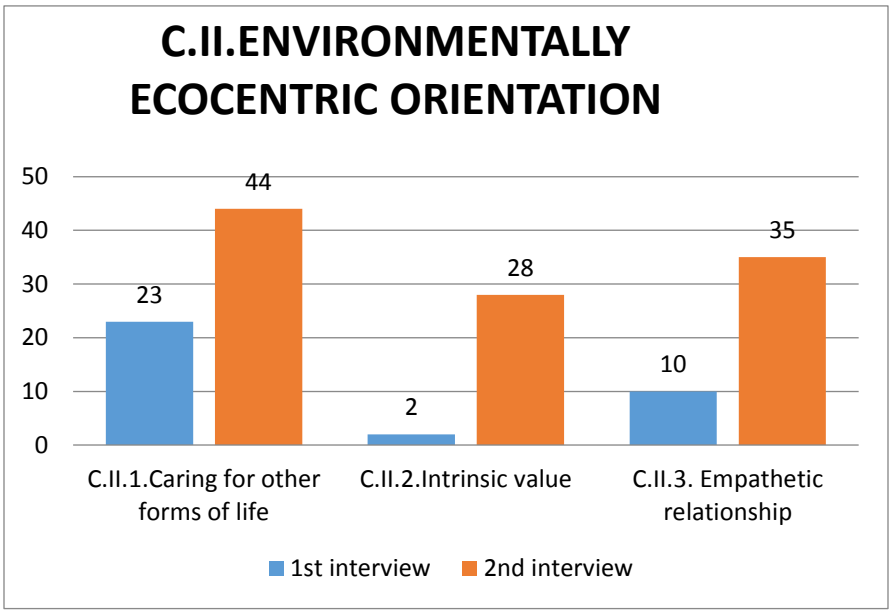

Figure 3: Ecocentric orientation, experimental group

In this research work, we mainly intended to develop the "empathic relationship" (C.II.3 in Table 3) and the planning of the intervention was designed accordingly. The difference between the number of the experimental group

responses of the initial interview (10) and the ones of the same group in the final interview (35) confirms their emotional activation. Children express themselves in the first person singular, which we considered as a sign of involvement and awareness of their actions' consequences and of their disposition to take personal responsibility.

Interestingly, a similar investigation by Kellert (1985) provided evidence that preschoolers do have emotional predisposition for the protection of non-human forms of life. More specifically, his cross-age study on the attitudes of children towards animals showed that children initially care for animals and justify that on emotional grounds, but later on they justify their care on ethical and ecological grounds.

The impressive presence of the subcategory of "intrinsic value" (see Table 3- C.II.2) in the children of the experimental group at the final interview confirms the development of environmentally friendly values. The content of the activities (which emphasized animals and trees "coming to life", their needs and desires) seems to have strengthened the functioning of the animistic character of the children's thinking at this age. Such anthropomorphism seems to have generally positive results; it is associated with empathy (Apostol, Rebega and Miclea, 2013; Chan, 2012; Tam, Lee and Chao, 2013) and leads toddlers to spontaneously recognize intrinsic value in trees and animals, which is probably the most disputed value within Environmental Ethics.

Additionally, the increased frequency of the subcategory "empathic relationship" at the final interview probably is due to the efficiency of empathy building methods, which were incorporated in the planning of the program. The development of the perspective of other people through role-taking is supported by a series of studies (Feshbach, 1982; Kalliopuska and Tiitinen, 1991; Diamond and Carpenter, 2000, p. 82; Shvedovskaya and Archakova, 2015, p.37; Tse, 2006, for children with disorders; Hess, 2006, for special needs children). Such methods are effective because they enrich the participants in cognitive and emotional elements (Damon, 1988). These techniques have been implemented by many well known programs such as "The Child Development Project", which stresses the role of literature as a means of identification with the main characters and thus of empathic skills development (Battistich, Watson, Solomon, Schaps, and Solomon, 1991).

Children who role played animals or responsible citizens involved with environmental issues during games, perceived the animals' point of view, recognized their emotions and consequently cared for them and protected them. Staub (1971) and Iannotti (1978) reported that children practiced role-taking with simulation games or improvised and acted out narratives, while the program of Kalliopuska and Tiitinen (1991) with children aged six and seven years old, combined practicing roles and storytelling leading to perspective taking of the "other" (McGinley and Carlo, 2007, p. 339; Mabry and Bhavnagri, 2012). Reduction of aggressive behavior and a corresponding increase in prosocial behavior was observed in children aged six years old who participated in activities recognizing emotions and exchanging roles (Feshbach, 1982). Additionally they used puppetry to play altruistic scenes, which they had previously watched on a television program (Radke-Yarrow et al., 1983).

Conclusion

The experimental group responses have changed between the initial and the final interview, whereas the control group ones remained the same. That fact is attributed to the participation of the first and the non-participation of the second in the experimental intervention. The experimental group was exposed to the natural environment (experiential component), it was provided of direct information in a slogan form (inculcation), its members participated in emotional role-taking (with empathy development techniques), they developed awareness of the consequences of their actions to the forest (inductive discussion), they were facilitated to take decisions while facing moral dilemmas (moral development) and developed the ability to diverge from egocentrism and show consideration for *others* and their needs. In this case the "Others" were non-human beings and thus the "ecocentric orientation" was developed. The same children were able to take responsibility and to proceed to environmentally friendly action (Newhouse, 1990). Such a multifaceted pedagogical approach is conducive to the development of environmental values and the progress of child morality.

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Footnotes

[i] Instrumental value is the value attributed to something which is used as a mean to an end. Retrieved from https://www.khanacademy.org/partner-content/wi-phi/wiphi-critical-thinking/wiphi-fundamentals/v/intrinsic-extrinsic-value, 6 January 2017.

[ii] The intrinsic value of something is said to be the value that that thing has "in itself," or "for its own sake," or "as such," or "in its own right." Retrieved from https://plato.stanford.edu/entries/value-intrinsic-extrinsic/, 28 December 2016.

[iii] The connections between nature and woman at an ethical level are illuminated by Carol Gilligan (1982) through her book *In a Different Voice*, where she laid the foundations of the *Ethics of Care.*
Caring is the feminine way of approaching things and is associated with the tendency of women to recognize themselves in relationships, in affection and responsibility networks. Caring is determined by reference to the well-being of people in relationships (Vreeke, 1991) and is not limited by reciprocity. The same belief in the value of relationships networks between beings is expressed by Niebuhr, as cited by the Scoville (1995).

[iv] The ability to adopt a role appears from the age of two, especially for people who are familiar to the pupils, therefore their perspective is known to them, but it is often not detected because surveys only measure cognitive and verbal ability.

[v] Affective role-taking refers to the understanding of the emotional state of another person. Perceptual role-taking rather concerns the perception of different experiences of space, while cognitive role-taking is associated with understanding the other's way of thinking.

[vi] The ethics of nature should, rather than rely on impersonal, universal, theoretical moral concepts called rights, probably pay more attention to moral concepts such as respect, sympathy, interest, gratitude, friendship, responsibility.

[vii] In connection with the empathy of adults towards animals, researchers are wondering about the widespread skepticism concerning the mistreatment of animals which is still alive (Aaltola, 2013). They refer to the "liberated feminine empathy" towards animals (Phillips et al., 2011), the increased empathy of veterinarians to cattle (Norring, Wikman, Hokkanen, Kujala, and Hänninen, 2014; Wikman et al., 2013), of women and the elderly to goats (Muri and Vale, 2012). Also the relationship between the interest towards animal welfare and the economic crisis has also been investigated (de la Lama, Genaro, Sepulveda, Villarroel, and Gustavo, 2013).

[viii] Inductive is the discussion which beginning from particular instances leads to the formation of general rules. The Oxford English Dictionary (OED Online, accessed October 20, 2012) defines “induction,” in the sense relevant here, as “the process of inferring a general law or principle from the observation of particular instances (opposed to deduction n., q.v.)”. Retrieved from https://plato.stanford.edu/entries/induction-problem/#ConNotInd, 28 December 2016.

[ix] While in the initial interview Environmental Ecocentric Orientation (C.II) had collected thirty-five (35) responses, in the final interview it reached one hundred and seven (107) responses.

[x] Decentration includes an understanding of how others see the world and seeing how we differ

[xi] According to a research work (Howard Vick, 2010), insects receive the most negative verbal and nonverbal responses, whereas a real dog was viewed much more positively.

[xii] Children were requested to draw a picture related to the value of affection and explain it (…) they generally depicted (…) animals like butterflies and dogs, trees, flowers and grass.

[xiii] The presence of a dog fostered the development of a better segregation of self/non-self, which is the foundation of sensitivity towards the needs and moods of other people. Also empathy with animals was developed.

[xiv] From the answers of the children of the experimental group (Table 4) it is revealed the interaction of birds with the trees of the forest. The emergence of the value of the ecosystem is established on this basic awareness of interdependence.

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Adult Perspectives on Structured vs. Unstructured Play in Early Childhood Environmental Education

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ABSTRACT

In this research report, the authors explore an early childhood center as it transitions from a traditional playground to an outdoor classroom. Herein, the first phase of this qualitative research project is introduced and a central finding of adult perspectives is explored. The tension inherent in the various adult perspectives concerning the extent of structured lessons versus free play is exhibited. This finding has resonance within the larger literature concerning open ended and pedagogical play and further reveals the differing goals for children's outdoor experiences from teacher, administrator, and parent perspectives.

Key Words: Young Children, Outdoor Play, Open Ended Play, Pedagogical Play, Adult Perspectives

In this article, we explore the perspectives of adults concerning outdoor experiences and play of children at an early childhood center. The data explored here forms the first part of a larger study in which play and outdoor learning is being investigated as the early childhood center is transitioning from a traditional playground to an outdoor classroom. This report focuses on the initial phase of research and provides early insights into the larger question of how children engage in outdoor play.

The early childhood center sits on the campus of a mid-western state university in the United States and has approximately 150 children ranging in age from 18 months to 6 years old. At the time this first phase of research was conducted, the center was transitioning from a traditional playground with swings and slides to a more intentional outdoor learning environment with natural building materials, garden plots, logs for balancing and stacking, and a stage. We were curious how this change in space would impact the ways children played and learned in the outdoors, and how the role of adult interactions and perspectives impacts outdoor learning for young children. A central concern of ours throughout the research has been the interplay between play-focused learning and more structured and intentional learning embedded in the outdoor learning environment and how children and adults perceive and make sense of these two elements of education.

We provide a short review of the literature concerning early childhood outdoor education and an explanation of our research methods and process. Subsequently, we explore a salient finding that emerged from the parent questionnaire and teacher interviews and which provides interesting points of divergence between parent and teacher perspectives of structured v. unstructured play.

Literature review

Our study finds relevance within a larger discourse concerning open-ended play v. pedagogical play and particular critiques of open-ended play along cognitive and culturally relevant practices (Cutter-Mackenzie & Edwards, 2013). Pedagogical play consists of multiple forms of intentional educative activity, all of which offer potential meaningful opportunities to engage children in developing awareness and understanding of their world (Woods, 2010; Cutter-Mackenzie & Edwards, 2013). There is a tension therefore between advocates for less structured outdoor experiences and those that have an intentional educative purpose. As Cutter-Mackenzie (2007) stresses, "the practice of environmental education requires a delicate pedagogical balance of knowledge, values, and action in the experience of environmental education in early childhood education" (p. 1996). This balance requires educators to consider pedagogical, cognitive, emotional, and physical responses of children to either open-ended or pedagogical play and recognition that environmental learning necessitates both teacher directed and unguided experiences in outdoor spaces (Tranter & Malone, 2004). Inherent in these ideas is the exploration of the importance of intentionality of adult engagement with children to support the learning process. For the purposes of this study we are interested in research that demonstrates centrality of adult interactions with children during outdoor play and how adults perceive their role in these experiences.

This intersection of adult perspectives and children's experiences in outdoor learning presupposes that the outdoor environment itself plays a role in the learning of children. In this regard, the perspectives of adults in the creation of outdoor environments can affect the subsequent experiences of children, (Moore & Wong, 1997; Kiewra & Veselack, 2016) who read schoolyard landscapes recognizing dominant adult values (Gamson Danks, 2014). Tranter and Malone (2004) share this concern for how adult oriented goals affect children's learning in their inquiry of the use of space by children related specifically to school grounds. Along these lines, the structured outdoor environment may create tension between adult oriented goals and children's interests and potential for creative engagement with nature (Johnson, 2000) or conversely, may foster keen interest in natural environments. The present study offers a unique exploration of how the outdoor environment can affect both the practice of educators and the environmental experiences, social learning, and engagement of children. As we detail below, our exploration begins with investigating the adult attitudes and perspectives for outdoor learning as the transition to an outdoor classroom commenced.

METHODS

Within this first phase of data collection, open-ended parent questionnaires and one-on-one semi-structured interviews with teachers and administrators were conducted. For both the questionnaires and interviews we sought to learn the perceptions and attitudes of adults concerning early childhood outdoor experiences. As such, we were interested in early experiences of these adults and how that might impact their present day attitudes. During analysis, we began by exploring through open coding first the questionnaires and subsequently the interviews. We developed a master code list for both sets of data and then returned to the data to reread transcripts for accuracy. We examined the codes for patterns of correlation and created categories of affiliated codes. From these categories we looked for relationships among them to generate themes that emerged out of the data.

FINDINGS

In comparing parent responses with teacher responses, a central finding emerged concerning varying attitudes of structured v. unstructured outdoor play. This finding offers insight into adult perspectives concerning outdoor learning for children at the early childhood center. The majority of parents responded that they were indeed hoping that the new outdoor classroom would create more opportunities for intentional environmental learning. Below are some representative examples of parent responses to questions from the questionnaire related to expectations for outdoor experiences for their children at the early childhood center:

> "Not a free-for-all, not let them loose, organized games"

> "Exploring. Learning to respect and care for the natural world. Exposure, curriculum to local plants and animal species."
>
> "Playing, but also some structured learning as in a classroom."
>
> "Learning about nature. Hands-on environmental education."
>
> "Hands-on interaction with both the familiar and the strange would be great. Not just outdoors as recreation space, but as a living space of plants, animals, rocks, etc."

Within these statements there is concern for time spent playing, but also guided activities that foster environmental awareness and concern. This was less a concern from the teacher perspective. Environmental awareness and intentional instruction in ecological learning was not a primary goal for teachers at the center. This could be related to lack of training or inclination, although there was a near universal awareness of the importance of having outside experiences that were unstructured and peer focused. This stemmed from teachers own experiences as children in which they were often unaccompanied by adults as they rambled around forests and fields. Referring to these memories, one teacher explained that, "we lived on a farm. It [outdoor play] wasn't anything structured by any means. We lived by a river. We went down to the river by ourselves. We were never supervised (laughter), down at the river. We just played down there. It was a shallow river, but, yeah, we spent a lot of time outdoors. Probably way more than kids do now." One of the administrators had a similar set of experiences as a child, stating, "I grew up on a farm that had 480 acres, and as long as I could see the silo, I was free to be. I had to be home when the yard light came on." These stories from childhood were pervasive among this group of teachers and there is apparent a connection between these experiences and their eventual concerns as practitioners when discussing the structured environment of outdoor play.

In response to questions related to the eventual transition to an outdoor learning environment there was some apprehension from the perspective of teachers. Part of this concern stemmed from concerns of continuations of classroom learning in the outdoors. "They want an outdoor classroom, but I feel like there also needs to be time where it's not so structured. I feel it's very structured." Another teacher likewise shared this concern by stressing that "hopefully, they will have more purposeful interactions and learning will take place. That's all great, well, and wonderful, but I think that there needs to be a space where structured learning isn't taking place." As a way of explaining a lack of intentional pedagogical play, a third teacher explained that as a child "you're not relying on an adult to help you learn or tell you what to do. I think it's really important, especially with kids to just step back and watch them do their thing."

An interesting counter position among staff at the center came from a newly hired administrator, who contends it is important to stress, "that this is an outdoor classroom. We're not building a new playground. That it's not a downtime. That it's not a time that you [teachers] get to just sit back and watch them run. There's intentional learning going on and intentional activities." This would appear to suggest that there is foreseeable tension ahead as the playground transitions to an outdoor classroom.

REFLECTIONS

At this point, we are left wondering how all this will impact education in outdoor environments for the children at the center. How can we reconcile the need for intentional environmental education with the need for unstructured childhood play? There are notable contrasts between the goals and expectations among parents, teachers, and administrators that will play out in the outdoors. The concern of teachers that the new space would be too structured and require more adult supervision or intrusion is juxtaposed with the parental expressions of a need for intentional environmental lessons that encourage children to develop appreciation and awareness of the natural world. How can environmental education be integrated within a play-based curriculum?

These are tensions and questions at the heart of our continued research and which have aided us in developing particular strategies for data collection that enlarges our awareness of these dynamics. Because we envision

qualitative research as an iterative process, we are guided by this early investigation of adult perspectives. As such, we will continue to account for adult perceptions but will additionally bring in children's ideas and views. To better understand these issues in a holistic way, the next phase of research will include observations of children in the existing playground, and subsequent observations, interviews with teachers and children, and questionnaires of parents after the transition to an outdoor classroom. Thus, we will continue to explore this dynamic between various forms of outdoor play and learning. Yet, what adults talk about in questionnaires and interviews will be supplemented through observations and interviews with children, allowing us to explore the actual practice of outdoor education and gain insight into what children make of it.

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