Interaction of Environmental Education and Montessori Pedagogy

By

Jennifer Rothmeyer

A Master’s Paper
Submitted in Partial Fulfillment of
The Requirements of the Degree of
Master of Science in Education – Montessori

_____________________________________________
Major Advisor’s Signature

_____________________________________________
Date

University of Wisconsin – River Falls

2019
Abstract

Research shows that environmental education and time outdoors increase social emotional, cognitive, and physical health. We know it’s important to start early and to use a holistic systems-based lens. While research is underway in traditional early childhood programs, research is lacking on how environmental education is implemented and practiced in Montessori early childhood programs. The purpose of the study is to integrate information on the philosophical underpinnings of environmental education with Montessori philosophy and pedagogy, create a questionnaire to examine the implementation of environmental education in Montessori early childhood programming, and pilot the questionnaire to gather information through educators’ responses to systems-based environmental education-framed questions on teacher’s understanding of environmental education, program and pedagogical practices, health promotion, social systems education, natural systems education, and barriers to implementation. Special attention was paid to constructivism, realism mixed with wonder, interdisciplinary practices, biophilia versus ecophobia, critical pedagogy of place, local versus global awareness, and the use of play. A pilot questionnaire was created and sent out via the Internet; 43 questionnaires were returned with sufficient information and analyzed using descriptive statistics and qualitative methods. The results are included in full to support continuing conversation about the interaction between environmental education and Montessori pedagogy. Final discussion highlights discrepancies between the philosophical foundations of Montessori pedagogy and environmental education and the reported practices.
Acknowledgements

This paper could not have been completed without the encouragement and support of Melina Papadimitriou, former director of the University of Wisconsin-River Falls Montessori Graduate Teacher Education Program and Dr. Kateri Carver, current director of the same program. Thoughtful guidance was also provided by second reader Linda Loomis of University of Wisconsin-River Falls, adjunct professor and Training Director at the Montessori School of Waukesha, and third reader Associate Professor Michael Miller of University of Wisconsin-River Falls. I’d also like to extend my gratitude to Cindy Goldade, adjunct professor at the University of Wisconsin-River Falls, for wonderful conversations regarding the implementation of Montessori philosophy and pedagogy in alternate program styles (such as family child care programs).

Without the support during my undergraduate work of Dr. Jodie Plumert of the University of Iowa and Dr. Josh Rodefer, then from the University of Iowa, I never would have dreamed I could finish research during my bachelor’s degree much less research during my master’s degree. Each spent many hours helping me learn the fundamentals of research and any unidentified weak areas in the following paper are definitely not due to their lack of trying.

To every educator working hard to better the world and to each of the participants who spent time filling out the survey and participating in this effort – thank you.

Last, I would also like to thank my husband Aaron Rothmeyer and my children Nathaniel, Samantha, Gabriel, and Cassiel Rothmeyer who gave up so much over the past two years so that I could pursue higher education. Without their support and encouragement, the completion of this project would not have been possible.
Interaction of Environmental Education and Montessori Pedagogy

In recent years, children have spent far less time outdoors than children of previous generations, are less active, and are less connected to nature (Frost & Sutterby, 2017; Martinez, 2011; England Marketing, 2009; Clements, 2004). This is happening despite our knowledge that there are whole-child benefits to spending time outdoors in early childhood for their health such as positive effects on cognitive, physical, and social emotional health. Children who spend time in the outdoors also become more environmentallly-literate citizens which can have implications on the long-term health of our society and world as they grow to become decision makers. In contrast to our knowledge of the benefits, the amount of time our children spend outdoors and our children’s understanding of the interplay between natural and social systems in the environment continues to decrease.

Most educators have a vague idea that children’s time spent outside and their understanding of environmental education are important, but they have barriers to educating children on the environment such as not knowing the method of instruction, not feeling competent in their own knowledge, licensing requirements that run counter to environmental education best practices, teacher education programs that omit environmental education, and finally, the unconscious effect of their own values and beliefs. Montessori educators, however, are expected to weave environmental education into the materials in the classroom, lessons, and prepared environment, although they may not be aware of the extent to which they do so and furthermore, many of the ways in which they support systems-based environmental education may not come from mindful intention.

While we have a body of research on the positive benefits of the implementation of a variety of environmental education practices (to include time spent outdoors and in nature), how
it is implemented in traditional early childhood programs, and how traditional educators feel about environmental education, we do not have research on these topics within Montessori programs. This research study was conducted in order to broadly explore the concrete interaction of environmental education and Montessori philosophy by examining practices and beliefs of Montessori-trained educators working in Montessori early childhood programs and comparing those practices to the philosophical underpinnings of both Montessori and environmental education.

Before describing the method of answering the research question regarding how Montessori-trained early childhood educators are using concepts from systems-based environmental education (see pages 71-72), this paper first explores Montessori philosophy and pedagogy as it relates to environmental education, interweaves the two into the traditional research on the benefits of environmental education and time spent outdoors in early childhood, examines the definitions of environmental education and related philosophies of learning in comparison to Montessori philosophy, and highlights barriers to implementing environmental education. The data instrument used to survey Montessori educators then uses all of that information to inform its creation as displayed in the comparison matrix within Appendix B.

When originally conceptualizing this research study, a holistic examination was initially intended based on:

- why environmental education should be implemented in Montessori classrooms,
- what framework would be used in implementation,
- when environmental education became important and how Montessori was placed within that,
- where practices occur inside and outside,
who would be most likely to practice environmental education based on their beliefs, values, training, and comprehension.

A smaller examination occurred as demonstrated in Figure 1.

This Research Study

While there is a wealth of research on environmental education in general, there isn’t a lot of information on the interrelation of systems-based environmental education and Montessori philosophy. There also isn’t much research on the implementation of environmental education in Montessori classrooms. Therefore, the purpose of this study was to tackle this lack of information by making philosophical connections between Montessori pedagogy and environmental education, providing baseline descriptive statistics and information on the interaction of environmental education with Montessori pedagogy, providing a voice for Montessori educators in the realm of environmental education, and supporting further research that includes comparison between non-Montessori and Montessori programs and refinement of environmental education processes in Montessori early childhood programs.

Research Question

How are Montessori-trained early childhood educators in programs or schools serving three- to six-year-old children, intentionally or unintentionally, using concepts from systems-based environmental education in their Montessori early childhood lessons, materials, and prepared environment?
Figure 1. An overview depicting which components of the relationship between Montessori philosophy and pedagogy and environmental education will be discussed within the context of the research question in this study.
Montessori Philosophy and Pedagogy

While Dr. Montessori’s emphasis on reality and nature is arguably not the first thing most people probably think of when bringing Montessori philosophy to mind (perhaps, instead, it’s more recognizable within Waldorf education), it is likely the most salient aspect of her work when viewing environmental education through the Montessori lens. This research study is firmly and holistically anchored in both Montessori philosophy and environmental education philosophies, intertwining the two just as Dr. Montessori saw mind and body as being integrated. Therefore, this section of this paper introduces Dr. Montessori’s philosophy and pedagogy, starting with her thoughts on reality and nature and continuing through the absorbent mind and sensitive periods, the importance of child-directed and meaningful work, the need to respect and follow the child, the role of the observant and knowledgeable teacher, significance of mind and body integration, and the prepared environment. While there are other characteristics of the Montessori philosophy, the ones highlighted in this section will be interwoven throughout the analysis of the interaction of environmental education and Montessori pedagogy and therefore understanding this philosophy is critical to being able to contextualize the results.

Reality and Nature

As referenced in the introduction, environmental education is inherently an important element of Montessori philosophy and pedagogy (Johnson, 2013, p. 39). Dr. Montessori encouraged educators to give children a wide foundation of the world around them, spending time with and connecting children to real and natural objects both inside and outside of the classroom (Montessori, 1909/1972, pp. 64-75). In Wings, Worms, and Wonder, Johnson writes that Dr. Montessori “strongly believed that a peaceful world will only come through a new style
of whole-child education which teaches compassion and connection to all living things” (2017, p. 15).

Regarding the use of reality in early childhood, Dr. Montessori believed that in the first plane of development, it was important to solidly ground the child in concrete reality before they moved to more abstract imaginative thoughts in the second plane of development (ages 6-12) (Lillard, 2017, p. 209). While some have viewed the stricture Dr. Montessori placed on fantasy and pretend play in early childhood as being a blanket dislike for all use of creative and imaginative skills, Dr. Montessori was not at all against the concept of imagination. In fact, imagination is the base of the elementary curriculum in the second plane of development (Lillard, 2013, p. 172) and a critical part of the child’s growth.

This discrepancy between Dr. Montessori’s beliefs and what critics think her beliefs are is easily explained by stating that Dr. Montessori felt that fantasy and imagination were two different concepts. Fantasy was based upon untruths or things that were made up and unreal, while imagination allowed children to understand larger concepts such as what the entirety of the planet may look like from space when their only concrete experience was with the soil under their feet and a simple globe (Montessori, 1949/1995, pp. 175-178). Before fantasy could ever become a part of children’s lives, Dr. Montessori felt, children needed to understand and have their roots based in reality (Lillard, 2017, p. 213). In Lillard’s article entitled “Playful Learning and Montessori Education,” she states that children are misled by fantasy stories, show no preference between fantastical stories and real stories, and the research on the benefits of pretend play in early childhood is problematic (2013, pp. 173-174). Pretend play will be discussed more in the Montessori Philosophy subsection on child-directed and meaningful work and in the Defining Environmental Education subsection: Philosophies of Learning on the use of play.
When discussing time spent in nature, Dr. Montessori wanted children to experience different elements of the natural world on their own terms, slowly stopping to examine the world as needed or even rushing ahead up a hill. She wrote, “[W]hen children come into contact with nature, they reveal their strength” (Montessori, 1909/1972, pp. 64-70). Dr. Montessori observed that taking an active role in the care of animals and plants fills children with delight (Montessori 1909/1972, p. 71), and they were more interested in the activities that had clear results such as harvesting (Montessori, 1909/1972, pp. 72-73). Other activities that children enjoyed included: searching for fragrant plants and then sorting them and gathering them; varied purposeful activities (as opposed to activities that had no clear purpose or meaning); classifying and learning the shape of plants and animals; and the act of caring for an edible garden (Montessori, 1909/1972, pp. 72-75).

In The Montessori Method, Dr. Montessori describes five gradations of nature in education. First, the child is allowed to observe plants and animals and over time, the child may become more interested in the care for the living beings and in turn become more appreciative of the care given to him or her. Second, the child learns more about the plants by watering them and more about the animals by feeding them – or perhaps the natural consequences of what happens when you don’t do either. After being engaged in these activities for a while, the child may find new baby animals or perhaps discover that a flower blooms. Thus, the child learns how his or her care leads to new wondrous things. Third, the child learns patience and also “confident expectation” as he or she witnesses the cycle of nature several times. The child grows confidence in what his or her efforts will yield. Fourth, the child is inspired by nature and grows to love it. Fifth, the child grows to understand how all of what he’s learned before impacts civilization and vice versa (Montessori, 1909/2012, pp. 91-94).
Absorbent Mind and Sensitive Periods

Dr. Montessori explained that in what she called the first plane of development (from birth to age 6), children move from the unconscious absorbent mind to the conscious absorbent mind. During the unconscious mind (from birth to approximately age 3), children are taking in all of the information around them as a whole and then later, during the conscious mind (age 3 to 6), children are constructing and refining their understanding of the discrete parts of that whole (Montessori, 1949/1995, pp. 24-27, 62, 84-85; Lillard, 1972, pp. 36-37; Standing, 1957/1998). By the time the child turns three, Dr. Montessori noted, when the child is engaged in some activity, the child is beginning to make conscious information that the child had previously unconsciously absorbed (1949/1995, p. 27). Dr. Montessori often recounts her observations in story form, as she does in The Discovery of the Child when she reproves a teacher on the importance of allowing children to observe and experience the shape of a square as a whole before children are expected to count lines, examine corners, and otherwise break the shape into parts. She explains that before children can truly appreciate that information, they must first understand and experience the shape in its entirety (Montessori, 1909/1972, pp. 109-111).

Dr. Montessori believed that children were motivated internally to create this understanding of the world around them through the process of sensitive periods (Montessori, 1936/1972, pp. 37-48). In Dr. Montessori’s words (1936/1972, p. 38):

A sensitive period refers to a special sensibility which a creature acquires in its infantile state, while it is still in a process of evolution. It is a transient disposition and limited to the acquisition of a particular trait. Once this trait, or characteristic, has been acquired, the special sensitivity disappears. Every specific characteristic of a living creature is thus attained through the help of a passing impulse or potency. Growth is therefore not to be
attributed to a vague inherited predetermination but to efforts that are carefully guided by periodic, or transient, instincts.

Lillard explained that while the absorbent mind is the process of how children encode information into memory, sensitive periods describe the patterns children use to gain that information (1972, p. 36). According to Standing, children are driven instinctually and impulsively towards certain activities during the time in which they are in a sensitive period (1957/1998). Modern research seems to agree with Dr. Montessori’s observations and the subsequent explanations (Thomas and Knowland, 2009; Wilson, 1996). Thomas and Knowland (2009) concluded in their assessment of findings regarding sensitive periods in brain development, “Sensitive periods in brain development can inform educational policy by indicating the appropriate age at which academic skills are taught. The strongest evidence for sensitive periods in human development is in sensory systems” (p. 20).

As a momentary divergence, Dr. Montessori observed the importance of isolation of the senses while training the senses (Montessori, 1909/1972, pp. 101-102). Thomas and Knowland (2009) state that the high-level cognitive skills targeted in most education involves utilizing and integrating multiple systems which may have different sensitive periods. This, along with their observation that learning skills individually in an appropriate sequence is important for later development, helps put Dr. Montessori’s emphasis during the first plane of development into perspective. On p. 19, the authors write, “Within the constructivist framework, more complex or abstract skills are built on top of simpler, perceptually driven knowledge.” Dr. Montessori observed that training the perceptions first led to better integration later. The breadth of topics of her sensitive periods may have needed more research and may have needed further refined to the underlying perceptual tasks, but the overall concept itself was solid. In Montessori’s time, she
posited that children undergo several sensitive periods between ages three to six to include periods such as: sense of order, further acquisition of language (letter shapes and sounds, writing, reading), interest in small objects and details, refinement of senses, including fine and gross motor movements, and grace and courtesy - or social emotional development (Montessori, 1936/1972, pp. 49-70; Standing, 1957/1998, pp. 120-131).

**Child-Directed, Meaningful Work**

Dr. Montessori felt that children, at the time she was writing, were not given enough respect or taken seriously enough regarding their place in the world; children were mostly isolated from the adult life while simultaneously being expected to function within it using tools geared for adults (Montessori, 1936/1972, p. 205). Despite the way children were largely ignored or viewed as incapable, Dr. Montessori observed that children wanted to produce work of some sort, even though the goal of their work (the production and perfection of themselves) was different than the goal of an adults’ (the production of something for society) (Montessori, 1936/1972, pp. 190-198). It’s important to note that in Montessori philosophy and pedagogy, work is defined as any purposeful activity. Colloquially, work may infer intonations of suffering or of being burdensome, but in Montessori education, children are often happy and fulfilled while “working.” It is important, too, that children are able to self-direct and exercise their freedoms of choice, repetition, and movement. Freedom of movement will be discussed more under the subsection on mind and body integration.

**Freedom of choice.** Dr. Montessori observed that children preferred to select their own activities, engage with them for as long as they wished, and then put the materials from their activities back in their appropriate locations (Montessori, 1936/1972, pp. 120-121; Montessori, 1909/1972, pp. 96-98). Children developed sustained and focused attention as they interacted
with the didactic materials in the classroom and upon completion of their work with the materials, the children were happy, satisfied, rested, and fulfilled (Montessori, 1936/1972, p. 114). This observation was important because Dr. Montessori felt “[t]he first essential for the child’s development is concentration. It lays the whole basis for his character and social behavior” (Montessori, 1949/1995, p. 222). Dr. Montessori linked concentration to normalization, which was a term that could also be described as a child who is emotionally regulated and makes good choices (Lillard, 2017, pp. 115-116). According to Lillard, psychological research since the time of Dr. Montessori “does show that young children, when free to choose, make good choices among certain sets of alternatives” which included selecting material just above “their current level of competence” (2017, p. 117).

**Freedom of repetition.** Dr. Montessori also found that when given the opportunity, children would repeat the exercises multiple times and then stop on their own (Montessori, 1936/1972, pp. 119-120). She stated that “[r]epetition is the secret of perfection” (Montessori, 1909/1972, p. 92), and she supported children in acting out repetition to fulfill this need. The hope was that the more children worked with a material, the more they would discover the secrets inherent to that material, perfect their skills, solidify their knowledge, and create sensorial impressions of the material. Dr. Lillard writes, “[I]n repetition lies a human tendency to note and control error; this is necessary to doing things better, moving us toward the ideal” (2017, p. 121). As a child continues to work with the material, they start to note different extensions, variations, and connections that can be completed – with or without the assistance of a teacher.

That said, all freedoms in the Montessori classroom come with limitations as Dr. Montessori’s understanding and explanation of freedom was not unlimited, but rather was surrounded by and informed by an individual’s responsibility to himself or herself and others.
For example, before a child can choose a material, they must have received a lesson from an adult or another child on expectations around the use of the material. When in this lesson, children are also connected to the direct and indirect aims of the material to maximize its learning potential. These lessons assist the child in internalizing the objectives associated with the material, but after the lesson is over, the adult leaves the child free in choice and execution (Montessori, 1909/1972, p. 63). After the child has shown that they understand the original use, they begin learning variations and extensions to the material. Throughout the process, though, there is a difference in the rigidity of expectations among various Montessori teachers (Lillard, 2017, p. 216). Once individual children have mastered a work through repetition or the teacher has observed they are ready for the next material, children are then given a lesson on a new material. This continues throughout the classroom areas as all of the Montessori materials are logically sequenced based on a developmentally-appropriate progression of skills (Lillard, 2013, pp. 168-169).

While it can perhaps be hard to understand an environment where children are both self-directed and limited, it’s possibly only a difference of degrees from a traditional preschool which also has rules on the use of materials and which materials children are allowed to use. Another way to view the limitations placed on the materials is through the lens of creating necessary structure to support the children due to the sensitive period in early childhood of the child’s inner sense of order and also the emphasis in Montessori education on the development of self-discipline (Lillard, 2013, p. 170). Lillard further explains there are potential academic ramifications as well, “If a set of blocks is intended to convey dimensional change, using them to explore dimension systematically would serve their intended purpose and be beneficial, but using them to build a house might not,” and could potentially mean that the child would struggle later
with the mathematical concepts intentionally built into the material they were misusing (2013, pp. 170-171). Nonetheless, teachers may observe a child using the materials in a way that was different than presented; if the teacher feels the child is being constructive with the materials and it is creating a learning moment, the teacher may allow it (Lillard, 2013, p. 170).

**Respecting and Following the Child**

During the time period in which Dr. Montessori was conducting her observations and working with children, she felt that adults were repressing children unconsciously and that for children to fully develop into their best possible self, adults would need to change and truly see the child. The adult would need to shift her or his perspective to look out at the world from the perspective of the child (Montessori, 1936/1972, pp. 13-16). Dr. Montessori also felt that the psychic life of the child, the development in integrated tandem of the child’s mind and body, must be protected and surrounded by a supportive environment for the child to have her or his best possible future (Montessori, 1936/1972, pp. 19-20). In the first three years of the first plane of development, during the unconscious absorbent mind, Dr. Montessori expressed that the child was already constructing his or her psychic life even though the child could not communicate such. She expected adults to honor and respect the hidden inner life of the child (Montessori, 1936/1972, pp. 33-35). Dr. Montessori explained that “the education of early childhood should be based entirely upon this principle: assist the natural development of the child” (1909/1972, p. 144).

Dr. Montessori felt that adults should allow children to take the lead (within limitations, as expressed above): that adults should *follow the child* and never do for the child what the child could do for himself or herself. In *The Absorbent Mind*, Dr. Montessori contrasted her novel work to previous conceptions of the child by emphasizing the importance of the shift from the
belief that teachers are to serve the child’s body by doing things for the child to teachers serving the child’s mind by assisting the child in the acquisition of physical independence. Teachers are to respect that the child is capable of taking care of himself or herself and directing his or her own movements (1949/1995, p. 281). Hanscom in *Barefoot and Balanced* similarly states (2016, p. 59):

> Sometimes as adults, we feel like we know the best activity to help our children learn something new. However, if we simply step back and follow our children, they will often lead us to what is most interesting and meaningful to them. Just like everyone else, children have specific interests and are naturally curious about the world. They will ask questions, experiment with what they see, try to replicate what they learn in creative ways, and form important neural (brain) connections from their experiences.

This focus on “following the child” does not mean that children can run wild and do whatever they want. Dr. Montessori believed in the development of order, concentration, coordination, and independence, and she also knew the importance of inner discipline. In *The Discovery of the Child*, Dr. Montessori instructed, “We should therefore prevent a child from doing anything which may offend or hurt others, or which is impolite or unbecoming. But everything else, every act that can be useful in any way whatever, may be expressed” (1909/1972, pp. 49-50).

**Observant, Knowledgeable Teacher**

In Montessori philosophy, it is believed that there must be a spiritual preparation of the teacher – the transformation of the adult (Montessori, 1932/1976, pp. 149-153). Teachers are to examine their own prejudices, beliefs, and blind spots in preparation for the shift to see things from the child’s perspective, but even more, teachers are to accept and embrace an entire shift in
their role as well. Dr. Montessori explains on a basic level that in the traditional classroom, teachers are expected to move and use objects, but in the Montessori classroom, children are the ones who move and use objects (1909/1972, pp. 149-150). The primary roles of the teacher are instead to: observe the children; be knowledgeable about all of the materials in the classroom and their aims; internalize the scope and sequence of the materials; enticingly and charmingly provide lessons on the use of new materials and connect children to the materials; assist children or leave them be as the child requires; assist in the maintenance of order; act with tranquility, patience, charity and humility; see the child who will be and not the child who is; and assist children in navigating social interactions with grace and courtesy (Montessori 1909/1972, pp. 150-152; Montessori, 1949/1995, p. 276-286).

**Mind and Body Integration**

Dr. Montessori was convinced that if movement was not integrated with intellect, it meant that the child would be incomplete and would not reach his or her full potential (Montessori, 1949/1995, p. 152). She wrote, “[M]ental development must be connected with movement and be dependent on it. It is vital that educational theory and practice should become informed by this idea” (1949/1995, pp. 141-142). She thought it was obvious that the child could only develop his or her mind and construct himself or herself by using his or her body (Montessori, 1949/1995, p. 142; Montessori, 1936/1972, pp. 96-99, 100-102) and even stated in *The Secret of Childhood* that a human being’s “upper limbs become instruments of his intelligence rather than means of locomotion” (1936/1972, p. 81) as in other animals. Dr. Montessori explained that movement or physical activity was another technique to gather information, just like the ability to see or hear also gathered data for the brain to act upon (Montessori, 1936/1972, pp. 100-102). In *The Discovery of the Child*, Dr. Montessori explains
that every object in the environment can be moved and used in the pursuit of work because without movement, a child’s interest is superficial and the child will not have sustained attention (1909/1972, p. 104).

In training for Children’s House, the Montessori term for the 2.5-6 year old early childhood classroom, prospective teachers are taught to sequence motor movement activities in their lesson plans based on the typical progression of physical motor development; the child then uses those activities to help regulate emotions and prepare himself or herself for higher order work in the next plane of development. These motor skills progress from gross motor skills of the entire body to the arm and then to the fine motor skills of the hand. All motor skills are viewed as integral to learning and foundations for the future development of intelligence. Dr. Montessori observed that children could learn things much sooner if they were using their hands in a concrete fashion than if they were purely attempting intellectual abstraction (1936/1972, p. 82; 1949/1995, p. 172).

On an even higher level, Dr. Montessori felt it was vital to imbue the child with movement from a young age, because society as a whole was dependent on constructive movement; if “everyone stopped working [or moving with purpose] for a single month, mankind would perish” (Montessori, 1949/1995, p. 146). While we have moved increasingly to a technology-based environment, movement is still used throughout the day in a variety of professions to sustain and support society.

**Prepared Environment**

When Dr. Montessori spoke about the prepared environment, it wasn’t only in regard to putting materials into the classroom and making sure the pencils are sharpened. The concept of the prepared environment, too, required a shift in thinking on the part of the adult: educators
needed to think about the classroom differently. Instead of discipline being demonstrated by a child who sits quietly and unmoving in a chair at a desk that is bolted down, Dr. Montessori envisioned a space where children could build their skills and understanding without fear of reprisal using their freedoms of choice, repetition, and movement. To that end, Dr. Montessori sourced and created materials that had certain criteria to place within her classroom: (a) direct and indirect aims thoughtfully designed to assist the child in developing, (b) inherent control of error that the child could determine on their own, (c) aesthetic appeal to entice the child to the materials, (d) an active component with built-in movement of the body, (e) limited quantity to force the development of patience and require social behavior, (f) child-sized and lightweight furniture, (g) child-sized working tools, and (h) a goal of the creation of peace and order (Montessori, 1909/1972, pp. 48, 62, 104-105).

Dr. Montessori believed that in the first plane of development (age 0-6), children preferred to learn about and work with real child-sized materials in order to perform real tasks (Lillard, 2017, pp. 208-209). As an example, a child in the first plane of development may rather actually bake bread using child-sized tools than pretend to bake bread. This is one reason that Dr. Montessori eschewed toys, which are discussed more later in the Definition of Environmental Education subsection Philosophies of Learning on the use of play.

Some individuals observe that children are drawn to bright colors, noises, lights, and other sensory stimulation, and then conclude that teaching them in this manner is what is most effective. Dr. Montessori cautions, “Adults have taken it for granted that children are sensible only to gaudy objects, bright colors, and shrill sounds, and they make use of these to attract a child’s attention . . . But these violent attractions are external and transitory, and can be more of a
distraction than boon” (Montessori, 1936/1972, p. 67). Natural materials often provide lovely variation in colors, noises, and other sensory stimulation without being overwhelming.

**Benefits of Environmental Education and Time Spent Outdoors in Early Childhood**

Another critical piece of context to analyzing the results of the research question is understanding why Montessori-trained teachers might already be incorporating elements of systems-based environmental education in their classrooms - or, if they aren’t, why they may want to do such. Research has supported and found numerous cognitive, physical, social emotional, and world health benefits to spending time outdoors and being educated on the environment in early childhood. The results harmonize with Dr. Montessori’s beliefs and values who “stressed that immersion in nature is imperative for proper physical and psychological development” (Johnson, 2013, p. 39). In addition to the examination of traditional early childhood findings as highlighted in the research, this section also interweaves Montessori philosophy and pedagogy into each subtopic in order to show how these benefits relate to Dr. Montessori’s aims in early childhood.

While the two concepts of time outdoors and environmental education are intermixed throughout this section, they could be examined separately in future research since a child who is outdoors is not necessarily explicitly being educated on the environment and a child could be educated on the environment while not being outdoors. However, in practice, the two often go together – and the research reviewed below will demonstrate why it is important that they are entwined.

**Cognitive Health**

Children who spend time in nature having meaningful hands-on experiences understand the world around them more fully. As they take in all the information in the environment, they
are building their skill in sensory processing (discussed more in the next section), connecting deeply to the environment around themselves, and building cognitive skills such as attention, concentration, memory, reasoning, and understanding (Hanscom, 2016, p. 58; Louv, 2008, p. 105). Children with unstructured outdoor time become better problem solvers through developed skills in analysis, synthesis, and evaluation as well showing more mental flexibility (or creativity), engagement, and social skills (Hanscom, 2016, p. 93 and 168, Louv, 2008, p. 124).

When children are physically active, which will be discussed next, they are also improving reading, math achievement, and overall general intelligence (Hanscom, 2016, p. 168).

Basile (2000) discovered the importance of hands-on investigation in the outdoors when examining two groups of third graders for near and far transfer regarding environmental education, finding that children who participated in a hands-on outdoor nature investigation program had better far transfer and procedural knowledge transfer than those learning in the classroom. Near transfer is using knowledge from one situation to another where the two situations are very similar; far transfer is when the skill is used in both situations, but the situations themselves are not similar.

In Basile’s seven-week-long skill-based outdoor nature investigation program, students in the first group read and researched problems, posed questions, collected data in their schoolyard, and analyzed the data through graphs and charts. Children spent three to five days per week in the schoolyard and each week were given a different problem. In the second group, students were taught for seven weeks primarily in a classroom (with a once per week walk and one field trip) through books, art projects, worksheets, and activities.

Both groups were tested with video vignettes that were followed by written and oral questions. The two groups had statistically insignificant differences in near transfer, but it is
significant that the group taught with the outdoor nature investigation program in the actual outdoor setting was better able to demonstrate far transfer of knowledge than children in the classroom. Most interesting, though, was the difference between groups on procedural knowledge transfer; the children in the outdoor group were statistically superior at the task. Procedural knowledge refers to problem-solving and general-reasoning skills. Procedural knowledge “is an important element in environmental education for children as they move toward decision making, action, and citizenship” (Basile, 2000, p. 22). A limitation of this study is the lack of clarity on how much the outdoor environment contributed versus the skill-based investigation.

Dr. Montessori would not have been surprised by Basile’s research results. In *The Discovery of the Child*, she wrote, regarding how actual experience leads to building a child’s empathy toward animals, “[A] feeling for nature grows with exercise. We certainly do not communicate it by a pedantic description or exhortation made to a listless and bored child shut up within the walls of a room” (Montessori, 1909/1972, p. 70).

Howard Gardner is a well-known researcher in the field of education (both in support of his work on multiple intelligences and also criticism of the same), and according to Louv (2008), he recently added an eighth intelligence known as naturalist intelligence. In a quote cited by Louv, Howard talks about how people demonstrate aptitude at categorizing and distinguishing and he links the skill to our ancestors’ need to be able “to recognize carnivorous animals, poisonous snakes, and flavorful mushrooms” (as cited in Louv, 2008, p. 72). Louv then states that the Montessori movement “has made this connection for decades” (2008, p. 73), but that there needs to be more research done on this by neuroscientists. Louv lists out ten descriptors from Leslie Owen Wilson on this eighth intelligence:
1. Have keen sensory skills, including sight, sound, smell, taste, and touch.

2. Readily use heightened sensory skills to notice and categorize things from the natural world.

3. Like to be outside, or like outside activities like gardening, nature walks, or field trips geared toward observing nature or natural phenomena.

4. Easily notice patterns from their surroundings – likes, differences, similarities, anomalies.

5. Are interested in and care about animals or plants.

6. Notice things in the environment others often miss.

7. Create, keep, or have collections, scrapbooks, logs, or journals about natural objects - these may include written observations, drawings, pictures and photographs, or specimens.

8. Are very interested, from an early age, in television shows, videos, books, or objects from or about nature, science, or animals.

9. Show heightened awareness of and concern for the environment and/or for endangered species.

10. Easily learn characteristics, names, categorizations, and data about objects or species found in the natural world (as cited in Louv, 2008, pp. 73-74).

This list of characteristics of the eighth intelligence seems to match very well with Montessori early childhood classrooms with their emphasis on supporting children: in training the senses; in spending time with concrete, natural phenomena; in searching for and discriminating between patterns; in caring for plants and animals; by respecting the sensitive period for the sense of order; creation of books, booklets, and nature journals; by seeding the prepared environment
with real plants and animals, realistic models of plants and animals, and realistic books about the same; and by providing many opportunities to categorize and distinguish between plants and animals from the natural world.

Physical Health

Dr. Montessori was first a medical doctor, so it is no surprise that her writings regarding her empirical method of research often discuss physical health. Dr. Montessori observed that children have a need to move around (Montessori, 1936/1972; Montessori, 1909/1972). Without movement, children are often restless and agitated. It has been noted that children are more active when they spend time in natural settings (Howard Frumkin, as cited in Louv, 2008, p. 48) rather than in the classroom. This is especially true in unorganized play as compared to organized sports (Louv, 2008, p.48). When outdoors, children are strengthening their sensory system, gross and fine motor skills, and boosting their immune systems.

Sensory system and integration. Dr. Montessori was an advocate on the importance of the senses, writing, “The senses, being explorers of the world, open the way to knowledge” (Montessori, 1949/1995, p. 183). Dr. Montessori trained the sensory system by isolating the senses and repeating different exercises in order to increase skill in detection and differentiation, which is why the early childhood curriculum includes an entire area of the classroom dedicated to sensory training with didactic materials, called the Sensorial area. Dr. Montessori felt that “[t]he training of the senses must begin in the formative period of life if we wish to perfect them later through education and make use of them in any particular human skill. This is why such training should be begun in methodically in childhood and then be continued during the time when an individual is preparing himself through education for the practical life he will have to live” (1909/1972, p. 147).
Building skill in each sense alone, though, isn’t the end goal. Children also need to integrate their senses, and the outdoors is a wonderful place for this. “Nature is about smelling, hearing, tasting, seeing below the ‘transparent mucous-paper in which the world like a bon-bon is wrapped so carefully that we can never get at it’” (D.H. Lawrence, as cited in Louv, 2008, p. 58). Exploring natural materials and the natural environment allows us to engage in all of our senses effortlessly as natural materials often come with their own scents, visual stimuli, sounds, tastes, and textures in a way that is far different from a classroom filled with manufactured products with its windows shut to the birds and other natural noises outdoors.

Sensory integration is when the brain organizes all the different incoming sensations to form perceptions, behaviors, and learning (Ayres, 2015, pp. 5-8). Young children are still learning to integrate and organize their senses in order to understand all the information that is flooding their brain, which is why it is so important for children to be exposed to a variety of sensory experiences (Ayres, 2015, pp. 7-8; Hanscom, 2016, p. 55). As children integrate the incoming sensations, they gain information that helps them understand how to feel and act, creating regulation. Hanscom points out, “The calmer and more alert we are, the better able we are to process and organize our senses” (2016, p. 44). According to Roley, Blanche, and Schaaf (2001), this calming effect “leads to an organized and calm state that is ideal for promoting healthy sensory integration” (as cited in Hanscom, 2016, p. 99).

Beyond the five senses traditionally taught, those of visual, auditory, gustatory, olfactory, and tactile, there are at least two more senses early childhood educators should be aware of: proprioceptive sense and vestibular sense. “Proprioception is the ability to sense what different parts of your body are doing without even looking at them. The vestibular sense is your awareness of where your body is in space; it determines your ability to effectively navigate your
environment with ease and control” (Hanscom, 2016, p. 44). These two rarely understood senses are extremely important because combined with tactile sense, they form the “building blocks for emotional stability” (Ayres, 2015, p. 57). When these three senses are well-regulated, children are able to attend more and therefore learn more. While tactile and proprioceptive sense are touched on in the gross and fine motor skills section, the remaining senses will be further discussed below.

*Auditory and vestibular sense.* While outside, children are exposed to a varied amount of auditory stimulus whether it is from humans, animals, the environment, or machinery. According to Hanscom, listening to the sounds in the environment gives children a three-dimensional understanding of the space that they occupy, connecting them to the environment, and forming the precursor for effective interaction, speaking, reading, and writing (2016, p. 51). Children in occupational therapy sometimes listen to specially modulated music in order to improve their mood, attention, auditory processing skills, social interactions, and activity level; some sounds are even nature sounds (Hanscom, 2016, p. 102). Alvarrsson, Wiens, and Nilsson (2010) found that, in adults, a nature mix of fountain and tweeting bird sounds was perceived as more pleasant and resulted in faster recovery of the sympathetic nervous system after a stressful task than a road traffic mix louder than the nature mix, road traffic at the same dB as the nature mix, or quiet ambient noise primarily of a ventilation system. Children who are taking in these natural sounds that are more calming to the sympathetic nervous system will most likely be more regulated and ready to learn and will be developing their auditory sense simultaneously.

Dr. Montessori included audition in her pedagogy as well with a variety of materials, stating that hearing is a special sense that “can receive impressions only from movements going on about a subject” (1909/1972, p. 134). She believed that training hearing started with silence
and moved from detecting large sounds to discerning even the slightest of sounds around the child (Montessori, 1909/1972, pp. 134-135).

Closely linked to the auditory sense is the vestibular sense. Biel and Peske (2009) found that “the auditory system (network of senses) and vestibular system are housed right beside each other in the inner ear. Therefore, they can significantly influence one another. In fact, moving around stimulates the auditory receptors, and any time you hear a sound you also stimulate the vestibular (gravity) receptors. This is why moving and swinging are often good strategies to use to get children with speech and language needs to start vocalizing more” (as cited in Hanscom, 2016, pp. 52-53). Active play outdoors gives children plentiful opportunities to activate their vestibular sense through spinning, tilting, tumbling, rolling, swinging, and otherwise moving their bodies in all axes of direction, strengthening this sense, which builds a foundation for muscle tone, body posture, alertness, attention, balance, cross-body coordination, and eye control (Hanscom, 2016, pp. 49, 81-82). As discussed in the Mind and Body Integration subsection earlier, movement is an important part of the Montessori philosophy.

**Olfactory and gustatory sense.** The sense of smell (olfaction) and sense of taste (gustation) are known to be linked and are discussed together in this subsection for simplicity.

Dr. Montessori wrote that scents for exercising the sense of smell were less prevalent in the classroom and needed to be intentionally added (Montessori, 1909/1972, p. 120), but this is not necessarily true when outside in nature. Hanscom explains that new smells and tastes are just more available outdoors in the natural setting: “The smell of the various flowers and herbs, contrasting with the pungent smell of manure and soil, also expose children to a variety of scents” (Hanscom, 2016, p. 54).
Hanscom also explains that children who are involved in outdoor experiences such as gardening will be more receptive to sampling new smells and tastes, since they were involved in growing their own vegetables, berries, and edible plants (Hanscom, 2016, p. 54), which has also been found in research (Somerset, Ball, Flett, & Geissman, 2005; Chaufan, Yeh, & Sigal, 2015).

Kalich, Bauer, and McPartlin describe a program Kalich created entitled “Early Sprouts” which led to children being more willing to taste the vegetables by: growing bell peppers, butternut squash, carrots, green beans, Swiss rainbow chard, and tomatoes; implementing sensory and cooking lessons on the six vegetables; providing training and support for classroom teachers; and involving the family. They stated children even expressed “a greater preference for the six vegetables highlighted” (2009, pp. 50-54). This practice of involving children in the growing of food and sensorial exploration of the products in the hopes of increasing the likelihood that children will taste and consume the food is also the base of the USDA’s Grow It, Try It, Like It! preschool program and also the Minnesota Department of Health’s LANA: Learning About Nutrition through Activities preschool program.

Visual sense. Scientists have long observed that there is an “outdoor effect” where the amount of time you spend outdoors has a negative impact on myopia: that is, there’s some relationship with being outdoors that reduces nearsightedness (Ohio State University Center for Clinical and Translational Science, 2014). Hanscom explains, “Scientists feel that outdoor light may actually help preserve the shape and length of the eye during this growth period [between ages five to nine]. They also believe that the bright light of the sun may be a contributing factor—that the pupil of the eye will respond better (open and close more effectively) if exposed to natural light on a regular basis” (Hanscom, 2016, p. 100). The National Eye Institute states that with the prevalence of myopia increasing in the U.S. and worldwide, prevention involves
more time outdoors; Taiwan made it a mandatory part of school curriculum and since, children’s vision has improved (2017).

**Gross and fine motor skills.** In *Balanced and Barefoot*, occupational therapist Angela Hanscom asks us to imagine a child walking across a decaying log that crosses a marsh where the surface of the log changes in density, texture, moisture, and angle as the child is crossing it; her senses are deeply engaged as she wonders if she is going to fall. “Walking on the log not only ignited all of her senses at the same time, but it also challenged her to react, tested her balance, and required that she learn to persevere in the face of difficulty” (Hanscom, 2016, p. 94). Active play outdoors, such as in the aforementioned situation, gives children opportunities to interact with varied surfaces and sensory experiences that are not as frequently found in indoor classrooms, providing unpredictable gravitational loads that result in improved gross motor strength, a stronger proprioceptive sense, and better body awareness. By strengthening their legs, arms, stomach, and back through continual practice throughout the day, children develop better looking and listening skills, more accurate and efficient body movements, and better balance and agility (Hanscom, 2016, pp. 32-35, 40, 78-81). Increased core strength and shoulder stability also leads to increased fine motor skills (Hanscom, 2016, p. 41). Strengthening all of these muscles as well as integrating senses through the impact and activation of proprioceptive sense will lead to better emotionally-regulated and capable children.

Dr. Montessori likewise felt that the refinement of gross and fine motor skills was an important part of early childhood. Regarding tactile sensation, she wrote, “[T]his habit of touching everything . . . is the obvious expression of a very keen muscular sensibility which a small child possesses at the period in his life in which the basic coordination of his movements is being fixed” (1909/1972, p. 117). Stereognostic exercises, therefore, are an important part of
Montessori pedagogy in early childhood and bolster tactile sense (Montessori, 1909/1972, pp. 116-120). The importance of movement itself was described earlier in the subsection on mind and body integration, which also assists in gross and fine motor skills.

**Immune systems and other.** Healthy bodies and immune systems are vital in education and both are supported by time outdoors. According to microbiologist Mary Ruebush, “What a child is doing when he puts things in his mouth is allowing his immune response to explore his environment. Not only does this allow for ‘practice’ of immune responses, which will be necessary for protection, but it also plays a critical role in teaching the immature immune response what is best ignored” (as cited in Brody, 2009). Okada, Kuhn, Feillet, and Bach compiled data in their 2010 paper about the hygiene hypothesis that explained that early exposure to certain microbiota may have a protective factor against autoimmune and allergic diseases.

It’s not just exposure to germs and dirt that help; other body systems are affected by time outside as well. Children only need to spend five to thirty minutes twice a week in the sunlight to have adequate vitamin D synthesis which assists with stronger bones (National Institutes of Health, 2018; Hanscom, 2016, p. 80). According to Hanscom (2016), regular movement increases blood flow and oxygen intake which activates children’s lymphatic system helping to rid the body of toxins and waste (p. 83).

**Social Emotional Health**

The benefits on social emotional health of children spending time in the outdoors has been well researched and explored. Only a very small portion of the research will be highlighted in this paper.
Psychosocial wellbeing. Spending time outdoors and building a connection with the environment has positive effects on psychosocial wellbeing. Psychosocial wellbeing is a combination of our thoughts, emotion, behavior, relationships, traditions, and culture interacting for holistic health wherein we feel like we have a meaningful social role, feel happy and hopeful, have positive relationships in a supportive environment, and have appropriate life skills. It is not just a measure of what’s inside us, but also of what’s outside – our relationships with others. On a very philosophical note, Louv writes, “Nature—the sublime, the harsh, and the beautiful—offers something that the street or gated community or computer game cannot. Nature presents the young with something so much greater than they are; it offers an environment where they can easily contemplate infinity and eternity” (2008, p. 98).

Robinson and Zajicek write in their article detailing a one-year school garden program with elementary students that school gardens have the capability to create an environment where children: learn delayed gratification, independence and motivation; feel valued and that they belong; and experience hands-on skills they will use throughout life. After their experiment, they found that the children engaged in the school garden had significant increase in working with others, self-understanding, and self-esteem (2005). This was also found by Somerset, Ball, Flett, and Geissman who commented that teachers commonly reported an increase in self-esteem and confidence by children who were involved in the garden (2005). As mentioned before, Montessori felt that using real child-sized tools was beneficial to a child’s independence and self-esteem – Block, Gibbs, Staiger, Gold, Johnson, Macfarlane, Long, and Townsend found that this was true as well as children were allowed to use real tools in their garden-to-kitchen program: “Learning to use ‘real’ chef’s knives, for example, when preparing food was particularly valued
by many children as a symbol of their own capability and the trust being placed in them by adults” (2011, p. 423).

Bento and Dias (2017) describe how the outdoor environment allows for open-ended use of materials such as sticks, rocks, flowers, soil, and water, in order to utilize children’s imagination, divergent thinking, creativity, and problem-solving skills. This same process also builds children’s connection to nature while drawing their attention to its richness and diversity. Allowing children to experience risky situations helps them build understanding of how to navigate unpredictability and challenges, building persistence, entrepreneurship, self-knowledge, and problem solving. Bento and Dias also observed that children had opportunities to integrate mathematics, science, and language into their outdoor experiences, creating connections between different academic subjects. Time spent outdoors seemed to help adults and children feel more relaxed and calmer with less stress and anxiety. They concluded that adults in educational settings needed to make time for children to experience time outdoors (Bento & Dias, 2017).

Even just viewing nature itself has been found to be calming to people. Louv (2008) cited research results where surgery patients with a view of trees went home sooner than patients with a view of a brick wall, Michigan inmates with cells facing a prison courtyard had 24 percent more illnesses than those facing farmland, and individuals who have a stressful experience and then look at natural landscape images calm in only five minutes (pp. 46-47). In a Montessori lower elementary (age 6-9) classroom, Johnson (2013) found that by facilitating a natural connection between the natural world and the classroom through the implementation of unintentional nature journaling led to children who: were more focused and attentive, had increased observation, and were more relaxed – both during the activity and also afterwards in the classroom (p. 39)! In fact, after an investigation with 337 children using four different scales,
Wells and Evans (2003) found that nearby nature seems to buffer the impact of stress on children. These stressful events included “family relocation, being picked on or punished at school, or being subject to peer pressure” (p. 321). In this study, nearby nature included “the amount of nature in the window view, the number of live plants indoors, and the material of the outdoor yard” (p. 318). This study highlights the importance of nature on mental health. Perhaps the less time we spend in nature, the more our mental health suffers? According to Thomas Roszak, this could be feasible. He states that humans have split their inner life from their outer life in modern times and this split may have led to an Age of Anxiety (as cited in Louv, 2008, pp. 43-44). Dr. Montessori, who viewed the child and his or her growth so holistically, would surely have seen this as problematic.

This positive effect of time outdoors and connection to the environment on psychosocial skills was also highlighted in otherwise underserved populations. In Somerset, Ball, Flett, and Geissman’s article regarding school gardens established in 54 Australian schools, it was reported that vegetable gardens had “a positive effect on the behaviour of disruptive students” such as a child with autism spectrum disorder (2005). In the Stephanie Alexander Kitchen garden program described by Block et al., the program “was described as engaging students from across the academic spectrum” but “was seen as particularly significant and valuable for connecting and integrating children potentially at risk of long-term disengagement” (2011, p. 424). Taylor, Kuo, and Sullivan (2001) noted that children with attention deficit/hyperactivity disorder were calmer if they sat indoors in a room with natural views than children who played outdoors in man-made environments (as seen in Hanscom, 2016, p. 96).

**Social skills.** In early childhood, there is often an emphasis on the importance of social emotional development and building social skills. While critics of the Montessori pedagogy feel
that there is not enough emphasis on social skills due to individualized teaching, Dr. Montessori felt that in her classrooms children actually had more capability to build social skills as they were not sitting at a desk listening to someone talk but rather living in an active community of larger classes with mixed age groups which required more social interaction between the children (Montessori, 1949/1995, p. 225). In a multi-age Montessori classroom, children also learn to help each other, and the older children even give younger children lessons in materials they have mastered, providing the older children with independence and self-confidence while allowing them the opportunity to practice skills they may otherwise have given up on practicing (Montessori, 1949/1995, p. 227).

Likewise, time outdoors has provided opportunities to build social skills as well. Block et al. investigated social environment within the Stephanie Alexander Kitchen Garden Program in their 2011 article. While there was no statistical significance in quantitative results throughout the dimensions they investigated, there was a “remarkable consistency of qualitative findings across a diverse range of schools and stakeholder groups that included children, teachers, parents, volunteers, school principals, and specialist staff” (p. 428). This study examined grades 3-6 in six Australian schools for two and a half years where children were introduced to a seed to table experience with 45-minute weekly garden classes and a 90-minute weekly kitchen class. Children also kept kitchen garden journals.

Block et al. found that students self-reported that they were more engaged, and participants felt that children grew in confidence, independence, and self-esteem (p. 423). Teachers found that children cooperated more, the teachers focused less on discipline, and that teachers learned along with the children (p. 425). Children also recognized that they were building more relationships: “Children not only found it fun but also felt that they were learning
and improving when it came to this valuable skill and expressed awareness that they were expanding their social networks beyond their immediate friendship groups” (p. 425). Similarly, Bento and Dias (2017) noted that children outdoors experienced less conflicts and cooperated more with each other, switching roles between teachers and learners, and developed empathy.

In Nimmo and Hallett’s school garden, three-year-old to five-year-old children collaborated on building a bean trellis without assistance from the adults and “[i]n so doing, they shared their knowledge, negotiated roles, and encouraged the younger children” (2008, p. 3). This parallels the expected experience in the integrated Montessori three-to-six-year-old classroom.

As noted in the previous section, these experiences often help children with differing abilities. Nimmo and Hallett explain that a child, Ted, struggled with his emotions and sensory input, and wasn’t well regarded by his peers. In the garden, though, he became known as a gardening expert and problem solver, and children came to him for suggestions. Over time, this transferred to the classroom as well (2008, pp. 3-4).

**Intergenerational benefits.** In several of the studies regarding the integration of school gardens into the curriculum, it was noted that these types of activities can often support intergenerational relationships (Nimmo & Hallett, 2008; Block, 2011; Pollock, Warren, & Anderson, 2017). It was summarized nicely by a focus group participant in a study by Block et al., “‘We all learn from one another, we work together, we share it all’” (2011, p. 425).

Continuing to pull findings from the Block et al. study of the Stephanie Alexander Kitchen Garden program, the researchers found that “[g]randparents . . . often brought valuable knowledge and skills, while enjoying the opportunity to be involved and contribute to their grandchildren’s education and the community” (2011, p. 427). Parents also volunteered, fund-
raised and worked to establish the gardens beyond just the early years when its typical of parents to come in and help with classroom literacy programs (p. 425). This provided special opportunities for parents from non-English speaking backgrounds, as well, who could often participate in the kitchen and garden perhaps without worries about their English capabilities. “This was highly valued by the school principal and teachers as an opportunity to engage this group of parents and by the parents as an occasion for cultural sharing. Parents also attributed to the program increased conversations with each other, describing it as a good “conversation starter” at the school gate” (Block et al., 2011, p. 425).

This support for intergenerational learning was also found in a qualitative case study by Pollock, Warren, and Anderson conducted in New South Wales, Australia, and published in 2017. The case study, which was informed by Vygotsky’s sociocultural theory, included document analysis and interviews within an early childhood education and care center as the researchers implemented the National Quality Framework (NQF). The NQF included the National Quality Standard and Early Years Learning Framework which both had components directly related to early childhood education for environmental sustainability (ECEfES) (p. 13). While educators felt that implementing ECEfES was important, they also struggled with several barriers that will be further explored later in this paper. In regard to the intergenerational benefits, the educators found that a focus on integrated ECEfES led to a “cyclical process of interaction and learning between educators, children, and their families” (p. 16). The center engaged families “in a ‘whole-of-settings’ approach [where the program] was relevant to the sociocultural contexts within the setting, enhancing the potential for sustainable change” (p. 16). In one story, a child showed her grandparents the garden and talked about how her father had helped in setting it up (p. 17). In the conclusions, the researchers stated they recommended that
Educators wishing to embed ECEfES programs need to collaborate, not only with children, but also their families. Such collaboration can lead to the creation of authentic sustainable changes within dynamic sociocultural contexts. In the spirit of collaboration, it is recommended educators support families to see the value of ECEfES by encouraging families to reflect on their own early childhood experiences with, and connections to, the natural environment (Pollock, Warren, & Anderson, 2017, p. 17).

Nimmo and Hallett describe in their article how children can relate to adults who aren’t related to them as well such as the farmer that came to help them put the garden to bed in the winter and how the children developed a relationship with him and with others. They wrote, “Children learn about human diversity through these contacts with perspectives and teaching styles that are not necessarily as child focused as are those of their parents and teachers” (2008, p. 5). Conversely, the researchers also asked the farmer what he learned in his relationship to the children and he said, “The children made me realize that my adult world isn’t the only world and that their world is as important or perhaps more important” (2008, p. 5). This statement is reminiscent of Dr. Montessori’s belief that adults need to shift their thinking to understand the viewpoint, or the world, of the child.

**World Health: Creating Environmentally-Literate Citizens**

Cosmic education is a vital part of the Montessori elementary classroom in the second plane of development. Montessorians Michael and D’Neil Duffy wrote *Children of the Universe: Cosmic Education in the Montessori Elementary Classroom* (2018) to unify the vision of cosmic education as presented by Dr. Montessori. The introduction, written by Aline Wolf, states that the Montessori Cosmic Education curriculum is a six-year all-inclusive integrated curriculum that “demonstrates the oneness of all creation and, most importantly, places children’s primary
orientation to life firmly in the Universe” (Introduction section, para. 2). She continues, the Cosmic Education curriculum “proclaims to children in their most impressionable years that the Universe is a web of relationships” (2018, Introduction section, para. 8). While Cosmic Education is intended for years 6-12, children in the 3-6 classroom should be developing the foundation for their future exploration (Duffy & Duffy, 2018, Chapter 3, para. 27). The Duffys link the importance of cosmic education to Dr. Montessori’s hope for a peaceful future: a vision heavily impacted by World War II (2018).

This integration is not surprising, but not only along academic lines. Dr. Montessori saw the child and the world holistically where complex concepts were integrated and affected each other. Johnson (2013) writes: “Maria Montessori achieved great success through her method’s ability to blend science and spirit seamlessly, while helping the child understand his place in the world. She strongly believed that a peaceful world will come through a new style of education that teaches compassion for and connection to all living things” (p. 40). To Dr. Montessori social systems and environmental systems were interlinked and affected each other and holistic world health.

This link has been made in research as well. Björneloo (2007) discovered teachers wanted their students to learn five different themes concerning sustainable development (SD) above and beyond learning about the environment itself: (1) wholes and connections in a holistic perspective, (2) sharing and responsibility where pupils playing an active role in society and making and understanding their choices, (3) empathy and understanding for other people, (4) empowerment and ability to communicate, and (5) ability to learn (as cited in Ärlemalm-Hagsér and Sandberg, 2010).
Ärlemalm-Hagsér and Sandberg (2010) further found that individuals working in early childhood programs in five Swedish municipalities saw democratic issues as important to sustainable development including human rights, democracy, gender-quality, morals, and ethics (p. 194). Pollock (2017) further states that “[e]arly childhood education for sustainability (ECEfS) has been nationally and globally recognized as having the potential to nurture caring, capable, and responsible citizens, by providing children with knowledge about sustainability problems, a voice in decision-making about these issues and the skills to do something about it” (p. 12). Duhn (2012) couches that in the future, children will need to be able to understand how social and environmental systems are related: “Learning to care for all life on earth, when topics like climate change emphasize the urgency of engagement at all levels (Chawla and Cushing 2007), inevitably introduces ‘reality’ into the protected space of childhood. Paradoxically, children, as (future) citizens, will have to be able to live in economic, natural, cultural, social, and political environments that are increasingly unpredictable and unstable (Irwin 2010)” (p. 21).

And of course, educators still need to assist children in building understanding of environmental systems as well. Blanchard & Buchanan (2011) write, “Teachers can help children become environmental stewards by constructing environmental literacy through a continuum of competencies with regard to prerequisite understandings, skills, and actions. Environmentally literate people are more likely to come better stewards of their environment as they progress through the stages of awareness, concern, understanding, and action” (p. 233). Helping children to build understanding and environmental literacy means that they will be able to move into the future with grace, purpose, and an understanding of their impact on themselves, others, and the world as a whole.
Defining Environmental Education

So far, this paper has discussed relevant aspects of Montessori philosophy and pedagogy and interwoven this style of education with some research-based benefits of time spent outdoors and environmental education. Before moving on to the barriers to implementing environmental education in early childhood, first environmental education itself must be defined in the context of this paper and its analysis. The following sections highlight definitions of environmental education, discuss several different systems-based environmental education guidelines, and touch on several philosophies of learning found in environmental education literature which were used both in the construction of the data instrument and also in the contextualization of the results.

Definition of Environmental Education

The definition of the term “environmental education” has changed over the years, but in 1970 during a working meeting of UNESCO, what Palmer describes as the classic definition of environmental education was adopted: “Environmental education is the process of recognising (sic) values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality” (1998, pp. 6-7). The National Environmental Education Advisory Council of the U.S. Environmental Protection Agency (EPA) defines environmental education as: “The interdisciplinary process of developing a citizenry that is knowledgeable about the total environment in its natural and built aspects and has the capacity and commitment to insure environmental quality by engaging in
inquiry, problem solving, decision-making and action” (as cited in Minnesota Office of Environmental Assistance, 2002, p. 5). Montessorians steeped in the idea of cosmic education may place more importance on the idea of the interrelatedness of the environment and humans as well as the importance of understanding each person’s place in the world.

An important mirror to environmental education (the structure of what we want to teach) is environmental literacy (the representation of what has been learned). Stone & Barlow (2005) state environmental literacy has been demonstrated “when individuals have the knowledge, skills, and dispositions to engage, individually and collectively, to support sustainable natural and cultural systems” (as cited in Wisconsin Department of Public Instruction, 2018).

In respect to environmental education in preschool years, Ärlemalm-Hagssér and Sandberg (2011) asked their participants to define the concept of sustainable development, from whom they defined the concept as, “both conscious thinking and an attitude for children and preschool staff, now and in the future, internationally and nationally, and in everyday life. It is not only about the relationship between people, but also about the relationship between people and nature” (p. 193). As explained in the next section, systems-based environmental education, which looks at not only knowledge about the environment itself but also about the relationship between people and between people and nature, has been implemented and suggested for the preschool setting.

**Systems-Based Environmental Education**

According to the American Association for the Advancement of Science (1993), “a system is a collection of interrelated parts consisting of objects, materials, phenomena, processes, ideas, principles, rules, organizations or people that interact to form a distinguishable whole. It consists of parts that work together in ways that cannot be understood only by studying the parts
alone. Systems are characterized by what arises from the interactions of the parts, and these interactions are often as much a part of the study as the parts themselves” (as cited in Minnesota Department of Environmental Assistance, 2002). The definitions of environmental education, above, showcase how vital it is that our education practices take on this systems-approach and help children investigate how all the objects, material, phenomena, processes, ideas, principles, rules, organizations, and people interact. It’s not only important to give children the names of these parts, but also to help them develop the capacity to understand the relationships between parts and how they create a whole system.

Minnesota’s Environmental Literacy Scope and Sequence. The Minnesota Department of Environmental Assistance defines the scope of environmental literacy as follow:

The earth is a set of interacting natural and social systems. An environmentally literate person must understand the relationship of the parts of a system and the interdependence of human and environmental systems. The content of environmental education is the exploration of the relationships between social and natural systems. (2002, p. 6)

According to Minnesota Statute §115A.073, the statewide focus on environmental education is on assisting students and citizens to build sustainable decision-making processes through understanding ecological systems, understanding cause and effect between human attitudes and behavior and the environment, being able to evaluate different courses of action, and understanding effects of how the environment is used by supporting access to information and experiences that help them build understanding. The intent of the scope and sequence is to set forth a curriculum that builds by grade level or previous knowledge, contributes to future learning, and enables coordinated learning across grade levels and programs (Minnesota
Department of Environmental Assistance, 2002). The document consists of benchmarks, key concepts, and supporting concepts. In grades preK-2, there are three benchmarks:

- social systems and natural systems are made of parts;
- social systems and natural systems may not continue to function if some of their parts are missing;
- when the parts of social systems and natural systems are put together, they do things they couldn’t do by themselves (Minnesota Department of Environmental Assistance, 2002, p. 10).

The five Key Systems Concepts are: parts and objects, interactions and relationships, subsystems, inputs and outputs, and change over time (Minnesota Department of Environmental Assistance, 2002, p. 11). In grades preK-2, only two of these are part of the benchmarks (parts and objects, interactions and relationships), and only some of the supporting concepts are included; see Table 1 for the breakdown.

Table 1

<table>
<thead>
<tr>
<th>Key Systems Concepts</th>
<th>Supporting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts and objects</td>
<td>Individuals, groups, ideas and concepts, biotic factors, abiotic factors, similarities and differences, properties</td>
</tr>
<tr>
<td>Interactions and relationships</td>
<td>Structure, function</td>
</tr>
</tbody>
</table>

Note. Table adapted from Minnesota Department of Environmental Assistance, 2002, p. 13.

Some examples are provided in the document:
Single system examples

- If bees were removed from an ecosystem, all the flowering plants that depend on them for pollination (the bees’ function within this system) are affected;
- Objects in natural systems have observable properties, e.g., size, weight, color, shape or existence in different states;
- Similarities and differences of the properties of the parts of natural systems form the basis of the taxonomic system of classification used to characterize species and their relationships to other groups of organisms;
- Family is a social system that we are all aware of. For younger students, identifying the members of the family, and the roles they play help them to see similarities and differences in a personal way (Minnesota Department of Environmental Assistance, 2002, p. 13).

Interactions

- Individual humans make decisions that are often very dependent on the social systems of which they are a part, like family. These decisions affect other individuals in the system;
- Groups utilize the environment for air, water, food, energy, space and a place to put their wastes;
- Humans can make changes in the biotic factors influencing a garden, influencing the plants that grow there;
- Fishermen use their knowledge of light, temperature and oxygen preferences (abiotic factors) of fish to locate them for angling (Minnesota Department of Environmental Assistance, 2002, p. 13).
The document goes on to summarize preK-5 as the time to introduce examples of single natural and social systems, learn to identify the parts and objects therein, learn the relationships of the parts to each other, and discover what happens if a part is missing or broken (Minnesota Department of Environmental Assistance, 2002, p. 17). Each key concept has its own page that gives a definition, statement of student understanding, information on the basic ideas of the concept, applications to natural systems, applications to social systems, and examples of the interaction between them.

Defining the term social system within the context of Minnesota’s *Environmental Literacy Scope and Sequence* may aid in understanding how to implement these benchmarks. Social systems in this document are understood as the human brain’s generation of systems that group and produce behavior patterns and tools that allow us all to live and adapt to our environment (getting and allocating food, finding shelter, keeping order, reproducing, raising offspring) and can include economic, political, or religious organizations and communications, kinship, or ideological systems (2002, p. 88). The underlying assumptions and knowledge that students are expected to have are: humans are subject to natural laws, social systems allow the human species to survive and adapt to environments, and social systems affect and are affected by natural systems (2002, p. 89). Each of these is also broken down into discrete qualities which are not listed here due to space considerations but may be read in full on the applicable page as cited.

**Wisconsin Standards for Environmental Literacy and Sustainability.** Created after Minnesota’s *Environmental Literacy: Scope and Sequence* and influenced by them, the *Wisconsin Standards for Environmental Literacy and Sustainability* were written with the underlying understanding that more environmental education is not necessarily better, but rather
the method of environmental education is critical. With that in mind, the writers envisioned “seven standards to help students connect, explore, and engage in the world around them” (p. 3). The standards focus on preparing students for the future and helping them to develop the skills needed to dive deep in any content area and engage in sustainability as a citizen “[b]y focusing on interactions and patterns within and among systems and embedding systems thinking into environmental literacy” (p. 4). The writers expected educators to look at both natural and human-created systems, examining cultural systems to include social, political, and economic systems, in order to reinforce the understanding that these are interconnected (p. 4). Environmental education in Wisconsin is interdisciplinary from Kindergarten to 12th grade and contains “’big ideas’ that cross content boundaries: networks, nested systems, and interdependence; diversity and resilience; cycles and flows change and adaptation; and dynamic balance (Stone & Barlow, 2005, p. 23)” using three interconnected strands: Connect, Explore, and Engage (p. 6). The Connect strand asks students to understand their place within the system (p. 7). The Explore strand asks students to use skills and knowledge from many fields to “find balance among systems to preserve, utilize, and sustain our environment for seven generations and beyond” (p. 7). The Engage strand asks students to examine individual and collective rights and responsibilities (p. 7).

*The Wisconsin Standards for Environmental Literacy and Sustainability* do not include any standards for preschool or 4-year-old kindergarten (4K) and instead suggest that early childhood educators use the North American Association for Environmental Education’s (NAAEE) *Guidelines for Excellence: Early Childhood Environmental Education Programs* in conjunction with “the natural connections to environmental literacy and sustainability that come
up every day in an effective 4K experience” (p. 10). This paper will further discuss this recommendation in the section on early implementation and grade-level standards.

**North America Association for Environmental Education’s Guidelines for Excellence: Early Childhood Environmental Education Programs.** The North American Association for Environmental Education (NAAEE) published *Guidelines for Excellence: Early Childhood Environmental Education Programs* in 2010 and 2016. Paraphrasing Ruth Wilson (1994), the document states, “[E]nvironmental education in early childhood includes the development of a sense of wonder; appreciation for the beauty and mystery of the natural world; opportunities to experience the joy of closeness to nature; and respect for other creatures. It also includes the development of problem-solving skills and the development of interest and appreciation in the world around us” (2016, p. 2).

In the introduction, the guidelines pinpoint how environmental education is different between early childhood and adulthood. One example is that in early childhood, environmental education is about free discovery and self-directed learning over a structured approach and that “[p]ersonal perceptions, attitudes, and connections with nature are the key goals at this stage” (2016, p. 3). The guidelines explain that in early childhood, children are developing their emotional connection to nature by experiencing the natural world through their senses in actuality (2016, pp. 3-4). It’s important, the guidelines explain, to focus on developmentally appropriate concepts and to avoid an “explicitly problem-oriented approach” as young children may have strong negative feelings about tragedies which negatively impacts the connection to the environment as they develop defensive apathy (2016, p. 4).

The guidelines state that the ultimate goal of environmental education is to develop environmentally literate citizens (2016, p. 3). Environmentally literate is defined as individuals
who “understand environmental issues and how human decisions affect environmental quality,”
who “use this knowledge to make informed, well-reasoned choices that also take social and political considerations into account,” and who have both knowledge and “a positive and caring attitude toward the environment” (2016, p. 3).

The theoretical underpinnings to NAAEE’s Guidelines includes systems (families, communities of people, animals, and plants), interdependence (people are connected to others and to the environment), the importance of where one lives (or place - children need to know their own habitat), integration and infusion (interdisciplinary), roots in the real world (concrete and real experiences with authentic materials), and lifelong learning (curiosity, creative thinking, problem solving, collaboration) (2016, p. 6). The 32 guidelines are organized by six key characteristics as shown in Table 2.

Within the document, each key characteristic and guideline are described and given concrete examples of what to look for in the program and its practices to show that the guidelines are being met. Additional information related to key topics within the guidelines is also provided throughout the document in informational boxes. These guidelines were used exhaustively in the creation of the survey for this project and supplemented by other systems-based environmental education documents and related research. This is further described in the Methods section regarding questionnaire design.
Table 2

_NAAEE’s Key Characteristics and Guidelines in Early Childhood Environmental Education Programs Guidelines for Excellence (2006)_

<table>
<thead>
<tr>
<th>Key Characteristic 1: Program Philosophy, Purpose, and Development</th>
<th>Key Characteristic 2: Developmentally Appropriate Practices</th>
<th>Key Characteristic 3: Play and Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guideline 1.1 – Focus on nature and the environment</td>
<td>Guideline 2.1 – Based on research and theory</td>
<td>Guideline 3.1 – Use of the natural world and natural materials</td>
</tr>
<tr>
<td>Guideline 1.2 – Focus on education of young children</td>
<td>Guideline 2.2 – Authentic experiences</td>
<td>Guideline 3.2 – Play and the role of adults</td>
</tr>
<tr>
<td>Guideline 1.3 – Culturally appropriate goals, objectives, and practices</td>
<td>Guideline 2.3 – Child-directed and inquiry-based</td>
<td></td>
</tr>
<tr>
<td>Guideline 1.4 – Environmental literacy: board, staff, and providers</td>
<td>Guideline 2.4 – The whole child</td>
<td></td>
</tr>
<tr>
<td>Guideline 1.5 – Health and safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guideline 1.6 – Ongoing evaluation and assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guideline 1.7 – Partnerships</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guideline 1.8 – Interpersonal and intergenerational relationships</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 (continued)

<table>
<thead>
<tr>
<th>Key Characteristic 4: Curriculum Framework for Environmental Learning</th>
<th>Key Characteristic 5: Places and Spaces</th>
<th>Key Characteristic 6: Educator Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guideline 4.1 – Social and emotional growth</td>
<td>Guideline 5.1 – Spaces and places to enhance development</td>
<td>Guideline 6.1 – Foundations of early childhood environmental education</td>
</tr>
<tr>
<td>Guideline 4.2 – Curiosity and questioning</td>
<td>Guideline 5.2 – Natural components</td>
<td>Guideline 6.2 – Professional responsibilities of the educator</td>
</tr>
<tr>
<td>Guideline 4.3 – Development of environmental understandings</td>
<td>Guideline 5.3 – Comfortable for both children and adults</td>
<td>Guideline 6.3 – Environmental literacy</td>
</tr>
<tr>
<td>Guideline 4.4 – Skills for understanding the environment</td>
<td>Guideline 5.4 – Maintenance and usability</td>
<td>Guideline 6.4 – Planning and implementing environmental education</td>
</tr>
<tr>
<td>Guideline 4.5 – A personal sense of responsibility and caring</td>
<td>Guideline 5.5 – Health, safety, and risk</td>
<td>Guideline 6.5 – Fostering learning</td>
</tr>
<tr>
<td>Guideline 4.6 – Physical health and development</td>
<td>Guideline 5.6 – Environmental sustainability</td>
<td>Guideline 6.6 – Assessment and evaluation</td>
</tr>
</tbody>
</table>

*Note. Table adapted from NAAEE’s Early Childhood Environmental Education Programs: Guidelines for Excellence (2006, pp. 8-9).*
Early Implementation and a Note on Grade-Levels in Standards

Connection and Embedding Values. In NAAEE’s introduction to their Guidelines for Excellence, they state that research backs up the importance of implementing environmental education in childhood because children form attitudes early in life (2016, p. 3). Chawla and Cushing (2007) “revealed a conclusive relationship between positive early childhood experiences in nature and the formation of pro-environment beliefs and behaviors later in life” (as cited in Pollock, 2017, p. 13). Not only are the values formed early, but connectedness to nature can be strengthened in children under the age of eleven and that connection is sustained into adulthood (Liefländer, Fröhlich, Bogner, and Schultz, 2013; Wilson, 1996). Liefländer et al. expected that frequent exposure to environmental education would further strengthen that connectedness. The authors cautioned that it was important to not just increase knowledge but also to help children create connection and empathy and advised “blending positive informal, affective experiences in nature with formal, cognitive environmental knowledge to promote greater connectedness” (2013, p. 380). This finding was supported by Lewis and Townsend who concluded, after conducting qualitative interviews with six ecologically embedded adults, that their motivation for creating action as adults for ecological wellbeing stemmed from their experiences in childhood that helped them to create an ecological identity (2015, p. 249).

Early Childhood Standards. In early childhood, standards focus more on skills (e.g. fine motor, gross motor, inquisitiveness, wonderment, ability to attend, self-direction, diligence, resilience, working memory, scientific reasoning, problem solving, dexterity, selfcare, classification) than on content knowledge, as Baldwin and Wilson (2017) found in their examination on linking Head Start Early Learning Outcomes with the Next Generation Science Standards. Rachel Carson wrote in The Sense of Wonder (1956/1998, pp. 49-50):
I sincerely believe that for the child, and for the parent seeking to guide him, it is not half so important to know as to feel. If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil. Once the emotions have been aroused—a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration, or love—then we wish for knowledge about the object of our emotional response. Once found, it has lasting meaning. It is more important to pave the way for the child to want to know than to put him on a diet of facts he is not ready to assimilate.

It’s important to start early and imbue that wonder and excitement in children so that later they want to learn the content and have the skills to do so.

Some states, such as Minnesota, explicitly align their early childhood standards to the Kindergarten standards (Minnesota Department of Education, 2017). In other situations, researchers have attempted to align standards such as Baldwin and Wilson. One of the challenges in Montessori settings, even when the standards are aligned, is that many of the standards for kindergarten or first grade are actually skills taught earlier in Montessori classrooms.

As an example, in Minnesota’s Environmental Literacy Scope and Sequence, the benchmarks for grades 3-5 also closely correlate with the Children’s House environment in Montessori (p. 94). More specifically, in grades 3-5, the key systems concepts and supporting concepts now include “patterns, trophic level, cycles, change and constancy, migration, predation, feedback, and communication” and the emphasis is on understanding the interactions and interdependence of living and nonliving systems and geography and citizenship (p. 94). These are concepts embedded in the Montessori cultural curriculum. In the Wisconsin Standards
for Environmental Literacy & Sustainability, there aren’t any standards provided for pre-kindergarten, but many of the standards for K-2 align well with Montessori early childhood pedagogy.

**Capability.** Dr. Montessori believed that children were capable of doing things much sooner than adults gave them credit - especially when they were explicitly shown and taught how and provided child-sized tools for use. Hanscom notes that “[m]ost injuries happen when hand muscles are weak and fine motor skills are not challenged. A child who has strong hands and arms shouldn’t be any more prone to injury than an adult” (2016, p. 42). It wasn’t only physical skills, though. Dr. Montessori also noted that children were capable of higher cognitive skills as well (see the section on Montessori Philosophy).

A note on categorization and learning nomenclature: Dr. Montessori felt that children between age three and six were insatiably thirsty for learning more words and her observations bore this out. She gave the example in *The Absorbent Mind* of a three-year-old boy telling older children that a specific part of a flower was named a pistil (1949/1955, p. 175). Many works in Montessori Children’s House involve learning nomenclature for many different objects whether it’s the parts of an individual item (such as the parts of a flower or parts of a horse) or the parts of a system (Fleege, 2013; Rigg, 2013a; Rigg, 2013b; Rigg, 2013c).

**Foundational Philosophies of Learning**

During the process of completing the literature review, these thematic philosophies of learning were repeatedly referenced or implied when discussing the method of teaching environmental education: constructivism, progressing from concrete to abstract, integrating real experiences mixed with wonder, creating interdisciplinary threads, supporting a critical pedagogy of place, reinforcing biophilia instead of ecophobia, and using play.
**Constructivism and progression from concrete to abstract.** Constructivism is a theory offering explanation on the acquisition of knowledge and process of learning. The premise is that new meaning and understanding is scaffolded onto, linked into, influenced by, and interacts with previous experiences as individuals actively construct knowledge, consciously or unconsciously, by observing, acting on, or reflecting on experiences and activities that challenge, change, or enhance their current knowledge base (Ültanir, 2012; Anderson, 1992, p. 1037).

Within constructivism, the learner operates within the “top position” instead of the teacher, is autonomous and independent, is an active collaborator and constructor of knowledge, best learns in a prepared setting with appropriate tools and materials that he or she can act upon, and is influenced by the social and cultural context surrounding them (Ültanir, 2012; Lillard, 2017, p. 10; Montessori, 1949/1995, pp. 8, 208). Others, including teachers and fellow students, act as guides, facilitators, co-collaborators, and co-explorers in this construction of knowledge (Ültanir, 2012). The primary role of teachers is to observe the learners, know where they are at in the process of constructing meaning around a concept or experience, and help facilitate the learner in their progression. This requires that each teacher recognizes that learning and building meaning is individual and people progress at different rates (Ültanir, 2012, p. 203; Anderson, 1992, pp. 1037-1038). There are four epistemological assumptions at the heart of constructivist learning:

1. Knowledge is physically constructed by learners who are involved in active learning,
2. Knowledge is symbolically constructed by learners who are making their own representations of action,
3. Knowledge is socially constructed by learners who convey their meaning making to others.
(4) Knowledge is theoretically constructed by learners who try to explain things they
don’t completely understand. (Gagnon and Collay, n.d.)

Some well-known theorists and practitioners who have influenced our understanding of the
constructivist framework include Bruner, Dewey, Montessori, Piaget, and Vygotsky (Ültanir,
2012; Gagnon & Collary, n.d.; Lillard, 2017, p. 10). Each individual who has contributed to
constructivism has approached it from different perspectives and to different degrees.

Ültanir (2012) describes how Dewey believed that while education is achieved via experience, not all experiences are equal and in fact, sometimes an experience is actually
counter-productive when it limits the possibility for richer experiences in the future or when it
connects experiences mistakenly or even wrongly (p. 200). Anderson (1992) also mentioned this
mental discomfort and juggling that can occur when individuals have built “folk knowledge”
around their experiences and then later find that “formal knowledge” contrasts with what they
know (p. 1038). He also cautioned that when children experience something repeatedly on a
sensory level and layer that sensory experience with incorrect information, it could perhaps be
difficult to reprogram their experiences to take in and understand the new information (p. 1043).

The limitations in Montessori education regarding the use of materials discussed in the
Montessori Philosophy subsection on child-directed and meaningful work perhaps relates back
here in that it is important to build a strong foundation that is correct in its sensorial impressions
and the knowledge gained.

Ültanir also explained “[t]he principle of continual experiences is that every experience
should acquire something from those that have come before it and in some way should change
the attributes of those that follow it” (2012, p. 200). Anderson states that young children are most
likely to benefit from multimodal sensorimotor tactics when learning (p. 1053) and that
educators would need to clearly understand “the students’ prior base of experiences” in order to design activities that “are consistent with, and capable of expanding, the previously acquired network of science knowledge” (p. 1043-1044). The purposeful sequencing of Montessori materials throughout Montessori pedagogy tap in to this progression of continual knowledge gain and help future educators (even upper elementary!) understand the base of knowledge that children steeped in Montessori education have already acquired.

Montessori pedagogy is constructivist in that it focuses on a holistic growth in the child; encourages student movement and purposeful interaction in a nurturing, supportive, and curated environment designed to inspire curiosity and foster interest; integrates academics and social skills within a sociocultural context; emphasizes concentrated learning that is self-directed, independent, and disciplined; supports creative problem-solving skills and cooperative group learning and collaboration while decentering the teacher; and has a sequential, progressive process of skill development (Ültanir, 2012, p. 203-205; Moll, 2004).

To further discuss the sequential, progressive nature of constructivism, this paper will turn to the idea of starting with concrete experiences and moving to more abstract experiences. While this concept was an integral part of Dr. Montessori’s early childhood pedagogy across subjects, American Nature Study educators in the late 19th and early 20th centuries also felt that it was vital to introduce children to science by starting with the concrete aspects of the natural world around them (Johnson, 2013, p. 40). Starting with the concrete world in early childhood was further discussed by Blanchard and Buchanan (2011) who explained that teachers are vital in assisting children “to become environmental stewards by constructing environmental literacy through a continuum of competencies with regard to prerequisite understandings, skills, and actions” (p. 233). The authors stated that constructivist learning models “suggest that teachers
should sequence instruction into a series of learning stages . . . that involves exploration, explanation, and elaboration” (p. 233).

In Blanchard and Buchanan’s article, they integrate Roth’s four stages of environmental literacy (awareness, concern, understanding, and action) with Kolb’s constructivist learning cycle (concrete experience, reflective observation, abstract hypothesis, active testing) and state that it’s consistent to do so as both “begin with concrete experiences, lead to increased understanding and knowledge, and culminate as the learner acts on new knowledge by taking action” (p. 233). In this integrated model, educators start with what is real, authentic, and concrete in the child’s local, immediate natural environment, integrate the experience with other content areas, and ask specific questions. Using this integrated model is also consistent with Bybee’s 5E instructional model: “(E)ngage in the topic, (E)xplore ideas and concepts, (E)xplain their findings using scientific language, (E)laborate on new understandings, and (E)valuate children’s knowledge” (Blanchard & Buchanan, 2011, p. 237; Baldwin & Wilson, 2017).

Real experiences mixed with wonder. Assisting children in the development of the sense of wonder around the natural world is an integral part of environmental education (Galloway, 2015, p. 31; Carson, 1998). In The Sense of Wonder (1956/1998), Rachel Carson exhorts us all to just listen and look as appreciation will follow immediately.

Johnson related that one of the reasons she was interested in starting a garden at her school was that children had relayed to her that year that none of their relatives gardened, and she was dismayed that they had not had real experiences with growing produce (2013, p. 38). This experience led to the creation of Wings, Worms, and Wonder: A Guide for Creatively Integrating Gardening and Outdoor Learning into Children’s Lives where she exhorts the benefits of real, concrete experiences for children and states, “If a child excitedly approaches
with a handful of mud and bugs, as much as the adult mind wants to cringe, we must override that feeling and embody a childlike wonder toward the handful, conjuring up our own curiosity and imagination and expressing that to the child through speech and body language” (2017, p. 14). This component of environmental education aligns very well with Dr. Montessori’s focus on reality and nature (Johnson, 2014, p. 41).

**Interdisciplinary.** Although the expectation is that environmental education should be integrated into early childhood in an interdisciplinary way (NAAEE, 2016), there is little research that indicates this integration is happening across the different methods of implementation. At other age and grade levels, environmental education is often an add-on to science curriculum instead of being fully integrated throughout all content areas (Cole, 2007, p. 37; Mullens & Cater, 2018, p. 10; Johnson, 2013, p. 42). This finding, however, contrasts to much of the literature on school gardens, which discussed how interdisciplinary the garden projects naturally end up, allowing for math, science and observation, history and studies of place, writing and literacy, art and design (across media including photography and computer design), and health (Somerset, Ball, Flett, & Geissman, 2005; Johnson, 2014, p. 38). While perhaps some people are intentionally integrating environmental education into all curricular areas, it seems more likely from the review of literature that people start with a project and then later realize how interdisciplinary it can be as they bring in other content areas. Part of changing this mindset to allow for more intentional and interdisciplinary integration may be reminding people that arts and sciences are not mutually exclusive (Johnson, 2013, p. 42).

**Critical pedagogy of place.** Children are increasingly less aware of their local biodiversity (Bebbington, 2005). Why is this? On top of the influence from the decreasing amount of time spent in actual nature, Louv (2008) points out the potential issue that children
learn more in school about the rainforest than their own local forests, or “even just the meadow outside the classroom door” (Sobel, 1996, as cited in Louv, 2008, p. 135). In other words, instead of spending time in “nearby nature,” defined in Wings, Worms, and Wonder by examples like gardens, neighborhood creeks, urban courtyards, and unkempt areas of the backyard (Johnson, 2017, pp.14-15), and being grounded in concrete and relevant experiences, children are learning about places they may never visit in their lifetime. Even more concerning, children are better at identifying species that don’t even exist over those native to their area. According to Balmford, Clegg, Coulson, and Taylor in Science magazine, children in the UK over the age of eight were “substantially better” at naming Pokémon species than local organisms (2002). The authors write that conservationists should take hope, though, that children do have “a tremendous capacity for learning about creatures” from their results (Balmford et al., 2002). Educators just need to take the time to intentionally tap into this capacity early in the child’s life and expand it from just the local wildlife and plants, but also to the local places (Gilder, 2009, p. 36).

Duhn (2012) states that the idea of place and a place-based focus was strongly discussed in a two-year qualitative study of ten early childhood centers in Auckland, NZ (p. 23). Teachers related that they found discussing global topics such as climate change to be overwhelming and hard to connect but began to feel more comfortable as they developed their sense of place in regard to local cultural elements. Some engaged with local history and politics, becoming more vocal and visible in their wider community, in order to widen their sense of place (Duhn, 2012).

Place-based education is a strong movement that exists and works to combat this decreasing knowledge of the local environment, but it has come under some criticism for not always involving cultural perspectives that differ from the hegemonic culture (McInerney, Smyth, & Down, 2010; Gruenewald, 2003). McInerney, Smyth, and Down summarize that rather
than just focusing on “place,” educators should be “giving students a say in what and how they learn; encouraging young people to engage with the big questions confronting the global community; building relational trust within schools and communities; developing a sense of student ownership, identity, and belongingness; creating spaces for dialogue, reflection, and political action; and, establishing an ethical commitment to justice and a ‘fair go’” (2010).

Gruenewald (2003) explains that place-based education has lacked a specific theoretical background but could be connected to many different traditions and philosophies including constructivism, outdoor education, and environmental and ecological education (p. 3).

As Gruenewald states, place-based education could involve building belongingness, cultural relevance, and ways for young people to build towards a global understanding. It just may involve building that on a local level, first, so that children understand their cultural roots – those concrete things in their lives, before they move to connecting their experiences to more abstract examples of others’. To restate more simply, children must know who they are, first, before they can expand to know who others are. This is supported by Dr. Montessori’s view of cosmic education and its emphasis on knowing who you are and your role in the universe.

Gruenewald additionally theorizes that frameworks such as eco-justice (where social and ecological justice is integrated through lenses of race, class, gender, language, politics, economics, and the environment) can be integrated into a critical pedagogy of place as well to make space for all people so they feel their complex interrelationship between cultural and ecological environments are understood and their perspective is honored (2003, pp. 5-6). He concludes that a critical pedagogy of place examines the intersection, or nexus, between environment, culture, and education (2003, p. 10). Cole (2007) likewise states that scientific content knowledge alone is too limited when we can richly integrate information with children’s
attitudes, values, and beliefs by including and embracing their unique cultural perspectives as valid parts of the formation of their knowledge (p. 42).

Systems-based environmental education attempts to address these complex and entangled concepts, constructs, and contexts, but it is definitely up to the educator to value and understand the importance of this critical interdisciplinary and cultural approach. Children lay the foundation for future environmental justice and activism when educators integrate the following concepts: familial systems, recognition of own and varied personal beliefs, value of important cultural places in the community, understanding of emotional reaction to nature, awareness of how people interact with natural systems, impact people have on nature, short- and long-term consequences of choices, and the importance of taking responsibility for one’s own actions.

**Biophilia versus ecophobia.** Dr. Montessori noted that nature frightens people, “They fear the air and the sun as if they were mortal enemies. They fear the frost at night as if it were a snake hidden in the grass. They fear the rain as if it were a fire. Civilized man is a kind of contented prisoner, and if now he is warned that he should enjoy nature for his own health, he does so timidly and with his eyes on the alert for any danger” (Montessori, 1909/1972, p. 68). Ecophobia, or a fear of natural world and the ramifications of ecological collapse or problems, is a concept of which educators should be aware. Nearly a quarter of the children in a study completed in England already state they are worried to be outside alone (England Marketing, 2009, p. 5). Nimmo and Hallett (2008) were surprised “that even teachers who grew up in a semirural environment are apprehensive about the world of gardening, whether it is the unexpected creatures, the threat of dirt, or the sweat of pulling weeds” (p. 3).

Children who are afraid of the natural world are going to struggle to build connection with and learn more about it. “Aversive responses to learning, such as fear of mathematics or
scientific terminology and formal constructs, may result in diminished learning due to inhibitory effects produced by emotional states mediated by the limbic system” (Anderson, 1992, p. 1051). This could especially be a problem with educators who over-politicize environmental education in the early years by focusing on topics like climate change or endangered animals as it can cause anxiety, fear, and hopelessness in young children (Gruenewald, 2003). Sobel (1996) warns against “premature abstraction” as it can induce ecophobia; instead teachers should use developmentally appropriate practice to create connection and empathy with the natural world in children (as cited in Gruenewald, 2003, p. 7). This emphasis on connection, love, and empathy is the basis of biophilia.

Wells and Zeece (2007) provide a list of twelve developmentally-appropriate literature options for educators to use in their classrooms with children who wish to support children’s understanding of place and the environment around them without the inducement of ecophobia.

**Use of play.** Play comes up often in early childhood, both inside and outside of environmental education, and its role in Montessori education is highly debated. While Montessori pedagogy does not include unstructured play within the Montessori work cycle, there are elements of play woven throughout the Montessori child’s day. In order to consider this perspective without immediate dismissal (sometimes created upon something as basic as the different ways in which early childhood educators label what a child is doing – either as “work”, “play”, or “learning”), it’s important to think about the definition of play in research, its components, and how both compare to what we think of as learning. Lillard describes playful learning’s space in a dimension of play in which “free play (in which children play independently), through guided play (where an adult oversees and gently directs—or scaffolds—their play), to didactic instruction (where a teacher directly instructs children)” exists. “Playful
learning occupies the span between free play and guided play” (2013, p. 157). She goes on to explain that “[p]layful learning is child centered, constructivist, affectively positive, and hands-on” (2013, p. 158). Therefore, let’s compare the elements of play to Montessori pedagogy through the constructivist approach of playful learning, but let’s start with the differences.

Montessori environments do not include toys; Dr. Montessori observed that when both work and toys were available, children preferred to do work rather than engage in play, so she eventually removed the toys from the classroom (Lillard, 2017, pp. 208, 212; Lillard, 2013, p. 171). She was supportive of children playing with toys in their leisure time but did not include them in the Montessori work cycle (Lillard, 2017, p. 208).

As mentioned earlier in the Montessori Philosophy section, Dr. Montessori believed that children wanted to work with real, child-sized materials in meaningful work to produce real things. She also felt it was important to ground the child in concrete reality during the conscious absorbent mind so that their use of imagination was rooted in the real. Therefore, the materials in the Montessori early childhood classroom are not fantastical, nor are they used in pretend play. The materials also have expectations around their use, as discussed in the Montessori Philosophy section, which is different than the completely open-ended use of toys in free play.

Pramling Samuelsson and Asplund Carlsson explore the concept of the playful learning child from the perspective of the child himself or herself in their article on the theoretical framework for a proposed developmental pedagogy wherein elements of play and learning influence each other in a pedagogy that intentionally makes space for both. The authors discuss cross-cutting concepts of the knowledgeable and observant teacher, creativity, variation, metacognition, mindfulness, choice, movement and activity, possibility thinking, and social interaction as they consider the objects of learning, which they define as what children play and
learn through the lens of the intended learning object, enacted learning process, and lived learning object (2008). The intended learning object is what the teacher intends children understand and the lived learning object refers to how the child understands and perceives the object of learning (Pramling Samuelsson & Asplund Carlsson, 2008; Johansson & White, 2011). This is important because not only do Pramling Samuelsson and Asplund Carlsson directly talk about Montessori in their article, but the playful learning cross-cutting concepts found implicitly and explicitly throughout the article also align well with Montessori pedagogy.

**Knowledgeable and observant teacher.** Pramling Samuelsson and Asplund Carlsson state “the preschools of highest quality are the ones where one can see in children’s play what they work with in their daily curriculum and also how themes coming up in play are picked up by the teachers in the curriculum work” (2008. p. 630). This relates back well to the Montessori concepts of having an observant, knowledgeable teacher who observes to see what children are interested in, respects their sensitive periods and interests, and follows the child by preparing the environment to include materials and opportunities for the child to construct more knowledge within that area of interest.

**Creativity.** While creativity may be thought of within the domain of play, it is also used in learning as children are creating new knowledge and constructing their understanding of a topic as they learn (Pramling Samuelsson and Asplund Carlsson, 2008, p. 636). This usage of creativity is closely linked to Dr. Montessori’s constructivist ideas and her view of imagination as discussed earlier.

**Variation.** Variation is used in play as children explore different possibilities and outcomes and oscillate between what the authors described as fantasy or reality (but perhaps could also be defined as abstract or concrete in the terms of their examples) (Pramling
Variation also features in learning as children’s understanding of the world springs from differences whether those are experienced simultaneously (such as contrasting shapes) or from comparing new knowledge to old knowledge (Pramling Samuelsson and Asplund Carlsson, 2008, p. 634; Johnasson & White, 2011). In Montessori philosophy and pedagogy, children are given space to see a singular phenomenon in different ways when they compare and contrast differences and similarities in categorization exercises as well as when they are introduced to variations of use of materials and extensions based upon the material or concept.

**Meta-cognition.** Meta-cognition is a less intuitive cross-cutting component, but Pramling Samuelsson and Asplund Carlsson state this is reinforced when educators encourage children to think, reflect, and express ideas in a variety of ways before relating these iterations back to the original topic and encouraging children to realize they have different ideas in relation to any singular phenomena (2008, p. 635). The Montessori directive to follow the child closely aligns with this idea as the Montessori teacher supports children in following through on and reflecting on their unique interests in as many ways as the child wants or needs.

**Mindfulness.** Mindfulness is drawn from Ellen Langer’s idea that children are to be aware of and perceive or be attentive towards something (Pramling Samuelsson and Asplund Carlsson, 2008, p. 636). As discussed in the Montessori Philosophy subsections on child-directed and meaningful work and the prepared environment, the Montessori classroom is created and organized in order to assist children in the development of attention and focus by choosing to work with what they are interested.

**Choice.** Regarding choice, the authors point out that play is considered to be something children initiate and choose and have some control over (pp. 623-624, 627). “[Peter Gray] is
what I would call a ‘play expert’—a scientist and researcher who studies the evolution and theory of play. He defines ‘play’ by talking about its distinct qualities. First, he says that play is self-driven and self-directed. You always have a choice whether you want to play or not. He says, ‘The ultimate freedom in play is the freedom to quit’ (Gray 2013, 141)” (Hansom, 2016, pp. 73-74). As discussed in the Montessori philosophy subsection on child-directed and meaningful work, in Montessori early childhood education, children have the freedom, within limits, to choose their activities and have control over various aspects of their activities such as how long they engage in their activities (Lillard, 2017, p. 215). This freedom to self-direct may even give them less drive to engage in pure, unstructured play activities as they are already fulfilling their need for choice (Lillard, 2017, p. 215).

**Movement and activity.** Movement and activity are referenced as being developmentally vital to young children (Pramling Samuelsson and Asplund Carlsson, 2008, pp. 628, 637). Both play and learning allow children to actualize brain connections through movement and activity. As discussed heavily in the Montessori Philosophy section, freedom of movement is likewise a vital part of Montessori education

**Social interaction.** Social interaction can include interaction between the educator and child and also between two children or groups of children. When children are interacting with each other and in control, they exercise self-control and develop further understanding and meaning (Pramling Samuelsson and Asplund Carlsson, 2008, p. 627). Dr. Montessori felt strongly about the social aspects of the Montessori pedagogy as discussed in the emotional health section on the benefits of environmental education and time outdoors.

**Playful learning conclusion.** Lillard provides a succinct summary of the differences and the similarities in her 2013 article when she writes, “Montessori shares many elements of playful
learning, including overall structure, the use of small objects for learning, individualized lessons, free choice, peer involvement, fun, and lack of extrinsic rewards. It differs by having a specific set of materials, less free choice in interacting with materials, in calling children’s activity ‘work,’ and, especially, in its lacking any pretend play” (p. 179). Children who are integrated into an environment where the pedagogy for play and learning are also integrated do not typically make a distinction between the two and will describe play and learning as joyful (Samuelsson & Carlsson, 2008, p. 626). Dr. Montessori observed that children in classrooms using her method found learning to be full of joy, contentment, and fulfillment. Therefore, while Montessori pedagogy is not “free play,” it still shares elements of playful learning and is compatible with the requests for play-based learning in environmental education.

Barriers to Implementation of Environmental Education

While the focus of this study is on how Montessori-trained early childhood educators are implementing systems-based environmental education concepts in their classrooms, there is a possible corollary question of “If not, why not?” While there is less focus placed on barriers within this study, there has been research conducted on the topic and including a few questions will provide even more context for future research.

Beliefs and Values

It is well known that teachers’ beliefs and values have a strong impact on the implementation of environmental education practices (Mullens & Cater, 2018, p. 2; Årlemalm-Hagsér and Sandberg, 2011, 191). Educators frequently misinterpret the underlying educational philosophies, themes, and content of environmental education and therefore do not intentionally include it in their lessons and classroom as they think time spent outdoors is enough (Pollock,
In addition, if teachers misunderstand the underlying philosophical aims of environmental education, they may focus on things like endangered species or climate change or even completely eschew environmental education as they may believe children should not have to worry about such complex and potentially scary issues (Duhn, 2012).

In addition, teachers themselves don’t always have the love for and sense of place to role model and share with the children in their classrooms (Gilder, 2009), and yet adults who are encouraging and connected themselves are so important (Johnson, 2014, p. 42). Carson wrote about the importance of this, “If a child is to keep alive his inborn sense of wonder […] he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in” (1956/1998, pp. 44-49). Sometimes adults know that they are supposed to educate about the environment, but if they don’t have the connection to nature themselves, their actions may show something very different from their words (Louv, 2008, p. 14).

Educators may even love the natural world and might want to engage children, but still feel less than confident or not be aware of ways in which to educate, which has been found to also have an effect on children’s abilities to engage (Block et al., 2011, p. 423). In the study by Pollock et al., educators identified that some challenges to environmental education were that they had variable levels of confidence in implementation (2017, p. 15).

Last, teachers have reported that they don’t feel that they have enough time to cover the core curriculum much less environmental education and that parents have also been concerned that environmental education would supplant the core academic subjects (Pollock et al., 2017; Block, 2011; Duhn, 2012, p. 22) In contract to these fears, the interdisciplinary nature of environmental education should be utilized and embraced instead of an either/or proposition. “In
almost all cases, at least among focus group participants, these concerns were allayed once the program was established, largely because kitchen and garden classes functioned as a natural site for curriculum integration” (Block et al, 2011, p. 424).

**Licensing, Insurance, and Risks**

Nimmo and Hallett (2008) describe the garden at their center is being a place that allows children many opportunities for safe risk and that it is important to allow children to engage in some risk-taking behavior (pp. 2-3). They specifically describe a small snake and also mud as opportunities for children to engage in these risky situations. They explain teachers must be willing to allow risks and ask, “Could we see children as capable of using (adult-size) gardening materials and tools and also being responsible for some of the real work involved, like weeding, planting, or mulching?” (p. 3). Some risks aren’t really even health risks, but perhaps a demonstration of ecophobia. Nimmo and Hallett give the example of a child tasting a green tomato. This would not hurt the child, and yet often adults may intervene instead of allowing the child to complete the sensorial experience.

It can be difficult for teachers to be willing to allow these risks when licensing standards can come down so hard on educators. Early childhood programs may be licensed under very different standards and expectations, and legislators often come down on the side of absolute physical safety over whole-child growth and development. It’s not only licensing; it’s also parent expectations. Supervision in the outdoors environment is increasing and children also spend less time outdoors (England Marketing, 2009; Hanscom, 2016). Parents worry about things like abduction, car accidents, or injuries (England Marketing, 2009; Hanscom 2016). Hanscom states, though, that the more children engage in risky activities, the better they get at developing strong physical skills and the ability to judge their own capability (Hanscom, 2016, pp. 127-132).
Another factor in how much time children get in the outdoors could be insurance rates. “In 2002, Australia’s Scouting organizations Girl Guides and Scouts Australia reported increases of as much as 500 percent in a single year, leading the executive director of Scouts America to warn that Scouting could be ‘unviable’ if insurance premiums continued to rise” (Louv, 2008, p. 154).

**Method**

This paper utilized a cross-sectional descriptive survey to gather information from Montessori educators on their lessons, materials, and prepared environment as it relates to systems-based environmental education. Simple frequency counts were provided for each multiple-choice and Likert-scale question. For the open-ended questions, qualitative methods were used as follows. First, content was sorted into patterns or themes. Dependent upon what emerged, the themes were either strictly reported as occurring or described with the frequency of the occurrence. Lastly, in order to capture some of the richness of responses, some participants’ answers were included as well. There were no inferential statistics calculated as there were no variables; the intent was merely to capture current, existing practices in the sample population.

**Participants and Procedure**

Potential participants were contacted via purposeful homogenous sampling: (1) half-sheet paper fliers describing the research study with a link to the questionnaire were handed out at the annual American Montessori Society conference between March 20, 2019 and March 24, 2019, (2) online e-mail groups and social media groups related to Montessori education were contacted and asked to distribute the electronic version of the invitational flier between March 19th and April 23rd, 2019, (3) 1,199 schools as listed on the American Montessori Society website with a
valid e-mail address located within all fifty states of the United States were sent an e-mail
message that included the electronic version of the invitational flier between April 17th and April
23rd, 2019, and (4) all former and current students in the Montessori Teacher Education program
on a University of Wisconsin-River Falls listserv were sent an e-mail message that included the
electronic version of the invitational flier on March 19th and on April 12th, 2019. The invitational
flier stated that the participant parameters were as follows, “You are invited to participate in a
research study. In order to participate, you must be working in a Montessori Children's House
(ages 3-6) and have contact with children between the ages of 2 years and 7 years. Taking part in
this research study is voluntary, anonymous, and confidential.” Please see Appendix C for a full
copy of the invitational flier.

Participants received no further contact from the researcher than initial invitational flier
with or without the accompanying e-mail message. It is unknown precisely how each participant
gained knowledge of the survey as the invitation to participate encouraged individuals to forward
the invitation or post it on social media, but each actual participant would have navigated to the
survey link and proceeded to fill out the survey starting with reading the informed consent and
indicating acceptance. There was no compensation given for completing the survey.

**Questionnaire Design**

The questionnaire was hosted entirely on SurveyMonkey and was broken into 11
unnumbered pages, nine of which had page titles as follows:

- Page 1: Consent to be Part of a Research Study, Question 1;
- Page 2: Demographic Information, Questions 2-7;
- Page 3: Environmental Education, Questions 8-10;
- Page 4: School/Program Information, Questions 11-10;
Page 5: Pedagogical Practices, Questions 20-30;
Page 6: Health Promotion (Cognitive, Physical, and Social Emotional), Questions 31-37;
Page 7: Social Systems Education, Questions 38-41;
Page 8, Questions 42-47;
Page 9: Natural Systems Education, Questions 48-55;
Page 10, Questions 56-67; and
Page 11: Other, Questions 68-71.

There was a percentage-based progress bar along the bottom of each page and the top of each page was headed with “Environmental Education in Montessori Pedagogy.” The 71 questions were always presented in the same order as outlined in Appendix A with the same order of options and were comprised of, in mixed order, 47 multiple choice questions (of which eleven had an “other” option with the opportunity to write-in an option), three fill in the blank questions, 18 short answer essay questions, one 5-point Likert scale, and two 7-point Likert scales.

Before creating the data instrument, I completed a broad literature review to pull themes and concepts from a variety of sources and then constructed the overall structure of the questionnaire and populated it with questions. During this process, the most influential information came from the four major themes and sub-themes found by Ärlemalm-Hagsér and Sandberg (2011), the strands and standards of the Wisconsin Standards for Environmental Literacy and Sustainability (2018), the key systems concepts and supporting concepts combined with the benchmarks found in Minnesota’s Environmental Literacy Scope and Sequence (2002), the key characteristics and guidelines found in NAAEE’s Early Childhood Environmental Education Programs: Guidelines for Excellence (2016), and personal knowledge of Montessori pedagogy. The holistic look at the foundation of the latter three documents combined with many
other articles resulted in six major philosophies of learning – regarding content or structure of learning or both. Questions were written based on the interplay of all of these and a comparison matrix of these sources in relation to each question can be found in Appendix B.

After the demographic questions, the questionnaire begins with the section Environmental Education with three short answer essay questions. This section of the survey was placed first in order to get answers that were not biased by participants inferring information about systems-based environmental education from the rest of the survey questions. The School/Program Information section was included next in the questionnaire in order to place into perspective the environments in which the teachers were working as well as gain information about nation-wide Montessori school/program practices. The third section, Pedagogical Practices, was written to include some larger themes around environmental education that had less to do with specifics and more to do with practices and things the teachers could control. The fourth section, Health Promotion (Cognitive, Physical, and Social Emotional) largely addresses items discovered in the literature review that relate to time outdoors. The fifth section was constructed to dig deeper into practices in social systems education and the sixth section for natural systems education. The seventh section was a catch-all with questions on integrating social systems and natural systems, on barriers, and a last opportunity for people to share.

Results

In order to support future research regarding the relationship between Montessori pedagogy and environmental education, the results have been reported in full in Appendix D. This will allow comparisons in future research (whether Montessori, traditional, or another educational philosophy such as Waldorf) even on areas that may not have been interesting in our
results. Conversation regarding the results and meanings found within them can be found in the Discussion section on page 125.

**Demographic**

Demographic information was captured through six questions on the questionnaire. There were 93 total participants who completed informed consent, but 50 of those were removed from the sample as they had not provided enough information beyond the demographic questions to be included. Of the remaining 43 participants, 33 read and completed the entire survey (although they were permitted to and did skip questions here or there) and 10 read and completed only up to a specific section. Those remaining ten were recorded as incomplete surveys but were included in all the results and therefore any questions they did not answer are reflected in the results as “skipped.” See Table 3, Table 4, Figure 2, and Appendix D for further demographic information.

Table 3

*Question 2: Participants’ Montessori training (n=43)*

<table>
<thead>
<tr>
<th>Questionnaire Choice</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS-affiliated Teacher Education Program</td>
<td>33</td>
<td>76.7%</td>
</tr>
<tr>
<td>AMI Training Center</td>
<td>2</td>
<td>4.7%</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>18.6%</td>
</tr>
</tbody>
</table>

Table 4

*Question 3: Participants’ employment position (n=43)*

<table>
<thead>
<tr>
<th>Questionnaire Choice</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
</table>

Montessori lead/guide or co-lead & 28 & 65.12% \\
Head of school, director, administrative & 10 & 23.26% \\
Teacher & 4 & 2.33% \\
Assistant & 1 & 2.33% \\

<table>
<thead>
<tr>
<th>Number of Years of Experience</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>2</td>
</tr>
<tr>
<td>2-4</td>
<td>7</td>
</tr>
<tr>
<td>4-6</td>
<td>7</td>
</tr>
<tr>
<td>6-8</td>
<td>1</td>
</tr>
<tr>
<td>8-10</td>
<td>6</td>
</tr>
<tr>
<td>10+</td>
<td>20</td>
</tr>
</tbody>
</table>

Figure 2. Question 7: Participants' years of experience in Montessori Children's House

**Discussion, Analysis, and Conclusions**

Overall, the examination of the philosophical foundation of Montessori pedagogy and systems-based environmental education seemed consistent that the two are well aligned. There were interesting findings identified in the results to the questionnaire, however, in the thematic areas of the definitions of environmental education and environmental literacy, school/program practices, critical pedagogy of place and teacher beliefs and values, interdisciplinary integration of environmental education, and integration between social systems and natural systems that show areas of concern or growth in the context of strengthening the relationship between these two educational realms in order to better merge environmental education into Montessori
pedagogy. After dialogue on the findings in these areas, this paper concludes with some additional future research possibilities and the limitations of this study.

**Environmental Education**

When the educators were asked to define environmental education (see Question 8), 76.32% focused more on the importance of building knowledge than on the importance of connecting with nature. 97.37% had a global or unspecified focus, meaning that they didn’t include the importance of the local place in their answer. Themes were heavily skewed towards stewardship (50%) and cause and effect (28.95%). Ideally, there would be more of a focus on a personal connection (26.32%) focusing on or starting in the local environment (2.63%) and in the creation of biophilia (15.79%). Given the Cosmic Education curriculum and Dr. Montessori’s belief in the importance of connecting children to reality and nature, I expected more of the educators to focus on connection and inducing biophilia. Another surprising result here was that only 10.53% of educators mentioned hands-on and experiential discoveries and exploration when there is such a large focus on experiential learning and the integration of mind and body in Montessori philosophy. Only two participants, or 5.26% even mentioned spending time outdoors in nature as being an important part of environmental education. This, again, does not correspond with Dr. Montessori’s view that real experiences in nature, as highlighted in her comment reported in the Benefits of Environmental Education and Time Spent Outdoors in Early Childhood sub-section Cognitive Health where she states that a feeling for nature will not happen in a child shut up in a classroom.

A similar experience occurred with the definition of environmental literacy (see Question 9). 51.35% of the participants focused on understanding nature and having knowledge regarding nature, where ideally there would be more focus placed on competence or skills (8.11%) and the
creation of identity or engagement (5.41%). This shift in the definition would be important when taking into consideration that standards in early childhood are focused more on building skills than knowledge and the research understanding of the importance of building connection and engagement with nature in early childhood as described in the Defining Environmental Education subsection entitled Early Implementation and a Note on Grade-Levels in Standards.

In this section of the questionnaire, participants were also asked to explain where future environmentalists would come from (see Question 10). It is no surprise that nearly all of the respondents stated future environmentalists would come from children or schools, given that the participants were early childhood educators. That said, only 10.53% of the participants responded that environmentalists would come from people who spend time in nature or from children who love nature. This surprising near-dichotomous result between what both Montessori and environmental education philosophies state is important versus the near absence of real experiences and time outdoors within the responses could be explained by at least two things: (a) a difference in internal beliefs and values versus cognitive knowledge of what should be happening, and (b) the questions were not phrased to ask about the definitions or possibility for future environmentalists in relation to early childhood. An interesting future study would be to re-frame the questions and re-administer, coding for the same thematic values (and potential new ones).

**Schools/Program Information**

A pleasant finding was that 86.21% of schools/programs have some form of written philosophy, goals, and objectives guiding their operations in the area of nature and environmental education in areas such as staff development, teaching practices, lesson development, and indoor and outdoor learning design. 83.87% had some form of written
guidelines regarding the value of nature in areas such as appropriate specimen collection, the importance of adults being role models, the importance of environmental responsibility in design or materials, waste management practices, and the development of stewardship in children. All but one educator also self-reported that whether or not his or her school or program had incorporated this, it was being practiced at some level.

There were, however, several areas where schools/programs could favorably impact their practices include requiring and providing professional development on environmental education, completing a formal assessment of their ecological sustainability practices, providing staff information on local environmental concerns, and encouraging partnerships with other organizations.

31.58% of the schools represented in the sample population provided professional development on environmental literacy and positive outdoor experiences and only 7.89% of participants stated their school/program required the training (see results on Question 13). While this study did not encompass teacher education programs, if teachers did not receive training there, then they may not be receiving training on this topic at all. That said, it is encouraging that 76.32% of the participants stated they had independently chosen to take advantage of professional development opportunities in this area regardless (see results on Question 14) and that 57.89% of schools or programs are encouraging this type of training. Encouragement alone is not enough, however, especially when teachers may be required to source and pay for these trainings on their own. An interesting future study could involve looking at how much environmental education is incorporated into teacher education programs and how much access educators have to these sorts of trainings outside of their initial training. This training is especially critical given that previous research shows that lack of training or confidence in skills
has been a barrier for the implementation of environmental education. Within this study, 17.24% of participants (nearly one-fifth) responded that they were not comfortable with providing environmental education (see Question 69).

When asked whether their school or program had conducted a formal assessment of ecological sustainability practices (see Question 16), 57.89% of participants related their program had not and an additional 21.05% stated they didn’t know. When this information is combined with 23.68% of participants stating classroom materials and furnishings were not purchased with sustainability in mind (Question 19), this becomes even more troubling. A significant area of growth would be for schools or programs to assess their ecological sustainability practices as it will give them a concrete starting place for implementing and effecting change.

Another area of concern is that 72.97% of schools do not provide their teachers with information on locally-relevant environmental concerns (see Question 15). While the intent would not be that teachers would explicitly use the information to scare or induce ecophobia in the child, teachers could choose to use the relevant information in their practices in other ways. An example would be if there is a certain type of pollinator that is threatened in the area, the school could work together to create food sources for that pollinator in the school yard and engage in citizen-science activities with the children without the focus of the lessons being on the critical or endangered aspect of the pollinator, but instead on building a love for that pollinator which could serve as a foundation for future studies at an older age. While one possibility for the importance of this question is on teachers implementing classroom lessons or activities around the information, another way to view it through the lens of critical pedagogy of place. If educators are not aware of the locally-relevant environmental concerns, are they truly
using place-based education and incorporating the views of local citizens who may be related to the children in their classrooms?

The last area of growth being highlighted is that schools could be encouraging and supporting teachers in partnering with other organizations (see Question 40). While originally located in the questionnaire section Social Systems Education, developing partnerships with other organizations is likely something that needs to be encouraged, supported, and approved by the school or program in which an educator works. Only 39.39% of participants reported that they partner with environmental education organizations, which often provide free training and activities that could be adapted by and incorporated into a Montessori environment. Less than a quarter reported: that they partner with county, state, or federal conservation agencies (24.24%); conservation agencies (21.21%); local public or private schools (18.18%); youth organizations such as Scouts or 4-H (12.12%); local colleges or universities (12.12%); or intergenerational programs (6.06%). These are, again, great places to receive free training, free activities, and access to experts who can create intergenerational relationships with the children in Montessori classrooms. Even more troubling, 36.36% of participants did not respond that they partner with families and 24.24% of participants stated they don’t partner with anyone at all. On top of the access to free or low cost educational lessons or activities, training, experts, and individuals of different ages to support the social growth of children, by not taking advantage of these partnerships, educators are missing out on that critical pedagogy of place discussed in the Defining Environmental Education subsection on philosophies of learning. Last, by partnering with these types of organizations, Montessori schools also get to showcase what they are doing for environmental education and increase the voice of Montessori schools in the field.
Pedagogical Practices

Being intentional and thoughtful is a key part of Montessori pedagogy. Observant, knowledgeable teachers intentionally think of direct and indirect aims to create an engaging and educational environment in which children are able to construct themselves and their understanding of the world. Yet, 13.16% of Montessori-trained early childhood educators are not intentionally including environmental education in their lesson plans (see Question 22) and an additional 13.16% do not have lesson plans at all. Of the 5 who stated they did not have lesson plans, one was an assistant and one was an administrator. While educators may still be highlighting systems-based environmental education components without lesson plans, it is surprising that approximately one-quarter of Montessori educators are not being intentional about its inclusion. One possible reason for this result is that Montessori-trained early childhood educators may not be aware of what the components of systems-based environmental education are, and therefore do not realize they are integrating important concepts into their lesson plans.

Allowing children self-directed time to observe their surroundings and process things they are learning is important. Yet when asked what participants would do or say to a child who was found staring out the window during work time, only 26.32% of the participants responded that they would not interfere in the child conducting this activity. 31.58% would allow the activity for a short period of time and then either ask the child what they see, suggest a follow-up activity, redirect the child, or share what the educator is seeing. 15.79% would redirect the child to what they considered a more appropriate activity. A future study could compare how a Montessori-trained educator would respond to this question versus a traditionally-trained educator with special attention paid to the percentage of educators who do not interfere and who redirect.
Another area of interest in pedagogical practices was the use of unprocessed natural materials in works (e.g. acorns as counters, pinecones for sorting sizes, pieces of bark for grading from rough to smooth, seeds in pouring works). 78.38% of the participants responded that they have natural materials in less than half of their works with mathematics, language arts, and movement having the least number of responses. Practical life and outdoor environments had the most (94.74% each), with cultural (84.21%) just behind. The cultural area of the classroom includes history, geography, and science, yet over 10% more of participants stated they had unprocessed natural materials in their practical life area. Future research could delve into what type of unprocessed natural materials are where. Supposition would state that the Practical Life curriculum’s pouring and tonging activities may include many unprocessed natural materials which may be skewing the results. Only 47.37% of participants had unprocessed natural materials in their Sensorial curriculum’s works. While that is nearly half of participants, the hope would be that more real and unprocessed natural materials would be incorporated into the development of children’s senses due to the importance given by Dr. Montessori in the creation of sensorial impressions, the emphasis on reality and nature in Montessori philosophy, the emphasis on real experiences mixed with wonder in environmental education, and Anderson’s (1992) cautionary note on the importance of sensorial experiences in cognitive neuroscience as highlighted in the Defining Environmental Education subsection on constructivism. Mathematics (39.47%) and the language arts area of the classroom (21.05%) have even less incorporation of unprocessed natural materials. In the Mathematics curriculum, there is a heavy emphasis placed on the didactic materials created or appropriated by Dr. Montessori, but there are places where these natural materials could be included.
Future research could be done on the finding that children are regarded as co-researchers, co-planners, and joint decision makers up to 64.29% of the time on average (see Question 29). Combining this with the reported results regarding how children get their questions answered (see Question 27) and how often children can share their information (see Question 28) could be compared to traditional and inquiry-based programs to situate Montessori-trained educators in the discussion on this aspect of systems-based environmental education. It would also be interesting to compare these results to participants results from educators in lower and upper elementary Montessori classrooms.

**Health Promotion (Cognitive, Physical, and Social Emotional)**

When participants were asked how they encourage children to explore natural materials with their senses, educators were slightly more likely to reference outdoor locations (40.63%) versus indoor locations (31.25%), but even more interestingly, they gave many more examples when discussing the outdoors. This may indicate that educators need more training on how to incorporate those unprocessed natural materials indoors and support sensorial exploration with them.

A surprising result was that 88.89% of participants reported that they had access to a school garden (see Question 34) and many participants reported that children were involved in garden activities (see Question 35). 96.97% of children start seeds, 93.94% water the garden, 90.91% engage in activities with tools like a shovel or rake, 90.91% harvest plants or plant materials, 87.88% plant seedlings and plants, 84.85% weed the garden, and 63.64% have compost activities. A future area of research would be to compare these results to traditional early childhood programs. One caveat may be that the people who elected to participate in this survey may have been individuals who already felt strongly about the importance of
environmental education and thus were willing to dedicate time to taking the survey. A smaller survey based on garden practices may yield less participants having access to gardens.

Another interesting, but not surprising, finding in the area of physical health involved the number of hours that children spend outdoors in late spring through early fall or late fall through early spring (see Questions 48-49 and Figure 10 and 11). Future research may find that comparing the change of how many hours spent outside based upon seasonal weather and location of the participants may be helpful. Demographic information on where schools or programs were located (such as inner city versus rural) and the economic structure of the school or program was not collected, which may also have an impact on how many hours per week are spent outdoors.

Social Systems Education

This noted area of growth for Montessori-trained early childhood educators deeply relates back to the beliefs and values of the teacher. When combining the below results, a troubling picture begins to emerge.

- As already discussed, when defining environmental education only one participant, 2.63% of the respondents for that question, got close to mentioning the local environment in their response (see Question 8).
- When describing where future environmentalists would come from, only a little over 1/10 of the responses mentioned anything about spending time in nature (see Question 10).
- In addition, 39.39% of participants reported they do not visit local natural sites while another 36.36% only visit a local natural site once per year (see Question 55).
• More than a quarter of participants reported that they do not intentionally include native or local plants or animals in the representations in their classroom (see Question 62).
• 38.24% of teachers are not using maps from their local community in their cultural studies (see Question 47).
• When teaching about endangered species (see Question 66), 48.48% of teachers are teaching about local endangered species while 78.78% are teaching about global endangered species. While I was primarily more interested in whether or not teachers were covering endangered species at all (in relation to ecophobia), I still found that this result showcased how local biodiversity is not examined as much as global.
• 27.27% of participants are not using the children’s cultural information in their classroom, whether they gather it from families or not, and 33.33% of participants are only using that information infrequently (see Questions 41-42). When using that information, most participants (30.43%) are only using that information to influence celebrations or holidays and only 13.04% said they are using the information to connect children and create greater community understanding.
• 28.13% of participants are not teaching about traditional and non-traditional families as they relate to the dominant culture (see Question 46).

While individually these results may not be alarming, together they paint a picture that utilizing a critical pedagogy of place may not be of much concern to Montessori teachers in early childhood at this time. Referring back to the discussion of Cole (2007) and Anderson (1992), ignoring children’s cultural background and experiences and not connecting them to the local environment in which they’re situated may be setting them up for future cognitive dissonance as they try to navigate the differences between the knowledge they gain between their families and
the school environment and they may not even register the importance of environmental education at all because it is not being contextually taught in a way that matters or makes sense to them.

**Natural Systems Education**

When teaching about seasons and natural cycles, it’s important for children to spend time outdoors frequently over a long period of time and also at different times of the day in order to see the environment at varying times. Animals that are active in the morning may not be active in the afternoon and plants that are closed early may open in the afternoon soon. The outdoor environment is a dynamic place, yet 75.76% of participants responded that children go outside at the same time every day (see Question 50). While this may be due to scheduling issues such as competing over the same outdoor space in larger schools or finding a spot outside of the work cycle and around meals, it could also be that educators do not think about varying outdoor time across the week or school year. One problem with this question is that it did not address that educators might be taking out children twice in a day, and therefore they would be getting time spent outdoors at different points during the day (even if they’re the same times every day).

Another look at this concept was performed when asking participants about their visits to local natural sites (see Questions 55-56). 39.39% of participants reported that they don’t visit local natural sites at all and 36.36% only go once per year. This could be explained by the reported barriers, although the questions were asked in different context (see Questions 69-70) that there are weather concerns (62.50%), not enough time in the day (59.38%), concerns that transportation is costly or difficult to arrange (21.88%), and limited access to natural areas (10.34%). In another surprising split between what educators should be encouraging (such as more time outdoors and more real and hands-on experiences), when educators were asked about
their practices when encouraging children to learn about the cycle of nature and seasonal changes (see Question 59), only 34.62% of participants mentioned time outside, while 23.08% each mentioned books and life cycle works.

In addition to not spending time frequently in local natural sites, 90% of participants reported that children spend at least a portion of their time guided in the natural site by an adult (see Question 56). 45% of the total respondents reported that children are led through structured activities. Only 45% of respondents stated children are given time for unstructured free play, which research indicates is important. Future research could narrow down this question about how children spend their time outdoor in local natural sites (as opposed to playgrounds where children may primarily be self-directed and unstructured but not among natural materials) by examining the elements of playful learning instead of phrasing the question as unstructured free play. As noted in several areas of this paper, there is a philosophical difference of language amongst early childhood educators when discussing work and play.

A positive finding was that 81.82% of participants responded that children are allowed to bring materials indoors from their outdoors spaces (see Question 53) and 75.86% of participants have a dedicated public classroom location for children to put things for future exploration (20.69%), to share with the class (17.24%), art projects (13.79%), or other uses (see Question 54). Yet, when discussing pedagogical practices, it was highlighted that there is more work to do in incorporating unprocessed natural materials in works across curricular areas indoors. One reason that this is important is that it supports interdisciplinary integration of the concepts embedded within systems-based environmental education. There are other areas that need support as well. In the outdoor environment, Montessori teachers may need to be more intentional about providing inquiry-based tools to children in conjunction with unstructured time
to explore (see Question 51). The outdoor environment was perhaps more neglected, outside of school gardens, than it could be with less intentional infusion of environmental education concepts and child-directed meaningful work. When reporting which curricular areas teachers integrated into lessons outdoors, math was underrepresented as compared to the subjects (see Question 57) which may have something to do with the precise Montessori math materials and the lesser emphasis on graphing and measurement in favor of more concrete activities.

A real strength of the Montessori early childhood classroom is the amount of hands-on experiences children get with live plants and animals as well as their representations (see Questions 60-61). In fact, only 9.38% of participants stated that children were not regularly involved in plant or animal care (see Question 63). That said, 27.27% of participants reported that they are not intentionally including native or local plants or animals in their 3D and 2D representations in the classroom (see Question 62). While it may be difficult to include live native or local plants or animals in the classroom, it should not be as challenging to include these representations.

In an examination of the practices of encouraging biophilia over inducing ecophobia, more research needs to be done. It was encouraging that 92.68% of participants responded in a way that reflected biophilia in the question regarding how they would react if a child walked up to them holding a giant centipede (see Question 64), but I realized after the fact that this question would engender drastically different results if the educator lived in a desert climate (where the first thing a respondent may think of is the venomous bite of the Scolopendra heros) versus if they lived somewhere in which the most relevant and immediate picture brought to mind of a giant centipede probably more closely resembles a house centipede. Regardless, 69.23% of participants would ask the child to place the centipede in a more appropriate place whether it is a
specimen container or back on the ground for future observation and 29% of participants responded in some way regarding the safe handling of an animal such as being respectful to the animal or taking care with it. Another result that informs on these practices is that 57.58% of participants do not cover climate change in their classrooms (see Question 67). A follow up question probably should have been asked to determine why educators were not teaching this in order to better get at this dimension of environmental education in early childhood.

The next set of results covers both the ecophobia and biophilia and the local versus global dimensions. Only 12.12% of educators are not covering endangered species of any kind in their classroom (see Question 66). But, the focus remains primarily on global species (78.78%) instead of local species (48.18%). More research needs to be done to find out why this is, and I would be curious to see how it relates to whether or not schools are providing information and education on local species that need protection or what sort of partnerships the educators are engaged in. In other words, where are they getting their information on local endangered species? It would also be interesting to see how educators are teaching about or incorporating works regarding endangered species in their classroom to see if they are managing to avoid inducing ecophobia in their methods.

In yet another seeming disconnect between what educators think they should be doing for children and their actual practices (outdoors and in natural sites), when asked how educators are connecting wonder to the natural world (see Question 65), 40.74% of the participants responded they allow time to observe such as bird watching, weather observation, watching water flow, examining early plant shoots, taking walks, noting seasonal changes, and noticing the small thing. 55.56% responded that they role model, show their own curiosity, or show their own excitement. This seeming disconnect may be explained that participants may be focusing more
on what they can see in less natural sites such as their playground or in their classrooms and not actually in time in natural environments. 22.22% each responded that they use books or discussion.

**Other**

When teachers were asked about the methods through which they integrate social systems and natural systems, such as how people have an impact on nature, how systems are made of parts, or how systems may not continue to function if any of their parts are missing, 23.53% of the participants thought that the Montessori cultural curriculum already fulfilled this in the continent study practices, 17.65% felt that the Montessori curriculum in general already did this, while another 23.53% primarily used informal discussions. But 17.65% said that they don’t think that they do this at all. This is an area for future research that may require actual observation to see the methods early childhood educators are using to integrate these concepts as well as other research methods to further explore this very key part of systems-based environmental education.

One of the more interesting results was found in Question 70 regarding the barriers to environmental education. Not only did more participants write in answers than choose the pre-written selections, but there was also a schism in the results. Some participants felt that environmental education was a separate subject mutually exclusive from Montessori education while others felt it was naturally integrated and emphasized throughout the curriculum. 20.69% of participants didn’t think there were any barriers at all while 41.38% thought environmental education wasn’t as important as other curricular areas to parents, 17.24% weren’t comfortable, and another 17.24% didn’t feel they had enough time. This one question did more than all the rest to highlight how important it is for teacher education programs to imbue environmental education into each of the curricular areas of their training programs and to highlight Dr.
Montessori’s belief in the importance of real, natural experiences in early childhood.

Environmental education practices should not be supplanting Montessori pedagogy in the classroom, but rather should be an integral and integrated part of daily practices. In other words, environmental education is not and should not be viewed as a separate subject by Montessori-trained educators.

**Future Research**

Areas for future research have been highlighted throughout the Discussion section of this paper. In addition, many of the questions in this survey could be better formulated and expanded to get at finer concepts of environmental education practices in Montessori education. This process may include refining the survey into smaller chunks with less questions to allow participants to more fully explain their practices and materials. Because this survey was intended to be broad and create a base to begin with, many concepts were left out or glossed over. The results have been fully reported in Appendix D in order to provide context, despite the small sample size, to perhaps encourage a future researcher to find an area to expand and clarify.

One large portion of the survey that was cut during the creation phase due to time constraints and the length of the survey was the section on teacher beliefs and values. Mullens and Cater (2018) and Torquati, Cutler, Gilkerson, and Sarver (2013, July) provide excellent starting points for this type of work including a complete questionnaire in Mullens’ and Cater’s work.

**Limitations**

There was a significant time constraint to completing this paper with an approximate six-week turn-around from IRB approval to the completion of the paper. The short data-collection
window combined with not having a built-in participant pool meant that there was ultimately a small sample size. Due to the length of the survey, more participants dropped out over time. Due to being an anonymous survey, results were self-reported and therefore participants’ reliability and accuracy are unknown. Only participants with internet access and significant time available to complete the survey (all completed surveys were finished in between 16 minutes to over five days, although most were under an hour and ten minutes) were able to provide their answers, which means that groups of people could have been unintentionally excluded. The questionnaire itself was not subjected to testing to ensure that it was accurately measuring the correct concepts, although it was descriptive and not inferential. The short-answer essay questions would have been better served as interview questions for richer qualitative data. Last, the sample population held mostly teachers trained in AMS-affiliated programs and only two had AMI instruction.
References


http://publications.naturalengland.org.uk/publication/5853658314964992


https://doi.org/10.1007/s10393-014-0987-y


Minnesota Department of Health. (2010). *Learning about nutrition through activities (LANA)*.


St. Paul, MN: Minnesota Office of Environmental Assistance.


United States Department of Agriculture. (2015, December). *Grow it, try it, like it!*


Appendix A: Participant Survey

Consent to be Part of a Research Study

Title of the Project: Role of Environmental Education in Montessori Pedagogy
Principal Investigator: Jennifer Rothmeyer, B.A, University of Wisconsin – River Falls
Faculty Advisor: Kateri Carver, Ph.D., University of Wisconsin – River Falls

Invitation to be Part of a Research Study
You are invited to participate in a research study. In order to participate, you must be working in a Montessori Children’s House (ages 3-6) and have contact with children between the ages of 2 years and 7 years. Taking part in this research study is voluntary.

Important Information about the Research Study
Things you should know:

- The purpose of the study is to investigate how Montessori programs implement concepts from systems-based environmental education. If you choose to participate, you will be asked to complete survey questions. This will take approximately 30-45 minutes.
- Risks or discomforts from this research include the inconvenience of completing the survey.
- The study will provide no direct benefit to you but will provide a baseline understanding of environmental education practices for future research into Montessori pedagogy and allow comparisons between Montessori and non-Montessori programs.
- Taking part in this research project is voluntary. You don’t have to participate, and you can stop at any time.

Please take time to read this entire form and ask questions before deciding whether to take part in this research project.

What is the study about and why are we doing it?
The purpose of the study is to examine if and how Montessori Children’s House educators are, knowingly or unknowingly, incorporating standards, concepts, and guidelines from systems-based environmental education within their lessons, materials, and prepared environments. This project utilizes theoretical underpinnings of constructivism, interdisciplinary systems-based environmental education, and Montessori pedagogy as a lens to analyze current practices in Montessori early childhood programs.

What will happen if you take part in this study?
If you agree to take part in this study, you will be asked to complete survey questions via SurveyMonkey. We expect the survey questions will take approximately thirty to forty-five minutes.
**How could you benefit from this study?**

Although you will not directly benefit from being in this study, others might benefit because this study will provide a baseline understanding of how environmental education is being implemented in Montessori early childhood programs. This could result in further research on environmental education that includes comparisons between non-Montessori and Montessori programs or could result in further refinement of environmental education processes in Montessori early childhood programs. You could benefit by reading the final master’s paper that will contain an aggregate of this data, which will be able to be found at University of Wisconsin – River Falls and its digital archive.

**What risks might result from being in this study?**

The only expected risk you might experience from being in this study is mild inconvenience.

**How will we protect your information?**

An aggregate of the data from this survey will be published in a final master’s paper. To protect your privacy, we will not include any information that could directly identify you. We will protect the confidentiality of your research records. Your name is not being collected. It is possible that other people may need to see the information we collect from you. These people work for the University of Wisconsin – River Falls and are responsible for making sure the research is done safely and properly.

If you tell us something that makes us believe that you or others have been or may be physically harmed against the statutes and rules of Minnesota law, we may report that information to the appropriate agencies.

**What will happen to the information we collect about you after the study is over?**

We will keep the survey data to use for future research. All information that could indirectly identify you will be kept secured. We will not share your research data with other investigators.

**Your Participation in this Study is Voluntary**

It is totally up to you to decide to be in this research study. Participating in this study is voluntary. Even if you decide to be part of the study now, you may change your mind and stop at any time. You do not have to answer any questions you do not want to answer. If you decide to withdraw before this study is completed, your data will be deleted.

**Contact Information for the Study Team and Questions about the Research**

If you have questions about this research, you may contact Jennifer Rothmeyer, jennifer.rothmeyer@uwrf.edu, or Kateri Carver, kateri.carver@uwrf.edu.

**Contact Information for Questions about Your Rights as a Research Participant**

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the following: University of Wisconsin – River Falls, c/o Diane Bennett, Director of Research, Office of Grants and Research, 104 North Hall, River Falls, WI, 50422, Phone: (715) 425-3195.
Your Consent
By clicking accept, you are agreeing to be in this study. Make sure you understand what the study is about before you consent. Please make a copy of this consent for your records. We will keep a copy with the study records. If you have any questions about the study after you consent, you can contact the study team using the information provided above.

1. I understand what the study is about and my questions so far have been answered. I agree to take part in this study.
   a. I accept
   b. I do not accept

Demographic Information
Please answer all demographic questions to move on to the survey.

2. From whom did you get your 3-6 Montessori training?
   a. AMS-affiliated Teacher Education Program
   b. AMI Training Center
   c. Other (please specify) [text box]

3. Check all that is relevant. I am employed...
   a. As a Montessori Lead/Guide/Co-lead
   b. As a teacher
   c. As an aide
   d. As an assistant
   e. As a substitute
   f. Part-time
   g. Full-time
   h. Other (please specify) [text box]

4. Check all that is relevant. I am employed in a...
   a. Montessori program
   b. Traditional program
   c. Other (please specify) [text box]
   d. In what ZIP code is the school/program at which you work located? (enter 5-digit ZIP code; for example, 00544 or 94305) [text box]

5. How many years of experience do you have teaching in a Montessori school/program?
   a. 0-2
   b. 2-4
   c. 4-6
   d. 6-8
   e. 8-10
   f. 10+

6. ...in a Montessori Children’s House (3-6 year old) school/program?
   a. 0-2
   b. 2-4
   c. 4-6
   d. 6-8
   e. 8-10
Environmental Education

Please answer the following questions in 1-3 sentences. Do not worry about having the most correct or most complete answer. It’s more important to know the first thing that comes to your mind. You may skip any question you do not wish to answer.

7. What is environmental education? [text box]
8. What is environmental literacy? [text box]
9. Where do you think future environmentalists will come from? [text box]

School/Program Information

10. Under the column “School/Program Created” below choose an option that describes the status of the development of nature-based and environmental education philosophy, goals, and objectives at the school/program at which you work.

Under the column “Practiced by Me” below choose an option that describes whether you implement philosophy, goals, and objectives relating to nature and the environment regardless of whether the school/program you work at has created them.

Note: To use the “fully implemented,” option these should be clearly written, available to staff, and used in:

- staff development
- teaching practices
- lesson development
- indoor and outdoor learning environment design to include educational materials, evaluation, and maintenance.

<table>
<thead>
<tr>
<th>Drop Down Options</th>
<th>School/Program Created</th>
<th>Practiced by Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philosophy, Goals, and Objectives</td>
<td>No intention to implement</td>
<td>No intention to practice</td>
</tr>
<tr>
<td></td>
<td>Not yet implemented</td>
<td>Not yet practicing</td>
</tr>
<tr>
<td></td>
<td>Partially implemented</td>
<td>Partially practicing</td>
</tr>
<tr>
<td></td>
<td>Fully implemented</td>
<td>Fully practicing</td>
</tr>
</tbody>
</table>

11. Under the column “School/Program Created” below choose an option that describes the status of the development of guidelines on the value of nature at the school/program at which you work.

Under the column “Practiced by Me” below choose an option that describes whether you practice following guidelines on the value of nature regardless of whether the
school/program you work at has created them.

Note: To use the “fully implemented,” option these should be clearly written, available to staff, and describe:

- appropriate specimen collection (e.g., flowers, leaves, insects)
- the importance of adults being role models for care of plants and animals
- importance of environmental responsibility in design or materials
- waste management practices
- the development of stewardship in children

<table>
<thead>
<tr>
<th>Drop Down Options</th>
<th>School/Program Created</th>
<th>Practiced by Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines on the Value of Nature</td>
<td>No intention to implement</td>
<td>No intention to practice</td>
</tr>
<tr>
<td></td>
<td>Not yet implemented</td>
<td>Not yet practicing</td>
</tr>
<tr>
<td></td>
<td>Partially implemented</td>
<td>Partially practicing</td>
</tr>
<tr>
<td></td>
<td>Fully implemented</td>
<td>Fully practicing</td>
</tr>
</tbody>
</table>

12. Check all that is relevant about professional development. The school/program I work at __________________ on environmental literacy and positive outdoor experiences.
   a. Requires training
   b. Provides training
   c. Encourages training
   d. Does not discuss training

13. I have independently chosen to take trainings on environmental literacy and positive outdoor experiences.
   a. Yes
   b. No

14. Check all that is relevant. The school/program I work at:
   a. Provides information on locally relevant environmental issues and ethical concerns
   b. Encourages me to think about my own approaches to and understanding of nature
   c. Encourages me to take children outdoors
   d. Provides education on environmental literacy and positive outdoor experiences to families

15. Has the school/program at which you work assessed its ecological sustainability practices according to formal environmental guidelines? These could be from state or federal guidelines or an environmental organization.
   a. Yes
   b. No
   c. I don’t know

16. Check all that is relevant. How is recycling handled at the school/program at which you work?
   a. Not yet implemented
   b. Staff is encouraged to recycle
c. Children are encouraged to recycle
d. Families are provided information on recycling

17. Do you regularly use re-purposed materials? (e.g. toilet paper tubes, old buttons, old lids, egg cartons, other loose parts)
   a. Yes
   b. No

18. Are classroom materials and furnishings purchased with sustainability in mind?
   a. Yes
   b. No

**Pedagogical Practices**

19. How many **hours per week** is your program open? [text box]

20. Fill in the average number of **hours per week** in your program dedicated to the following (number only):
   a. Montessori work cycle [text box]
   b. Unstructured free play [text box]
   c. Time outdoors [text box]
   d. Other [text box]

21. Do you intentionally and regularly incorporate environmental education into your lesson plans?
   a. Yes
   b. No
   c. I don’t have lesson plans

22. Please answer the following question in 1-3 sentences. A child is staring out the window during work time. What would you do or say? [text box]

23. Select on the scale below how many of your works use **unprocessed natural materials** (e.g. acorns as counters, pinecones for sorting sizes, pieces of bark for grading from rough to smooth, seeds in pouring works).

   Note: This **does not** include processed natural materials (e.g. acorns carved from wood, felt pinecones, sandpaper for grading from rough to smooth, glass seed replicas) or non-natural materials (e.g. plastic, vinyl).

   ![Scale](chart.png)

24. Check all that is relevant. Which areas of your prepared environment include **unprocessed** natural materials?
   a. Practical Life
   b. Sensorial
   c. Math
   d. Language Arts
   e. Cultural
   f. Art
   g. Movement
   h. Outdoor
25. Check all that is relevant. Describe your outdoor environment:
   a. Substantially natural (e.g., forest, prairie, lake/marsh, desert)
   b. Plastic playground equipment
   c. Natural playground equipment
   d. Open area
   e. Climbing area
   f. Messy materials or loose parts available
   g. Building materials available
   h. Art or music available
   i. Water for animals (e.g. pond, stream, bird bath)
   j. Water for children (e.g. spigot, mud kitchen, sensory table)
   k. Rain water collection
   l. Edible garden
   m. Native plants
   n. Non-native plants
   o. Plants for wildlife
   p. Trees
   q. Concrete
   r. Mulch
   s. Grass
   t. Shade
   u. Sun
   v. Windbreaks
   w. Other (please specify) [text box]

26. Check all that is relevant. When children have questions, how do they usually get their answers?
   a. Teacher notes the question and looks it up to answer
   b. Teacher notes the question and child and teacher research it together
   c. Child notes or remembers question and researches it with other children
   d. Child notes or remembers question and researches it on their own
   e. Questions are often not answered
   f. Unknown
   g. Other (please specify) [text box]

27. Are children given opportunities regularly to share what they’ve learned with the entire class?
   a. Yes
   b. No

28. Select your best estimate on the scale below. How often do you feel children in your classroom are regarded as co-researchers, co-planners, and/or joint decision makers?
29. Select your best estimate on the scale below. How many of your materials and lessons are intentionally designed to accommodate or be adapted to all abilities of children?

None of them  |  Half of them  |  All of them

Health Promotion (Cognitive, Physical, and Social Emotional)

30. Check all that are relevant. Does the outdoor environment at the school/program at which you work have varied levels and density of terrain?
   a. Yes, it is naturally varied (e.g. hills, marsh)
   b. Yes, we provided it through additional unprocessed or processed natural materials (e.g. stumps, logs, wooden bridges)
   c. Yes, we provided it through additional non-natural playground equipment (e.g. plastic playground equipment)
   d. No, it is completely flat (e.g. concrete)
   e. Other (please specify) [text box]

31. Check all that are relevant regarding activities that are available using natural materials in the outdoor environment at the school/program at which you work.
   a. Climb
   b. Balance
   c. Crawl
   d. Jump
   e. Roll
   f. Run
   g. Lift
   h. Spin
   i. Smell
   j. Taste
   k. Visual Variety
   l. Listen to natural sounds (e.g. birds, water)
   m. Engage in group social activities
   n. None

32. Answer in 1-3 sentences or in list form. How do you encourage children to explore natural materials indoors and outdoors with all of their senses? [text box]

33. Does the school/program that you work at have a school garden on site or accessible to the children?
   a. Yes, and we use edible food or products from the garden in our school meals, snacks or classroom activities
   b. Yes, and we do not use the edible food or products from the garden in our school meals, snacks, or classroom activities
   c. No, we do not have a school garden

34. Check all that is relevant. How do children regularly participate in garden activities?

   Note: Please check applicable items even if you do not have a school garden.
   a. Activities with tools (e.g. shovel, hoe, rake)
   b. Starting seeds
c. Planting seedlings and plants
   d. Weeding garden
   e. Watering garden
   f. Harvesting plant or plant materials
   g. Compost activities

35. Do any of your lessons or materials make connections between food and source? (e.g. beef and cow, strawberry and strawberry plant, chicken egg and hen)
   a. Yes, but only for vegan food items (not including any animal byproducts such as eggs and dairy)
   b. Yes, but only for vegetarian food items (including eggs and dairy)
   c. Yes, for all food items (including meat)
   d. No, we do not make connections between food and source

36. Answer in 1-3 sentences. How and how often do your lessons make connections between food and source and what materials do you use? (e.g., life cycles, three-part cards, shelf work [describe]) [text box]

Social Systems Education

37. Answer in 1-3 sentences. How do you encourage children to engage in activities outdoors that promote independence? (e.g., planting seeds, collecting specimens for study, exploring safely, harvesting without help, taking materials to a compost bin) [text box]

38. Answer in 1-3 sentences. How do you encourage children to respect the feelings of others? Please include in your answer if you have a specific conflict resolution curriculum or philosophy. [text box]

39. Check all that is relevant. How do you actively engage in partnerships with others to support resource sharing, enhanced program development, and expanded outreach.

I partner with...
   a. No one/Not yet implemented
   b. Families
   c. Youth organizations (e.g., Scouts, Future Farmers of America, 4-H)
   d. Faith-based organizations
   e. County, state, and federal conservation agencies (e.g. state fish and game agencies, Cooperative Extension or Master Gardeners, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, National Park Service, U.S. Forest Service)
   f. Conservation organizations (e.g. Keep America Beautiful, Audubon)
   g. Environmental education organizations (e.g. Project Learning Tree, Project WILD, Project WET, Nature Mapping)
   h. Intergenerational programs (e.g., community centers, senior citizen centers)
   i. Businesses that serve children (e.g. zoos, nature centers, discovery museums, public libraries)
   j. Local public or private schools
   k. Local colleges or universities
   l. Professional teaching and curriculum development organizations (e.g., AMS, AMI, NAECY)
   m. Other (please specify) [text box]
40. Do you gather information about children’s family culture including the beliefs and practices related to daily life and child rearing, home language, and religious, ethnic, political, and geographic characteristics?
   a. Yes, at admission
   b. Yes, throughout the year
   c. No, I do not gather cultural information

41. Do you use the cultural information you gather to plan relevant lessons in the classroom?
   a. Yes, frequently
   b. Yes, infrequently
   c. No

42. Answer in 1-3 sentences. How has the gathered cultural information impacted your practices? [text box]

43. Check all that is relevant. Who have you had contact with from your students’ families?
   a. Parents or Guardians
   b. Grandparents
   c. Aunts/Uncles
   d. Siblings
   e. Other (please specify) [text box]

44. Answer in 1-3 sentences. How do you teach children about families? What materials do you use? [text box]

45. When learning about family structures, do you teach about traditional and non-traditional families as related to the dominant culture?
   a. Yes
   b. No

46. Do you have lessons that involve maps of the local community with an aim to develop the child’s sense of place within their local community?
   a. Yes
   b. No

**Natural Systems Education**

47. How many **hours per week** do children typically spend outdoors in late spring through early fall?
   a. 0-2
   b. 2-4
   c. 4-6
   d. 6-8
   e. 8-10
   f. 10+

48. How many **hours per week** do children typically spend outdoors in late fall through early spring?
   a. 0-2
   b. 2-4
   c. 4-6
   d. 6-8
   e. 8-10
   f. 10+
49. Do children always go outside at the same time of day, every day that they go outside? (e.g., recess is scheduled for 10:00-10:30 am every day of the week)
   a. Yes
   b. No

50. Answer in 1-3 sentences. What supplies/tools are regularly available to children while they are outside? (e.g., magnifying glass, insect net, clear containers or baskets, rulers, paper, clipboards, writing materials) [text box]

51. Are children able to bring materials outdoors from the classroom?
   a. Yes
   b. No

52. Are children able to bring materials into the classroom from the outdoors?
   a. Yes
   b. No

53. Answer in 1-3 sentences. Where do children put the outdoor materials when they come inside and what do they do with them? [text box]

54. How often do you visit a local site that remains in its natural state? (e.g. arboretum, prairie, marsh/lake)
   We visit a local natural site at least:
   a. Once per day
   b. Once per week
   c. Once per month
   d. Once per quarter
   e. Once per school year
   f. We do not visit a local natural site.

55. When at the local natural site, what is the format of the visit?
   a. Children are given unstructured free play and exploration
   b. Children are guided around the natural site by adults
   c. Children are led through structured activities by adults
   d. Other (please specify) [text box]

56. Check all that is relevant. What curricular areas do you integrate into lessons when outdoors?
   a. Practical Life
   b. Sensorial
   c. Math
   d. Language Arts
   e. Cultural
   f. Art
   g. Movement
   h. Other (please specify)

57. Describe or list a few of your most frequently used methods of integrating other curricular areas into the outdoors. [text box]

58. Answer in 1-3 sentences. How do you encourage children to learn about the cycle of nature and seasonal changes? [text box]

59. Check all that is relevant regarding animals available for a considerable amount of time (e.g. more than a week) to children in your classroom.
3D Representations include small objects, sculpture, or other non-live 3D representations of animals.

2D Representations include books, puzzles, photos, three-part cards, etc.

<table>
<thead>
<tr>
<th></th>
<th>Live Animals, Natives to Region</th>
<th>Live Animals, Non-Native</th>
<th>3D Representations</th>
<th>2D Representations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reptile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amphibian</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammal (not including humans)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

60. Check all that is relevant regarding plants or plant material available for a considerable amount of time (e.g. more than a week) to children in your classroom.

3D Representations include small objects, sculpture, artificial plants, artificial flowers, or other non-live 3D representations of plants.

2D Representations include books, puzzles, photos, three-part cards, etc.

<table>
<thead>
<tr>
<th></th>
<th>Natives to Region</th>
<th>Non-Native</th>
<th>3D Representation</th>
<th>2D Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants from a variety of biomes (e.g. cactus, orchid, ferns, and cattails)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live potted plants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut flowers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other plant material (e.g. branches, acorns, leaves)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

61. Do you intentionally include native/local plants and native/local animals in your 2D or 3D representations?
   a. Yes
   b. No

62. Are children regularly involved in the care of plants or animals?
   a. Yes
b. No

63. Answer in 1-3 sentences. A child walks up to you holding a giant centipede. What do you do or say? [text box]

64. Answer in 1-3 sentences. How do you connect wonder to the natural world? [text box]

65. Check all that are relevant. Do any of your lessons or materials cover endangered species?
   a. Yes, endangered species on a global level
   b. Yes, endangered species on a local or regional level
   c. No, we do not cover endangered species

66. Do any of your lessons or materials cover climate change?
   a. Yes
   b. No

Other

67. Please describe how you integrate social systems (culture, families, ideas, concepts, individuals) with natural systems (everything involving nature) in your lessons, materials, and prepared environment. Please include if you discuss how people have an impact on nature, how systems are made of parts, or how systems may not continue to function if any of their parts are missing. [text box]

68. Check all that are relevant. What do you feel are barriers to being able to provide time outdoors?
   a. Lack of natural space
   b. Transportation is costly or difficult to arrange
   c. Risk to health and safety
   d. Allergies
   e. Physical disabilities or sensory integration disorder
   f. Parents do not want their children to get dirty
   g. Licensing
   h. I don’t feel comfortable
   i. Weather
   j. Not enough time in the day
   k. Outdoor time is scheduled by someone else
   l. Other (please specify) [text box]

69. Check all that are relevant. What do you feel are barriers to being able to provide environmental education?
   a. Environmental education is not as important as other curricular areas to parents
   b. Environmental education is not as important as other curricular areas to you
   c. Environmental education is not as important as other curricular areas to head of school
   d. I don't feel comfortable teaching this subject
   e. Other (please specify) [text box]

70. Feel free to clarify or share more information on any of the questions in this survey or other areas of environmental education. [text box]
## Appendix B: Comparison Matrix and Theoretical Underpinnings of Survey

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>1</td>
<td>Consent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Environmental Education Beliefs and Values

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Defining environmental education</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>G6.1; G6.2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Defining environmental literacy</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>G1.4; G6.1; G6.2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Birth of environmentalists</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>G6.1; G6.2</td>
<td>x</td>
</tr>
</tbody>
</table>

### School/Program Information

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Philosophy, goals, and objectives</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>G1.1; G5.6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Guidelines on value of nature</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>G1.1; G5.6</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Professional development</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>G1.4; G6.1; G6.2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Professional development</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>G1.4; G6.1; G6.2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Program atmosphere:</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>G1.4; G5.6</td>
<td>x</td>
</tr>
</tbody>
</table>

A: Reality and Nature (numbers denote gradations of nature education, p. 12)  
B: Absorbent Mind and Sensitive Periods  
(O is order, L is language, D is small objects and details, S is senses, and G is grace and courtesy)  
C: Child-Directed, Meaningful Work  
D: Respecting and Following the Child  
E: Observant, Knowledgeable Teacher  
F: Mind and Body Integration  
G: Prepared Environment  
H: Constructivism  
I: Real experiences  
J: Interdisciplinary  
K: Critical pedagogy of place  
L: Biophilia versus Ecophobia  
M: Playful Learning
### Environment and Montessori: Reality and Nature (numbers denote gradations of nature education, p. 12)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Formal assessment of sustainability practices</td>
<td></td>
<td>G5.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Recycling</td>
<td>G3.1; G5.6</td>
<td>Inputs and outputs</td>
<td>Connect, Engage</td>
<td></td>
<td>Arlemalm-Hagsêr and Sandberg, 2011, p. 195</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Re-purposed materials</td>
<td>x G5.6</td>
<td>Inputs and outputs</td>
<td>Engage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Sustainability purchasing</td>
<td>x G5.6</td>
<td>Inputs and outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pedagogical Practices

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Structural distribution of time</td>
<td>x G2.3</td>
<td>Connect</td>
<td></td>
<td></td>
<td>Louv, 2008, p. 48</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Structural distribution of time</td>
<td>x x G2.3</td>
<td>Connect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Intentional inclusion of environmental education in lesson plans</td>
<td>x x x G6.4</td>
<td>Connect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Child-directed observation</td>
<td>I S x x x</td>
<td>G2.3; G4.4; G4.5</td>
<td>Connect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>------------------</td>
<td>-----------------------</td>
<td>--------------------------------------</td>
<td>----------------------------</td>
<td>---------------------------</td>
<td>------------------------</td>
<td>------</td>
</tr>
<tr>
<td>24</td>
<td>Quantity of works using unprocessed natural materials</td>
<td>x D S x x G3.1; G4.5; G5.2</td>
<td>Parts and objects, inputs and outputs</td>
<td>Connect x x x</td>
<td></td>
<td>Louv, 2008, p. 138</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Areas of classroom using unprocessed natural materials</td>
<td>x D S x x G3.1; G5.2</td>
<td>Parts and objects, inputs and outputs</td>
<td>Connect x x x</td>
<td></td>
<td>Louv, 2008, p. 138</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Components of the outdoor environment</td>
<td>x S x x G3.2; G4.5; G5.1; G5.2</td>
<td>Subsystems</td>
<td>Connect x x</td>
<td></td>
<td>Buffer effect of nature (Wells and Evans, 2003); Sensorial experiences while outdoors (Hanscom; Louv)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>How children get answers to questions</td>
<td>x x G2.3; G4.2; G4.4</td>
<td>Subsystems</td>
<td>x x</td>
<td></td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Children sharing information</td>
<td>G2.3; G4.4; G4.5</td>
<td>Interactions and relationships, subsystems</td>
<td>x x</td>
<td></td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Inquiry-based education: co-research, co-plan, joint decision making</td>
<td>x x x G2.1; G2.3; G2.4; G2.5</td>
<td>Interactions and relationships, subsystems</td>
<td>x x</td>
<td></td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Adaptation and accommodation for differing abilities</td>
<td>x x x x G2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Health Promotion (Cognitive, Physical, and Social Emotional)**

<table>
<thead>
<tr>
<th>Q#</th>
<th>Types of varied terrain</th>
<th>x</th>
<th>x x G4.6; G5.1</th>
<th>Connect</th>
<th>x x</th>
<th></th>
<th>Hanscom, 2016; Buffer effect of nature (Wells and Evans, 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>Physical and sensorial activities outdoors</td>
<td>x D S x x G2.2; G3.1; G4.6</td>
<td>Parts and objects</td>
<td>Connect x x x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>------------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A B C D E F G</td>
<td></td>
<td>H I J K L M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Exploring natural materials with senses</td>
<td>x D S x x x x G4.2; G4.4; G4.5; G4.6</td>
<td>Parts and objects</td>
<td>Connect, Explore</td>
<td>x x x x Hanscom, 2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Garden, nutrition</td>
<td>x D S x x G4.6; G5.1</td>
<td>Parts and objects, inputs and outputs</td>
<td>Connect, Explore</td>
<td>x x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Garden, participation in garden activities</td>
<td>x D S x x G4.6</td>
<td>Parts and objects, inputs and outputs</td>
<td>Connect, Explore</td>
<td>x x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Connection between food and source, life cycles, cultural consideration</td>
<td>x D x x x G1.3; G4.3</td>
<td>Parts and objects, inputs and outputs, change over time</td>
<td>Connect, Explore</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Connection between food and source, life cycles, cultural consideration</td>
<td>x D x x x x</td>
<td>Parts and objects, inputs and outputs, change over time</td>
<td>Connect, Explore</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Social Systems Education**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A B C D E F G</td>
<td></td>
<td>H I J K L M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Social relations, independence</td>
<td>x x x x x x x G4.1; G4.5</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x x x</td>
<td>Arlemalm-Hagsër and Sandberg, 2011</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Social Relations</td>
<td>G x x</td>
<td>G1.8; G4.1; G4.5</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

A: Reality and Nature (numbers denote gradations of nature education, p. 12)
B: Absorvent Mind and Sensitive Periods (O is order, L is language, D is small objects and details, S is senses, and G is grace and courtesy)
C: Child-Directed, Meaningful Work

D: Respecting and Following the Child
E: Observant, Knowledgeable Teacher
F: Mind and Body Integration
G: Prepared Environment
H: Constructivism
I: Real experiences
J: Interdisciplinary
K: Critical pedagogy of place
L: Biophilia versus Ecophobia
M: Playful Learning
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Social Relations, Place-Based Education</td>
<td>G x x x</td>
<td>G1.7; G4.1; G4.5</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>41</td>
<td>Cultural Diversity, Place-Based Education</td>
<td>x x x</td>
<td>G1.3</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>42</td>
<td>Cultural Diversity, Place-Based Education</td>
<td>x x x</td>
<td>G1.3; G3.2</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>43</td>
<td>Cultural Diversity, Place-Based Education</td>
<td>G x x x</td>
<td>G1.3; G3.2</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>Arlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>44</td>
<td>Cultural diversity, place-based education, intergenerational learning</td>
<td>x</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>x Arlemalm-Hagsér and Sandberg, 2011</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Cultural Diversity, Social Systems</td>
<td>D x x x</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>x x x Arlemalm-Hagsér and Sandberg, 2011</td>
<td></td>
</tr>
</tbody>
</table>

A: Reality and Nature (numbers denote gradations of nature education, p. 12)
B: Absorbent Mind and Sensitive Periods
(O is order, L is language, D is small objects and details, S is senses, and G is grace and courtesy)
C: Child-Directed, Meaningful Work
D: Respecting and Following the Child
E: Observant, Knowledgeable Teacher
F: Mind and Body Integration
G: Prepared Environment
H: Constructivism
I: Real experiences
J: Interdisciplinary
K: Critical pedagogy of place
L: Biophilia versus Ecophobia
M: Playful Learning
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A B C D E F G</td>
<td></td>
<td></td>
<td>H I J K L M</td>
<td></td>
<td>relationships, subsystems</td>
</tr>
<tr>
<td>46</td>
<td>Cultural Diversity, Place-Based Education, Social Systems</td>
<td>x x</td>
<td>G4.1</td>
<td>Parts and objects, interactions and relationships, subsystems</td>
<td>Connect, Explore</td>
<td>x</td>
<td>Årlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>47</td>
<td>Place-Based Education</td>
<td>x O D x x</td>
<td>G4.3</td>
<td>Subsystems</td>
<td>Connect</td>
<td>x x</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Outdoor education, seasons</td>
<td>x S D x x</td>
<td>G2.2</td>
<td>Interactions and relationship, change over time</td>
<td>Connect, Explore</td>
<td>x x</td>
<td>Årlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>49</td>
<td>Outdoor education, seasons</td>
<td>x S D x x</td>
<td>G2.2</td>
<td>Interactions and relationship, change over time</td>
<td>Connect, Explore</td>
<td>x x</td>
<td>Årlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>50</td>
<td>Outdoor education, seasons</td>
<td>x x</td>
<td>G4.4</td>
<td>Change over time</td>
<td>Connect, Explore</td>
<td></td>
<td>Årlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>51</td>
<td>Tools and opportunities outside</td>
<td>x x x</td>
<td>G4.4; G4.6</td>
<td>Parts and objects</td>
<td>Explore</td>
<td>x x x x</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Bringing materials outdoors</td>
<td>x x x</td>
<td></td>
<td>Connect, Explore</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Bringing materials indoors</td>
<td>x x x</td>
<td></td>
<td>Connect, Explore</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------------------</td>
<td>-------------------------------</td>
<td>---------------------------</td>
<td>-------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A B C D E F G</td>
<td></td>
<td></td>
<td></td>
<td>H I J K L M</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Placement and use of natural materials brought indoors</td>
<td>x x x x</td>
<td>G4.6</td>
<td>Connect, Explore</td>
<td>x x x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Outdoor education, seasons, cycles of nature</td>
<td>3 x</td>
<td>G4.3</td>
<td>Parts and objects, subsystems</td>
<td>Connect, Explore</td>
<td>x x x</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Outdoor education</td>
<td>x x x</td>
<td>G4.4; G4.5</td>
<td>Parts and objects, subsystems</td>
<td>Connect, Explore</td>
<td>x x x</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Outdoor education, interdisciplinary</td>
<td>x x x</td>
<td>G4.6</td>
<td>Connect</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Outdoor education, interdisciplinary</td>
<td>x x x</td>
<td>G4.6</td>
<td>Connect</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Outdoor education, cycle of nature/seasonal changes</td>
<td>3 x x x x x</td>
<td>G4.4; G5.2</td>
<td>Parts and objects, change over time</td>
<td>Connect</td>
<td>x x x</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Animals</td>
<td>1 x D</td>
<td>G5.2</td>
<td>Parts and objects</td>
<td>Connect, Explore</td>
<td>x x x x x</td>
<td>Buffer effect of nature (Wells and Evans, 2003); Årlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>61</td>
<td>Plants</td>
<td>1 x D</td>
<td>G5.2</td>
<td>Parts and objects</td>
<td>Connect, Explore</td>
<td>x x x x x</td>
<td>Buffer effect of nature (Wells and Evans, 2003); Årlemalm-Hagsér and Sandberg, 2011</td>
</tr>
<tr>
<td>62</td>
<td>Local/global, place-based education</td>
<td>x x</td>
<td>G4.3</td>
<td>Parts and objects, subsystems</td>
<td>Connect, Explore</td>
<td>x x x</td>
<td>Louv, 2008, pp. 135, 138</td>
</tr>
<tr>
<td>63</td>
<td>Caring for plants/animals</td>
<td>2 D x x x</td>
<td>G4.3; G4.5; G4.6</td>
<td>Parts and objects, inputs and outputs</td>
<td>Explore</td>
<td>x x x</td>
<td></td>
</tr>
</tbody>
</table>

A: Reality and Nature (numbers denote gradations of nature education, p. 12)  
B: Absorbent Mind and Sensitive Periods  
(O is order, L is language, D is small objects and details, S is senses, and G is grace and courtesy)  
C: Child-Directed, Meaningful Work  
D: Respecting and Following the Child  
E: Observant, Knowledgeable Teacher  
F: Mind and Body Integration  
G: Prepared Environment  
H: Constructivism  
I: Real experiences  
J: Interdisciplinary  
K: Critical pedagogy of place  
L: Biophilia versus Ecophobia  
M: Playful Learning
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>Biophilia/ecophobia</td>
<td>x D x S x x</td>
<td>G4.4</td>
<td>Parts and objects</td>
<td>Connect</td>
<td>x x x x</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Wonder</td>
<td>x x x x x x</td>
<td>G4.5</td>
<td>Connect, Explore</td>
<td>x x x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Local/global, place-based education, endangered species</td>
<td>x</td>
<td>G4.3; G4.5</td>
<td>Parts and objects, subsystems, change over time</td>
<td>Connect, Explore, Engage</td>
<td>x x</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Biophilia/ecophobia</td>
<td>x</td>
<td>G4.5</td>
<td>Change over time</td>
<td>Explore, Engage</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

| 68 | Integration of Social and Natural Systems | x x x x x x | Parts and objects, interactions and relationships, subsystems | Connect, Explore, Engage | x x x x | | |
| 69 | Barriers to EE | | | | | | |
| 70 | Barriers to EE | | | | | | |
| 71 | Miscellaneous Comments | | | | | | |
Appendix C: Research Flier

Title of the Project: Role of Environmental Education in Montessori Pedagogy
Principal Investigator: Jennifer Rothmeyer, B.A, University of Wisconsin – River Falls,
jennifer.rothmeyer@uwrf.edu
Faculty Advisor: Kateri Carver, Ph.D., University of Wisconsin – River Falls
kateri.carver@uwrf.edu

Invitation to be Part of a Research Study
You are invited to participate in a research study. In order to participate, you must be working in a Montessori Children's House (ages 3-6) and have contact with children between the ages of 2 years and 7 years. Taking part in this research study is voluntary, anonymous, and confidential.

What is the study about and how will you benefit?
The purpose of the study is to examine if and how Montessori Children’s House educators are incorporating standards, concepts, and guidelines from systems-based environmental education within their lessons, materials, and prepared environments. This study is intended to provide a baseline understanding of how environmental education is being implemented in Montessori early childhood programs. This could result in further research or further refinement of environmental education processes in Montessori early childhood programs. You could potentially benefit by reading the final master's paper that will contain an aggregate of this data, which will be able to be found at University of Wisconsin - River Falls and its digital archive.

This survey is expected to take between 30-45 minutes to complete. Thank you for your consideration.

https://www.surveymonkey.com/r/EEMONTESSORI
Appendix D: Results

Demographic Information

Q2. Training. See Table 3 for the training breakdown. Of the eight participants who chose other, two were not currently certified, one was MEPI-trained, one was NCME-trained, one was trained in an unspecified MACTE-accredited program, and three did not specify.

Table 5

Question 2: Participants’ Montessori training (n=43)

<table>
<thead>
<tr>
<th>Questionnaire Choice</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS-affiliated Teacher Education Program</td>
<td>33</td>
<td>76.7%</td>
</tr>
<tr>
<td>AMI Training Center</td>
<td>2</td>
<td>4.7%</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>18.6%</td>
</tr>
</tbody>
</table>

Q3-4. Position. See Table 4 for the participants’ employment positions. 16.8% (7) participants filled more than one role in their school. 97.67% (42) stated they were employed in a Montessori program (including one participant who specified they were in a Montessori public charter school) and 2.33% (1) participant was employed in a Reggio-inspired Montessori program.

Table 6

Question 3: Participants’ employment position (n=43)

<table>
<thead>
<tr>
<th>Questionnaire Choice</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montessori lead/guide or co-lead</td>
<td>28</td>
<td>65.12%</td>
</tr>
<tr>
<td>Head of school, director, administrative</td>
<td>10</td>
<td>23.26%</td>
</tr>
<tr>
<td>Teacher</td>
<td>4</td>
<td>2.33%</td>
</tr>
</tbody>
</table>
Q5. Location. Participants were employed in 22 different states in the United States. The breakdown is as follows: 16.28% (7) in Minnesota; 9.3% (4) each in Indiana, North Carolina, and Wisconsin; 6.98% (3) in Colorado; 4.65% (2) each in California, Florida, and Ohio; 2.33% (1) each in Arizona, Idaho, Illinois, Kentucky, Maryland, Massachusetts, Michigan, Nebraska, New York, Pennsylvania, Tennessee, Texas, Utah, and Washington. One individual did not disclose their location.

Q6-7. Experience. See Figure 2. 46.51% (20) of participants had been employed in a Montessori Children’s House for more than ten years with 53.49% (23) of the participants employed for less than ten years.

Defining Environmental Education

Q8. Environmental education. See Table 5 for thematic analysis. 88.37% (38) of the total survey participants answered Question 8 which asked, “What is environmental education?”; four participants skipped this question. One participant was excluded from the results as their answer did not relate to the question. Responses were first categorized as either knowledge-focused or connection-focused, then sorted as either global-focused or local-focused, then were also analyzed thematically.

Knowledge or connection. 76.32% (29) of the participants on this question answered with a knowledge focus (e.g. included words such as: know, educate, provide language, learn, understand, teach, study, functionality, aware) while 26.32% (10) answered with a connection focus (e.g. cosmic education, personal place in world, relationship, connection, personally meaningful, personal values in environment). One answer was coded as both (which is why the
percentages above add up to more than 100): “Environmental ed begins with gaining an appreciation and curiosity for the natural world, especially at the early childhood ages. Then it is learning how nature’s systems works and what is necessary for these systems to continue to survive, whether it is animal, plant, soil, or atmospheric nature.”

**Global or local.** 97.37% (37) of the participants on this question answered with a global or unspecified focus (e.g. the environment, the world, our environment, our world, the natural world, nature). One participant’s answer was hesitantly coded with a local focus: “Environmental Education begins with an awareness of the greater natural environment, grows with an understanding of how personal values impact interactions with the greater natural environment, and can grow into a life-long education through citizen action with regard to one’s interactions within their greater natural environment(s).”

Table 7

*Question 8: Thematic breakdown of participants’ answers to “What is environmental education?” (n=38)*

<table>
<thead>
<tr>
<th>Themes</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stewardship, preservation, conservation, or sustainability</td>
<td>19</td>
<td>50.00%</td>
</tr>
<tr>
<td>Cause and effect between people and the environment</td>
<td>11</td>
<td>28.95%</td>
</tr>
<tr>
<td>Growing love or appreciation for nature</td>
<td>6</td>
<td>15.79%</td>
</tr>
<tr>
<td>Hands-on, experiential discoveries and exploration</td>
<td>4</td>
<td>10.53%</td>
</tr>
<tr>
<td>Spending time in the outdoors</td>
<td>2</td>
<td>5.26%</td>
</tr>
<tr>
<td>Cultural elements</td>
<td>1</td>
<td>2.63%</td>
</tr>
</tbody>
</table>
Observation 1 2.63%
Citizen action 1 2.63%

Q9. Environmental literacy. See Table 6. Five participants skipped this question. One participant was excluded from the results as their answer did not relate to the question.

Responses were analyzed thematically.

Table 8

*Question 9: Thematic breakdown of answers to “What is environmental literacy?” (n = 37)*

<table>
<thead>
<tr>
<th>Theme</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding</td>
<td>19</td>
<td>51.35%</td>
</tr>
<tr>
<td>Knowledge (facts, define or identify items or concepts)</td>
<td>17</td>
<td>45.95%</td>
</tr>
<tr>
<td>General awareness</td>
<td>5</td>
<td>13.51%</td>
</tr>
<tr>
<td>Able to communicate about the environment</td>
<td>4</td>
<td>10.81%</td>
</tr>
<tr>
<td>Display competence in the environment</td>
<td>3</td>
<td>8.11%</td>
</tr>
<tr>
<td>Able to take citizen action</td>
<td>2</td>
<td>5.41%</td>
</tr>
<tr>
<td>Forming an ecological identity</td>
<td>1</td>
<td>2.70%</td>
</tr>
<tr>
<td>Individuals who continually engage with the environment and use all their senses</td>
<td>1</td>
<td>2.70%</td>
</tr>
</tbody>
</table>

Q10. Future environmentalists. See Table 7 for thematic analysis. Five of the total survey participants elected not to answer Question 10 regarding from where future environmentalists would come. Some notable responses:
• “Future environmentalists will come from places where they have seen, touched, tasted, and otherwise experienced true beauty and richness in the natural world - they will know its value to them and love to share it with others.”

• “Children/people that are passionate about caring for our earth; those that see that they can make positive changes starting at the local level.”

• “Children who have developed deep Relationships and connections with the natural world and from caregivers and educators who respect, value and nurture those connections”

• “First and foremost it starts at home. The more educated and motivated adults and parents are to make the world a better place, the more likely the children will follow. The classroom should solidify and guide students to make responsible choices for themselves and the community.”

• “I think that anyone can be an environmentalist. Those who have repeated opportunities to develop their environmental sensitivity, ideally from a young age and with an adult or two who model positive interactions with the natural environment, may hold a more positive (and privileged) perspective/have a stronger connection with the natural environment.”

Table 9

*Question 10: Thematic breakdown of participants’ answers to “Where do you think future environmentalists will come from?” (n=38)*

<table>
<thead>
<tr>
<th>Theme</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools Montessori</td>
<td>6</td>
<td>15.79%</td>
</tr>
<tr>
<td>Any</td>
<td>7</td>
<td>18.42%</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>34.21%</td>
</tr>
<tr>
<td>Children In general</td>
<td>18</td>
<td>56.25%</td>
</tr>
</tbody>
</table>
Who love nature 4 10.53%
Who spend time in nature 2 5.26%
Total 24 63.16%
Anyone who spends time in nature 2 5.26%
From everywhere or all walks of life 4 10.53%

**School/Program Information**

**Q11. Philosophy, goals, objectives.** See Figure 3. 20.93% (9) of the total survey participants elected not to answer Question 11 on where their school or program was at in the process of creating and developing written philosophy, goals, and objectives as it relates to nature and environmental education. 32.56% (14) of the total survey participants elected not to answer Question 11 regarding the level to which they were practicing these items whether or not their school/program had implemented them. Five of the participants had dropped out of the survey before this question.

![Figure 3. Question 11: Level of program implementation or teacher practice on the development of written philosophy, goals, and objectives](image)

**Q12. Guidelines regarding value of nature.** See Figure 4. 16.28% (7) of the total survey participants elected not to answer Question 12 on where their school or program was at in
the process of creating and developing written guidelines on the value of nature. 25.58% (11) of
the total survey participants elected not to answer Question 12 regarding the level to which they
were practicing these guidelines regardless of whether their school/program had implemented
them; five had dropped out of the survey before this question. Five participants had dropped out
of the survey by this question.

![Graph: Development of Written Guidelines on the Value of Nature]

Figure 4. Question 12: Level of program implementation or teacher practice on the development of written guidelines on the
value of nature.

**Q13-14. Professional development.** See Figure 5. Five of the total survey participants
had dropped out of the survey before Question 13. Participants could choose more than one
answer. Only one of the schools or programs that required training on environmental literacy
actually provided the training.

![Graph: Approach to Training on Environmental Literacy and Positive Outdoor Experiences by School/Program, n=38]

Figure 5. Question 13: Responses to “The school/program I work at _________ on environmental literacy and positive outdoor
experiences.”
88.37% (38) of the total survey participants answered Question 14 on if they had independently chosen to take trainings on environmental literacy and positive outdoor experiences; five participants had dropped out of the survey before this question. Of those 38 participants, 76.32% (29) stated they had chosen independently to take trainings while 23.68% (9) stated they had not. Of the nine who stated they had not taken trainings, three were employed as heads of school, one was employed as an assistant, and five were employed as lead teachers.

**Q15. Program atmosphere.** 86.05% (37) of the total survey participants answered Question 15. Of those 37 participants, 27.03% (10) stated their school/program provides information on locally relevant environmental issues and ethical concerns, 72.97% (27) encourages them to think about their own approaches to and understanding of nature, 100% (37) encourage them to take children outdoors, and 45.95% (17) provides education on environmental literacy and positive outdoor experiences to families. One person chose not to respond, and five participants had dropped out of the survey before this question. The result on taking children outdoors may be influenced by licensing requirements; future research would need to be completed to investigate this result.

**Q16. Assessment of sustainability practices.** See Figure 6. Five participants had dropped out of the survey before this question.
Figure 6. Question 16: Whether or not participants’ school/program had assessed its ecological sustainability practices according to formal environmental guidelines

**Q17. Recycling.** 88.37% (38) of the total survey participants answered Question 17 describing recycling practices at their school/program; 5 participants had dropped out of the survey before this question. 5.26% (2) had not yet implemented recycling. 92.11% (35) encouraged staff to recycle. 97.37% (37) encouraged children to recycle. 21.05% (8) provided information to families on recycling.

**Q18. Re-purposed materials.** 88.37% (38) of the total survey participants answered Question 18 on whether they regularly used re-purposed materials such as toilet paper tubes; five participants had dropped out of the survey before this question. 89.47% (34) did use re-purposed materials and 10.53% (4) did not.

**Q19. Sustainable purchasing.** 88.37% (38) of the total survey participants answered Question 19 on whether classroom materials and furnishings were purchased with sustainability in mind; five participants had dropped out of the survey before this question. 76.32% (29) did have sustainability in mind and 23.68% (9) did not.

**Pedagogical Practices**

**Q20-21. Structural distribution of time.** 67.44% (29) of the total survey participants answered Question 21 and Question 22 in some portion. Four participants elected to skip question 21, five participants’ answers were not included as they did not fit the expected format, and five participants had dropped out of the survey before this question.

Table 10

*Questions 20-21: Structural breakdown of time spent weekly in activities (n=29)*
Choice | n | Range       | Average |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Montessori Work Cycle</td>
<td>29</td>
<td>25.00-73.85%</td>
<td>43.58%</td>
</tr>
<tr>
<td>Unstructured Free Play</td>
<td>24</td>
<td>6.00%-50.00%</td>
<td>21.89%</td>
</tr>
<tr>
<td>Time Outdoors</td>
<td>29</td>
<td>3.33%-50.00%</td>
<td>19.96%</td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
<td>3.65-33.33%</td>
<td>15.44%</td>
</tr>
</tbody>
</table>

**Q22. Intentional inclusion of environmental education in lesson plans.** 88.37% (38) of the total survey participants answered Question 22 on whether or not they intentionally or regularly incorporated environmental education into their lesson plans. 73.68% (28) reported they did incorporate environmental education, 13.16% (5) indicated they did not, and 13.16% (5) stated they did not have lesson plans. Of the ones who reported they did not have lesson plans, one was employed as an assistant, one as an administrator, and three were lead teachers. Five participants had dropped out of the survey before this question.

**Q23. Child-directed observation.** See Table 9 for thematic analysis. 88.37% (38) of the total survey participants answered Question 23 which was a short-essay question that asked participants what they would do or say if they found a child staring out the window during work time. Five participants had dropped out of the survey before this question.

Five of the participants stated their response would depend upon the child and the situation. Some other notable responses:

- “I would first observe. Rather than make some judgment that the child is not engaged. Staring out the window could mean many things. The child could be thinking, processing, bored or observing. The child could even be watching the squirrel on a branch. After observation and with time I would engage the child. If there was a
squirrel I would choose paper and materials for us to draw or sketch the squirrel or simply observe and theorize alongside the child what the squirrel might be doing. I would not! Teach at the child. This robs the child of the thrill of observation, and discovery, and relationship building with the natural world. If staring was due to lack of interest in materials I would observe and respond accordingly. First I don’t devalue daydreaming nor do I judge a child who might long to be outdoors.. I do both. I may even change the work cycle to include time outdoors. First follow the child. Honestly they can teach us far more about how to be humans in an ever-changing world then we can teach them much of the time.”

- “It is the child's work. I try to prevent interruptions. I may ask about what they saw for information on areas of interest and lessons.”

Table 11

*Question 23: Thematic elements in participants’ responses regarding what they would do or say to a child who was found staring out the window during work time (n=38)*

<table>
<thead>
<tr>
<th>Theme</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respect child’s period of observation and… do not interfere</td>
<td>10</td>
<td>26.32%</td>
</tr>
<tr>
<td>…follow with below</td>
<td>12</td>
<td>31.58%</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>57.89%</td>
</tr>
<tr>
<td>Ask child questions about what the child sees</td>
<td>20</td>
<td>52.63%</td>
</tr>
<tr>
<td>Suggest follow-up activity based upon what child observes</td>
<td>7</td>
<td>18.42%</td>
</tr>
<tr>
<td>Redirect child to more appropriate activity</td>
<td>6</td>
<td>15.79%</td>
</tr>
<tr>
<td>Share what adult sees</td>
<td>2</td>
<td>5.26%</td>
</tr>
</tbody>
</table>
Q24. **Unprocessed natural materials.** See Figure 7. 86.05% (37) of participants answered Question 24 regarding how many of their works on a 5-point Likert scale (none, some, half, most, or all) were constructed of unprocessed natural materials (e.g. acorns as counters, pinecones for sorting sizes, pieces of bark for grading from rough to smooth, seeds in pouring works); one person elected not to answer this, and five participants had dropped out of the survey before this question. Participants were instructed that this did not include processed natural materials (e.g. acorns carved from wood, felt pinecones, sandpaper for grading from rough to smooth, glass seed replicas) or non-natural materials (e.g. plastic, vinyl). No participants answered “all.”

![% of Works in Classroom That Use Unprocessed Natural Materials, n=37](image)

*Figure 7. Question 24: Percentage of works in the classroom that use unprocessed natural materials*

Q25. **Classroom areas with unprocessed natural materials.** See Table 10 for results. Five of the total survey participants had dropped out of the survey before Question 25 detailing which area of the classroom environment contained unprocessed natural materials. Five participants that had written in “science” under the “other” option were recoded to remove their
answer from “Other” and placed under “Cultural.” The remaining 4 responses under other referred to a peace table, gardening class, gardening area, and loose parts cart.

Table 12

Question 25: Areas in the classroom with unprocessed natural materials (n=38)

<table>
<thead>
<tr>
<th>Area of the Classroom</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Life</td>
<td>36</td>
<td>94.74%</td>
</tr>
<tr>
<td>Outdoor</td>
<td>36</td>
<td>94.74%</td>
</tr>
<tr>
<td>Cultural</td>
<td>32</td>
<td>84.21%</td>
</tr>
<tr>
<td>Art</td>
<td>27</td>
<td>71.05%</td>
</tr>
<tr>
<td>Sensorial</td>
<td>18</td>
<td>47.37%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>15</td>
<td>39.47%</td>
</tr>
<tr>
<td>Language Arts</td>
<td>8</td>
<td>21.05%</td>
</tr>
<tr>
<td>Movement</td>
<td>6</td>
<td>15.79%</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>10.53%</td>
</tr>
</tbody>
</table>

Q26. Outdoor environment. Five of the total survey participants had dropped out of the survey before Question 26 detailing facets of their outdoor environment. Answers written in other included: 3 mentions of sand, 2 of synthetic grass, 1 of a dirt area for fairy garden, 1 of bikes, 1 of container gardens, 1 of a mud kitchen without water access, 1 of chickens, and 1 reference to an orchard (this participant had also selected edible garden).

Table 13

Question 26: Areas in the classroom with unprocessed natural materials (n=38)

<table>
<thead>
<tr>
<th>Answer Choice</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
</table>
### Play Equipment

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic playground equipment</td>
<td>22</td>
<td>57.89%</td>
</tr>
<tr>
<td>Natural playground equipment</td>
<td>20</td>
<td>52.63%</td>
</tr>
<tr>
<td>Substantially natural (e.g. forest, prairie, lake/marsh, desert)</td>
<td>12</td>
<td>31.58%</td>
</tr>
</tbody>
</table>

### Types of Play Available

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open area</td>
<td>32</td>
<td>84.21%</td>
</tr>
<tr>
<td>Climbing area</td>
<td>27</td>
<td>71.05%</td>
</tr>
<tr>
<td>Messy materials or loose parts available</td>
<td>26</td>
<td>68.42%</td>
</tr>
<tr>
<td>Building materials available</td>
<td>18</td>
<td>47.37%</td>
</tr>
<tr>
<td>Art or music available</td>
<td>18</td>
<td>47.37%</td>
</tr>
</tbody>
</table>

### Water

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water for children (e.g. spigot, mud kitchen, sensory table)</td>
<td>21</td>
<td>55.26%</td>
</tr>
<tr>
<td>Water for animals (e.g. pond, stream, bird bath)</td>
<td>12</td>
<td>31.58%</td>
</tr>
<tr>
<td>Rain water collection</td>
<td>10</td>
<td>26.32%</td>
</tr>
</tbody>
</table>

### Plants

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees</td>
<td>31</td>
<td>81.58%</td>
</tr>
<tr>
<td>Native plants</td>
<td>30</td>
<td>78.85%</td>
</tr>
<tr>
<td>Edible garden</td>
<td>24</td>
<td>63.16%</td>
</tr>
<tr>
<td>Plants for wildlife</td>
<td>18</td>
<td>47.37%</td>
</tr>
<tr>
<td>Non-native plants</td>
<td>15</td>
<td>39.47%</td>
</tr>
</tbody>
</table>

### Surfaces
Q27. **Children’s questions.** Five of the total survey participants dropped out of the survey before Question 27. See Figure 8 for results.

In the eight responses of “other,” three responses mentioned the age or skill of the children they work with being a factor in this question: one participant selected both that the child and teacher work together to research a question and noted that they work in a toddler and primary program (18mo-6yr); one participant mentioned most children are not reading on their own yet; the last wrote in that it depends upon the question and level of inquiry-based research the child is capable of pursuing on their own or among peers. Another participant wrote in that the teacher and child problem solve together with the teacher supporting by asking questions to dig deeper into what the child perhaps already knows. One participant stated that they turn it back on the child and question, “What do you think the answer might be?”

One participant had an interesting culturally-referenced answer: “Sometimes questions are not answered – children are taught that sometimes it’s ok to just not know, but to try to remember the question. As is said in the Quaker tradition, ‘the truth is continually revealed.’ This
is our philosophy when it comes to questions.” This participant had also selected both teacher-researched and both child-researched answers.

**Figure 8.** Question 27: Participants’ responses to “When children have questions, how do they usually get their answers?”

**Q28. Sharing information.** 88.37% (38) of the total survey participants answered Question 28 on whether or not children are given opportunities to regularly share what they’ve learned with the entire class. 86.84% (33) stated children had these opportunities while 13.16% (5) stated children did not. Five participants had dropped out of the survey before this question.

**Q29. Co-researchers, co-planners, joint decision makers.** See Figure 9 for results. Five of the total survey participants had dropped out of the survey before Question 29. This question was on a 7-point Likert scale with only three points clearly labeled in a linear progress from None of the time (1), two blank radial buttons, Half of the time (4), two radial buttons, and All of the time (7). The weighted average was 4.5 (64.29%) implying that children were regarded in this way just above half of the time.
Q30. **Adaptation and accommodation.** Five of the total survey participants had dropped out of the survey before Question 30. This question was on a 7-point Likert scale with only three points clearly labeled in a linear progress from None of them (1), two blank radial buttons, Half of them (4), two radial buttons, and All of them (7).

**Figure 10.** Question 30: Participants’ answers to “How many of your materials and lessons are intentionally designed to accommodate or be adapted to all levels of ability?”

**Health Promotion (Cognitive, Physical, and Social Emotional)**

**Q31. Varied terrain.** See Table 12 for answers. Seven of the total survey participants had dropped out of the survey before Question 31 on the type of terrain in their outdoor
environment. Two participants had their answers re-coded to additionally have naturally varied terrain. One participant described the acre of cultivated gardens on their campus stating there were four sections of edible gardens surrounding “the school like a protective oasis” with each section (toddler, Primary, Lower Elementary, and Upper School) being designed around development appropriateness by “plant selection, environmental affordances, work available, and space to work.”

Table 14

**Question 31: Type of varied terrain in outdoor environment (n=36)**

<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, it is naturally varied (e.g. hills, marsh)</td>
<td>19</td>
<td>52.78%</td>
</tr>
<tr>
<td>Yes, we provided it through additional unprocessed or processed natural materials (e.g. stumps, logs, wooden bridges)</td>
<td>24</td>
<td>66.67%</td>
</tr>
<tr>
<td>Yes, we provided it through additional non-natural playground equipment (e.g. plastic playground equipment)</td>
<td>17</td>
<td>47.22%</td>
</tr>
<tr>
<td>No, it is completely flat (e.g. concrete)</td>
<td>1</td>
<td>2.78%</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>16.67%</td>
</tr>
</tbody>
</table>

**Q32. Outdoor activities available using natural materials.** See Table 13 for results.

Seven of the total survey participants had dropped out of the survey before Question 32 on the type of outdoor activities available using natural materials. Participants could select more than one activity.

Table 15

**Question 32: Outdoor activities available using natural materials (n=36)**
<table>
<thead>
<tr>
<th>Types of Activity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>31</td>
<td>86.11%</td>
</tr>
<tr>
<td>Jump</td>
<td>28</td>
<td>77.78%</td>
</tr>
<tr>
<td>Listen to natural sounds (e.g. birds, water)</td>
<td>28</td>
<td>77.78%</td>
</tr>
<tr>
<td>Climb</td>
<td>27</td>
<td>75.00%</td>
</tr>
<tr>
<td>Roll</td>
<td>27</td>
<td>75.00%</td>
</tr>
<tr>
<td>Visual variety</td>
<td>27</td>
<td>75.00%</td>
</tr>
<tr>
<td>Engage in group social activities</td>
<td>27</td>
<td>75.00%</td>
</tr>
<tr>
<td>Balance</td>
<td>26</td>
<td>72.22%</td>
</tr>
<tr>
<td>Crawl</td>
<td>25</td>
<td>69.44%</td>
</tr>
<tr>
<td>Smell</td>
<td>25</td>
<td>69.44%</td>
</tr>
<tr>
<td>Lift</td>
<td>20</td>
<td>55.56%</td>
</tr>
<tr>
<td>Taste</td>
<td>18</td>
<td>50.00%</td>
</tr>
<tr>
<td>Spin</td>
<td>17</td>
<td>47.22%</td>
</tr>
</tbody>
</table>

**Q33. Encouraging children to explore natural materials with their senses.** 74.42%

(32) of the total survey participants answered short essay Question 33 on encouraging children to explore natural materials indoors and outdoors with all of their senses; four participants elected to skip the question, and seven participants had dropped out of the survey before this question.

When reflecting on how participants encouraged children to explore natural materials indoors with all their senses, 10 participants answered: integrating natural materials into the classroom (4); examining and engaging with plants and flowers (3), formal cooking lessons or works with or without produce from the garden (2), emphasizing sensations in typical works
(e.g., drawing attention to the sound and smell when pouring dry materials, feeling the vibration of strings on musical instruments), and having an interactive nature basket in the classroom.

Not only did more participants reference the outdoors (13) in their answers (see Table 14 for the breakdown of responses by location type), but they also provided more examples of how they encouraged children to explore natural materials outdoors. Answers included: playing the silence game with a focus on what they hear or feel (3), digging (3), having a scavenger hunt (2), birdwatching (2), taking walks, raking leaves, engaging in photography, collecting pinecones, jumping in puddles, art (rubbings, painting, moving stones to make paths), and providing tools (such as magnifying glasses, binoculars, and field guilds). For more on this last item, please see the results for Question 51.

Only 19.75% (6) of the responses referenced an outdoor garden despite 63.16% (24) of the responses to Question 26 stated the participants had an edible garden on site. In looking at the other 18 participants’ answers, 11 answered more thematically without specific answers and 2 of the participants who responded to Question 26 skipped Question 33. That left five participants who responded to Question 33 with specific examples of things that they do to encourage exploration with the senses but didn’t mention the garden as a place in which children completed this type of activity. The six participants who did mention things they did in the garden included: formal lessons on gardening (3), informal lessons on gardening, smelling plants such as herbs or flowers (2), watering and growing plants, touching plants and describing textures, and harvesting snacks from the garden.

Table 16

<table>
<thead>
<tr>
<th>Question 33: Locations Referenced in Participant Answers (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit Location Reference</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
</tbody>
</table>
There were also some specific thematic items that came out of this question such as encouraging exploration (8), allowing free play or choice (4), role modeling wonder (2), rotation of materials, seasonal activities, encouraging observation, asking “I wonder” questions, and providing varied natural materials.

A few notable responses:

- “Because our environments (indoor and outdoor) are so varied and diverse, children are constantly called to explore materials, spaces, and abstract concepts at ever-evolving depth and complexity.”
- “When outdoors we encourage children to taste weeds and other plants, so long as they ask first and can properly identify the plant!”
- “[Children] are free to explore as long as they are being respectful to the environment and those around them.”
- “Our senses = our tool boxes, and we encourage children to use them throughout each day as inquiry-based scientists.”

Q34. School garden and use of products. 83.72% (36) of the total survey participants answered Question 34 on whether children had access to a school garden and whether the edible foods or products were used in the school’s meals, snacks, or classroom activities; 7 participants had dropped out of the survey before this question. 72.22% (26) had access to a school garden...
and used the edible products in meals, snacks, or classroom activities. 16.67% (6) had access to a school garden and did not use edible food or products in school meals, snacks, or classroom activities. 11.11% (4) did not have access to a school garden.

**Q35. How children participate in garden activities.** See Table 15 for results. Three participants elected to skip Question 35 on what gardening activities children regularly participate in, and seven participants had dropped out of the survey before this question.

<table>
<thead>
<tr>
<th>Types of Activity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting seeds</td>
<td>32</td>
<td>96.97%</td>
</tr>
<tr>
<td>Watering garden</td>
<td>31</td>
<td>93.94%</td>
</tr>
<tr>
<td>Activities with tools (e.g. shovel, hoe, rake)</td>
<td>30</td>
<td>90.91%</td>
</tr>
<tr>
<td>Harvesting plant or plant materials</td>
<td>30</td>
<td>90.91%</td>
</tr>
<tr>
<td>Planting seedlings and plants</td>
<td>29</td>
<td>87.88%</td>
</tr>
<tr>
<td>Weeding garden</td>
<td>28</td>
<td>84.85%</td>
</tr>
<tr>
<td>Compost activities</td>
<td>21</td>
<td>63.64%</td>
</tr>
</tbody>
</table>

**Q36. Connection between food and source.** See Table 16 for results. One of the total survey participants elected not to answer Question 36 on whether lessons or materials make connections between food and source and in which situations, and eight participants had dropped out of the survey before this question.

<table>
<thead>
<tr>
<th>Question 36: If Lessons or Materials Make Connections Between Food and Source</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
</table>
(n=34)

<table>
<thead>
<tr>
<th>Answer</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, for all food items (including meat)</td>
<td>22</td>
<td>64.71%</td>
</tr>
<tr>
<td>Yes, but only for vegetarian food items (including eggs and dairy)</td>
<td>5</td>
<td>14.71%</td>
</tr>
<tr>
<td>Yes, but only for vegan food items (not including any animal byproducts such as eggs and dairy)</td>
<td>4</td>
<td>11.76%</td>
</tr>
<tr>
<td>No, we do not make connections between food and source</td>
<td>3</td>
<td>8.82%</td>
</tr>
</tbody>
</table>

**Q37. Methods of connecting food to source.** 76.74% (33) of the total survey participants answered Question 37 on their methods to connect food and source; 2 participants elected to skip this question, and 8 participants had dropped out of the survey before this question. While this question also asked how often people connected food to source in their lessons, and materials, the answers were all over the board with some stating they never really engage in this type of lesson, to several times a year to several times a day. Regarding methods, participants listed quite a few: life cycle activities (15), three part cards (11), books (6), through traditional Montessori cultural shelf materials (unspecified which) (6), through nutrition lessons (4), in cooking classes or lessons (4), informal discussions during lunch (3), 3D models (3), sequence cards (3), unit studies of farm animals or agriculture (3), when around live animals (2), formal group discussions, cultural celebrations, singing songs, observing real animals or plants, parts-of-the cards, language materials, and while gardening in the spring. One participant answered, “[T]oo many to name.”

One participant responded in length: “To augment the Science area of my classroom, I try to consistently feature a seasonally appropriate life cycle as a combination of: a featured group
lesson (to make the connection), connected to a shelf work with related extensions. Each usually has: three-part cards, corresponding 3D models (felt, plastic, and/or the real thing depending upon the work), a diagram for further exploration/extension, and a related book or two.

- parts of a plant (parts of a tree/plant introductory cards, a diagram to color and label with appropriate colored pencils, lima bean deconstruction with tweezers)
- parts of an apple (three-part cards, felt pieces to match, a book with photographs, a diagram to color and label with appropriate colored pencils, and an activity involving washing apples/cutting/stamping the star pattern/making cider/compost/saving seeds)
- parts of a pumpkin (three-part cards, a book with photographs, a diagram to color and label with appropriate colored pencils, and an activity involving washing pumpkins/roasting pumpkin seeds/compost/saving seeds)
- sunflower project: I have had older students plant & tend sunflower seeds in the classroom, measure their growth & track it on a phenology calendar, transplant into the garden, and later harvest for pincer grip work for their younger peers to start all over again... some flower heads were left for the birds, as well.”

Social Systems Education

Q38. Promoting activities outdoors. 67.44% (29) of the total survey participants answered Question 38 on how they encourage children to engage in activities outdoors that promote independence (e.g. planting seeds, collecting specimens for study, exploring safely, harvesting without help, taking materials to a compost bin); 5 participants elected to skip this question, and 9 participants had dropped out of the survey before this question. Responses to this question seemed to group into garden-related tasks, exploration, art, intentionally setting up works, and routine tasks. Garden-related tasks: gardening from seed to harvest (15), taking
materials to compost (5), taking materials to vermicompost (2), planting seeds, watering the
garden, canning and making juice, cooking and serving a meal to family and community,
participating in seasonal cleanup. Exploration: free exploration of natural areas (3), collecting
natural specimen for study (3), taking nature walks (2). Art: engaging in outdoor drawing (2),
journaling (1), and painting (1). Routine tasks: filling and emptying water table, cleaning up after
selves, collecting recyclables. Two respondents discussed how they preface outdoor activities by
discussing safety with the children and then encourage them to work independently. One
respondent described encouraging independence in the garden space:

“Our environmental education classes meet with each classroom once a week in the
morning for 30 minutes and again with our Kindergarteners, or third-year students, for
another 30 minutes in the afternoon once a week. In the full classroom lessons with 20-25
young children, everyone is introduced to the garden space and learns the basic garden
rules (walk on paths, ask before you pick, use helping hands) and are afforded multiple
garden works and work stations to explore during their time. There are shelf works that
are housed in a small garden shed that all children can use. The garden shed includes
works such as seed sorting, seed spacing, identification cards that can be taken
throughout the garden and replaced for another child to use, as well as larger tools, like
brooms to sweep the sidewalk, magnifying glasses and toilet paper roll binoculars for
close specimen study, big compost bins for turning and working on gross motor control,
and of course, watering cans, shovels, rakes, and trowels, for their use in designated
areas.

In total, there are over 30 garden works we have developed that children have available to
them at any given time during these morning and afternoon lessons. Just as we do in the
indoor classroom, mistakes are allowed and encouraged in this environment, peers teach each other, and reflection on our findings is encouraged in small group circles. Teacher guides sing songs and lead short impressionist lessons before moving into a brief student-chosen work cycle.

Examples of lessons given include: proper harvesting and hand washing outdoors, watering, weeding, listening for bird calls, and safe handling of worms! Children are allowed to harvest freely and safely when produce is available. The garden environment itself supports children's independence through physical signs ("Water ME!" in a garden bed that needs water) and landscape design (small, winding paths with stepping stones and large rocks for balance), and appropriate tools provided. We support the wonder of childhood in this environment by balancing each child's need for independence with the knowledge and skills necessary for achieving just that.”

**Q39. Respect the feelings of others.** See Table 17 for results. Two of the total survey participants elected to skip Question 39 regarding how they encourage children to respect the feelings of others, and nine participants had dropped out of the survey before this question.

Table 19

*Question 39: Methods Used to Encourage Children to Respect the Feelings of Others*

(n=32)

<table>
<thead>
<tr>
<th>Methods / Curriculum Names</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher-child guided conflict resolution</td>
<td>7</td>
<td>21.88%</td>
</tr>
<tr>
<td>Sharing feelings with each other</td>
<td>7</td>
<td>21.88%</td>
</tr>
<tr>
<td>Peace table, shelf, or tray</td>
<td>6</td>
<td>18.75%</td>
</tr>
<tr>
<td>Victim approval of an action to “make it better”</td>
<td>6</td>
<td>18.75%</td>
</tr>
</tbody>
</table>
Lesson: Peace Rose  5  15.63%
Role modeling appropriate behavior  5  15.63%
Group discussions  5  15.63%
Grace and Courtesy lessons  5  15.63%
Montessori peace education  3  9.38%
Books  3  9.38%
Infusing caretaking and empathy for the earth and all creatures of the earth into daily activities  2  6.25%
Reflective listening  2  6.25%
Using “I-statements”  2  6.25%

Each of these received one mention each: social stories, identifying good behavior, roleplaying, using I-Care rules, Positive Discipline, think sheets, explicit instruction on how to interpret nonverbal language, Honoring the Light of the Child, Zones of Regulation, Welcoming Schools.

**Q40. Partnerships with others.** See Table 18 for results. One of the total survey participants elected to skip Question 40 on how they partner with others to support resource sharing, enhanced program development, and expanded outreach, and nine participants had dropped out of the survey before this question.

Table 20

*Question 40: Types of Partnerships with Others (n=33)*

<table>
<thead>
<tr>
<th>Types of Partnerships</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families</td>
<td>21</td>
<td>63.64%</td>
</tr>
</tbody>
</table>
Professional teaching and curriculum development organizations (e.g., AMS, AMI, NAEYC) 18 54.55%

Businesses that serve children (e.g. zoos, nature centers, discovery museums, public libraries) 17 51.22%

Environmental educational organizations (e.g. Project Learning Tree, Project WILD, Project WET, Nature Mapping) 13 39.39%

No one/not yet implemented 8 24.24%

County, state, and federal conservation agencies (e.g. state fish and game agencies, Cooperative Extension or Master Gardeners, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, National Park Service, U.S. Forest Service) 8 24.24%

Conservation organizations (e.g. Keep America Beautiful, Audubon) 7 21.21%

Local public or private schools 6 18.18%

Youth organizations (e.g., Scouts, Future Farmers of America, 4-H) 4 12.12%

Local colleges or universities 4 12.12%

Faith-based organizations 3 9.09%

Intergenerational programs (e.g. community centers, senior citizen centers) 2 6.06%

Q41-42. Gathering and using cultural information. One of the total survey participants answered Question 41 on whether or not they gather information about child’s family culture including the beliefs and practices related to daily life and child rearing, home language, and religious, ethnic, political, and geographic characteristics; 1 participant elected to skip this
question, and 9 participants had dropped out of the survey before this question. 60.47% (26) of the total survey participants answered Question 42 on when they use cultural information; 8 participants were not eligible as they had stated they don’t gather cultural information, and 9 participants had dropped out of the survey before this question. 1 of these answers was removed from the below chart as they had not answered Q41: their answer was “yes, frequently.”

Table 21

**Questions 41-42: Gathering and Using Cultural Information (n=33)**

<table>
<thead>
<tr>
<th>Gathering Cultural Information (Question 41)</th>
<th>Using Cultural Information (Question 42)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, at admission</td>
<td>Yes, frequently</td>
<td>6</td>
<td>18.18%</td>
</tr>
<tr>
<td></td>
<td>Yes, infrequently</td>
<td>6</td>
<td>18.18%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1</td>
<td>3.03%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>13</td>
<td>39.39%</td>
</tr>
<tr>
<td>Yes, throughout the year</td>
<td>Yes, frequently</td>
<td>7</td>
<td>21.21%</td>
</tr>
<tr>
<td></td>
<td>Yes, infrequently</td>
<td>5</td>
<td>15.15%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>12</td>
<td>36.36%</td>
</tr>
<tr>
<td>No, I do not gather cultural information</td>
<td>Total</td>
<td>8</td>
<td>24.24%</td>
</tr>
</tbody>
</table>

**Q43. Impact of gathered information.** See Table 20 for results. Three of the total survey participants elected to skip Question 43 regarding how gathered cultural information
impacted their practices; eight participants were ineligible, and nine participants had dropped out of the survey before this question.

Table 22

**Question 43: Impact of Gathered Cultural Information on Practices (n=23)**

<table>
<thead>
<tr>
<th>Thematic Elements</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporating new celebrations or holidays</td>
<td>7</td>
<td>30.43%</td>
</tr>
<tr>
<td>Bringing in visitors</td>
<td>3</td>
<td>13.04%</td>
</tr>
<tr>
<td>Incorporating different foods</td>
<td>3</td>
<td>13.04%</td>
</tr>
<tr>
<td>Incorporating storytelling</td>
<td>3</td>
<td>13.04%</td>
</tr>
<tr>
<td>Connecting children and creating greater community understanding</td>
<td>3</td>
<td>13.04%</td>
</tr>
<tr>
<td>Teaching children to respect differences</td>
<td>2</td>
<td>8.70%</td>
</tr>
</tbody>
</table>

Each of these received just one mention: incorporating new music or dance and movement, including representative books in the classroom, taking field trips related to cultural discoveries, holding an International Day or Fair, learning about “other lands, other people far away”, including representative cultures in cultural studies, an exploration of different clothes.

One participant explained one way in which they use food as the starting point for cultural investigations, “Parents have come and given guest lessons about a particular vegetable we grow in our garden and how they use it traditionally in their home life.”

**Q44. Family contact.** See Table 21 for results. Nine of the total survey participants had dropped out of the survey before Question 44 regarding which family members they had had
contact with. Two individuals also wrote in friends, extended family members, babysitters, and nannies.

Table 23

*Question 44: Contact with Family Members (n=34)*

<table>
<thead>
<tr>
<th>Family Member</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents or guardians</td>
<td>34</td>
<td>100%</td>
</tr>
<tr>
<td>Grandparents</td>
<td>32</td>
<td>94.12%</td>
</tr>
<tr>
<td>Siblings</td>
<td>29</td>
<td>85.29%</td>
</tr>
<tr>
<td>Aunts/uncles</td>
<td>25</td>
<td>73.53%</td>
</tr>
</tbody>
</table>

**Q45. Methods of teaching about families.** See Table 22 for results. Four of the total survey participants elected to skip Question 45 regarding how they teach children about families and what materials they use, and nine participants had dropped out of the survey before this question.

Table 24

*Question 45: Methods of Teaching About Families and Materials Used (n=30)*

<table>
<thead>
<tr>
<th>Thematic Elements</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>17</td>
<td>56.67%</td>
</tr>
<tr>
<td>Discussion</td>
<td>16</td>
<td>53.33%</td>
</tr>
<tr>
<td>Montessori Cultural Studies materials</td>
<td>5</td>
<td>16.67%</td>
</tr>
<tr>
<td>Children of the World photos or photos from the child’s family</td>
<td>5</td>
<td>16.67%</td>
</tr>
<tr>
<td>3-Part Cards</td>
<td>4</td>
<td>13.33%</td>
</tr>
<tr>
<td>Stories</td>
<td>3</td>
<td>10.00%</td>
</tr>
</tbody>
</table>
These items were each mentioned once: songs, talk about imitating the Holy Family, puzzles, and explicit lessons.

**Q46. Non-traditional families.** 74.42% (32) of the total survey participants answered Question 46 regarding if they teach about traditional and non-traditional families as they relate to the dominant culture; 2 participants elected to skip this question, and 9 participants had dropped out of the survey before this question. 71.88% (23) participants answered they do teach about traditional and non-traditional families while 28.13% (9) participants answered they do not.

**Q47. Using maps to increase sense of place.** 79.07% (34) of the total survey participants answered Question 47 regarding if they have lessons that involve maps from the local community with an aim to develop the child’s sense of place within their local community; 9 participants had dropped out of the survey before this question. 61.76% (21) of participants answered they do have lessons with maps while 38.24% (13) participants answered they do not.

**Natural Systems Education**

**Q48. Hours outdoors from spring through fall.** See Figure 11 for results. Ten of the total survey participants had dropped out of the survey before Question 48 regarding the number of hours per week children spend outdoors in late spring through early fall.
Q49. **Hours outdoors from fall through spring.** See Figure 12 for results. Ten of the total survey participants had dropped out of the survey before Question 48 regarding the number of hours per week children spend outdoors in late spring through early fall. Future research with a larger sample size may find this question and the one before it to be more useful, particularly in conjunction with a comparison to the states that participants live in and their seasonal weather.

Q50. **Exposure to outdoors at different times.** 76.74% (33) of the total survey participants answered Question 47 regarding if children always go outside at the same time every day, every day that they go outside; 10 participants had dropped out of the survey before this
question. 75.76% (25) of participants answered they do while 24.24% (8) participants answered they do not.

**Q51. Tools available outside.** See Table 23 for results. Five of the total survey participants elected to skip Question 51 regarding what supplies/tools were regularly available to children while they were outside, and 10 participants had dropped out of the survey before this question.

Table 25

**Question 51: Tools Available to Children Outside (n=28)**

<table>
<thead>
<tr>
<th>Items Mentioned</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Magnifying glass</em></td>
<td>12</td>
<td>40.00%</td>
</tr>
<tr>
<td><em>Specimen gathering (bug catchers, insect nets)</em></td>
<td>10</td>
<td>33.33%</td>
</tr>
<tr>
<td>Gardening tools (shovels, trowels, ranks)</td>
<td>9</td>
<td>30.00%</td>
</tr>
<tr>
<td><em>Containers, baskets, buckets</em></td>
<td>9</td>
<td>30.00%</td>
</tr>
<tr>
<td><em>Paper, pencil, clipboards</em></td>
<td>5</td>
<td>16.67%</td>
</tr>
<tr>
<td>Art supplies for drawing, painting, sketching, journaling</td>
<td>5</td>
<td>16.67%</td>
</tr>
<tr>
<td>Plant care/watering</td>
<td>4</td>
<td>13.33%</td>
</tr>
</tbody>
</table>

It’s worth nothing that in the question itself, the italicized items of magnifying glass, specimen gathering tools (insect net), containers and baskets, and paper, pencil, and clipboards were all mentioned.

Many other objects were also mentioned such as outdoor play equipment like balls, sandbox, push and ride toys, hula hoops, messy materials, balance boards, and play structures. These were eliminated from the above table as they didn’t directly address the question. Refinement of the question may lead to better information reported on the types of tools and
supplies that are available to children that assist them in learning more about the outdoor environment.

One participant wrote, “We have a cabinet with outdoor activities that include many things that change regularly, including drilling, hammering, plant care, cloth washing, drawing and painting, window washing, sorting, observing (magnifying glass), and gathering activities, and many others.” While not directly related to the question, it is an interesting look into practical life activities that are available outdoors at this school. Another participant wrote that children had access to tools such as magnifying glasses, paper, and clipboards only during nature walks, but during recess they did not have access to any of those.

**Q52. Bring materials outdoors.** 76.74% (33) of the total survey participants answered Question 52 regarding if children were able to bring materials outdoors from the classroom; 10 participants had dropped out of the survey before this question. 78.79% (26) of participants answered they are allowed while 21.21% (7) participants answered they were not.

**Q53. Bring materials indoors.** 76.74% (33) of the total survey participants answered Question 53 regarding if children were able to bring materials into the classroom from outdoors; 10 participants had dropped out of the survey before this question. 81.82% (27) of participants answered they are allowed while 18.18% (6) participants answered they were not.

**Q54. Location children place outdoor materials, inside.** See Tables 24 and 25 for results. Four of the total survey participants elected to skip Question 51 regarding where children put the outdoor materials when they come inside and what the children do with them, and 10 participants had dropped out of the survey before this question. One respondent wrote, “We have a ‘Museum Table’ that the children curate and are allowed to place any natural item upon.”
Question 54: Places Children Integrate Outdoor Materials in the Classroom (n=29)

<table>
<thead>
<tr>
<th>Mentioned Locations</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistent display tray, shelf, basket, table</td>
<td>22</td>
<td>75.86%</td>
</tr>
<tr>
<td>Cubby/backpack</td>
<td>4</td>
<td>13.79%</td>
</tr>
<tr>
<td>Dedicated flower vase (for dandelions)</td>
<td>1</td>
<td>3.45%</td>
</tr>
<tr>
<td>Things stay outside</td>
<td>1</td>
<td>3.45%</td>
</tr>
</tbody>
</table>

Table 27

Question 54: How Children Use Outdoor Materials in the Classroom (n=29)

<table>
<thead>
<tr>
<th>Mentioned Activities</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explored and observed with scientific tools</td>
<td>6</td>
<td>20.69%</td>
</tr>
<tr>
<td>Shared with the class</td>
<td>5</td>
<td>17.24%</td>
</tr>
<tr>
<td>Used in art works</td>
<td>4</td>
<td>13.79%</td>
</tr>
<tr>
<td>Integrated into practical life works</td>
<td>3</td>
<td>10.34%</td>
</tr>
<tr>
<td>Used in snack (when appropriate)</td>
<td>1</td>
<td>3.45%</td>
</tr>
</tbody>
</table>

Q55. Frequency of visiting local natural site. See Figure 13 for results. Ten of the total survey participants had dropped out of the survey before Question 55 regarding how often they visit a local site that remains in its natural state.
Figure 13. Question 55: Participants’ answers to “How often do you visit a local site that remains in its natural state?”

Q56. Child-directed time in natural spaces. See Table 26. 46.51% (20) of the total survey participants answered Question 56 regarding the format of the visit to the natural site; 13 participants were not eligible as they had answered they do not go to natural sites, and 10 participants had dropped out of the survey before this question. Respondents were allowed to choose more than one option, and four individuals wrote in examples of how children may experience more than one of these options during a single visit such as: “When on field trip to nature conservancy the structure is often provided by adults. When on nature walks children and adults will guide our direction. When we reach our destination, children are provided time for unstructured play. Then we return to our school.”

Table 28

Question 56: Child-Directed Time in Natural Spaces (n=20)

<table>
<thead>
<tr>
<th>Answer option</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children are guided around the natural site by adults</td>
<td>18</td>
<td>90%</td>
</tr>
<tr>
<td>Children are led through structured activities by adults</td>
<td>9</td>
<td>45%</td>
</tr>
<tr>
<td>Children are given unstructured free play and exploration</td>
<td>9</td>
<td>45%</td>
</tr>
</tbody>
</table>

Four of the nine individuals who stated that children are led through structured activities by adults also stated that children were not given unstructured free play and exploration.

Q57. Curricular integration into outdoors. See Table 27 for results. One of the total survey participants elected not to answer Question 57 regarding which curricular areas they integrate into lessons outdoors, and 10 participants had dropped out of the survey before this question.
Table 29

Question 57: Curricular Integration into Outdoors by Area (n=32)

<table>
<thead>
<tr>
<th>Curricular Area</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensorial</td>
<td>26</td>
<td>81.25%</td>
</tr>
<tr>
<td>Movement</td>
<td>26</td>
<td>81.25%</td>
</tr>
<tr>
<td>Practical Life</td>
<td>25</td>
<td>78.13%</td>
</tr>
<tr>
<td>Cultural</td>
<td>25</td>
<td>78.13%</td>
</tr>
<tr>
<td>Art</td>
<td>25</td>
<td>78.13%</td>
</tr>
<tr>
<td>Language Arts</td>
<td>22</td>
<td>68.75%</td>
</tr>
<tr>
<td>Math</td>
<td>17</td>
<td>53.13%</td>
</tr>
<tr>
<td>I don’t</td>
<td>1</td>
<td>3.13%</td>
</tr>
</tbody>
</table>

Q58. Methods of integrating curricular areas outdoors. 59.4% (19) of the total survey participants answered Question 58 regarding their methods for integrating curricular areas outdoors; 14 participants elected to skip this question, and 10 participants had dropped out of the survey before this question.

**Practical Life.** Respondents mentioned: washing activities such as with windows or foods; plant care; harvesting in the garden; playing co-operative games.

**Sensorial.** Respondents mentioned: sorting and grading natural materials; engaging in senses in the gardens; doing scavenger hunts for different colors; examining the textures of different barks.

**Language.** Respondents mentioned: oral discussion of things seen, felt, or experienced; creative writing; vocabulary enhancement.
Culture. Respondents mentioned: hiking; using the sandbox to make landforms; nomenclature of plants, leaves, birds, flowers, insects; find real land and water outside for lessons on land, air, and water; interact with gardens, bees, chickens; observe shadows and light; experience life cycles; watch for changes in the environment over the seasons.

Math. Respondents mentioned: counting, weighing, measuring, and graphing natural materials like seeds, rocks, leaves, acorns, pinecones, wildflowers, tomatoes on a vine; check the rain gauge.

Art. Respondents mentioned: journals; projects; drawing; painting; creations with sticks, rocks, and flowers.

Music and Movement. Respondents mentioned: “move like the sandhill crane”; dance; climb trees; sing.

Q59. Cycle of nature and seasonal changes. Seven of the total survey participants elected to skip Question 59 regarding how they encourage children to learn about the cycle of nature and seasonal changes, and 10 participants had dropped out of the survey before this question.

Table 30

Question 59: Methods for Encouraging Children to Learn about Cycle of Nature and Seasons (n=26)

<table>
<thead>
<tr>
<th>Thematic Elements</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time outside for observation, walks</td>
<td>9</td>
<td>34.62%</td>
</tr>
<tr>
<td>Literature, books</td>
<td>6</td>
<td>23.08%</td>
</tr>
<tr>
<td>Life cycle works</td>
<td>6</td>
<td>23.08%</td>
</tr>
<tr>
<td>Discussion</td>
<td>4</td>
<td>15.38%</td>
</tr>
</tbody>
</table>
Three-part cards 4 15.38%
Formal lessons 3 11.54%
Weather 3 11.54%
Songs 2 7.69%
Rotating shelf works to match season 2 7.69%
Calendar works 2 7.69%

Participants also mentioned harvesting as a poignant time, cosmic education, formal environmental education classes, biome work, science journals, intentionally placing photos of the seasons around the classroom, hosting baby chicks or caterpillars, and vermicompost.

Q60. Animals represented in the classroom. See Figure 14 for results. Ten of the total survey participants had dropped out of the survey before Question 60 regarding animals represented in the classroom. Participants were instructed that 3D representations included small objects, sculpture, or other non-live 3D representations of animals while 2D representations included books, puzzles, photos, and three-part cards.

Animals Represented in the Classroom, $n=33$

<table>
<thead>
<tr>
<th>Types of Animals</th>
<th>None</th>
<th>Insects</th>
<th>Fish</th>
<th>Bird</th>
<th>Mammal (Non-Human)</th>
<th>Amphibian</th>
<th>Reptile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live Animals, Natives</td>
<td>1</td>
<td>17</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Live Animals, Non-Natives</td>
<td></td>
<td>6</td>
<td>18</td>
<td>6</td>
<td>10</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>3D Representations</td>
<td></td>
<td>29</td>
<td>25</td>
<td>26</td>
<td>30</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>2D Representations</td>
<td></td>
<td>31</td>
<td>28</td>
<td>32</td>
<td>31</td>
<td>31</td>
<td>32</td>
</tr>
</tbody>
</table>
Q61. **Plants represented in the classroom.** Ten of the total survey participants had dropped out of the survey before Question 61 regarding plants represented in the classroom. Participants were instructed that 3D representations included small objects, sculpture, artificial plants, artificial flowers, or other non-live 3D representations of plants while 2D representations included books, puzzles, photos, and three-part cards.

![Plants Represented in the Classroom, n=33](chart)

**Figure 15.** Question 61: Plants represented in the classroom

Q62. **Intentionally focusing on native/local.** 76.74% (33) of the total survey participants answered Question 62 regarding if they intentionally include native or local plants and animals in their 3D and 2D representations in the classroom; 10 participants had dropped out of the survey before this question. 72.73% (24) of participants answered they did while 27.27% (9) participants answered they did not.

Q63. **Children caring for plants/animals.** 74.42% (32) of the total survey participants answered Question 63 regarding if children were involved regularly in the care of plants or animals; 1 participant elected not to answer the question, and 10 participants had dropped out of the survey before this question. 90.63% (29) of participants answered children were involved regularly while 9.38% (3) participants answered they were not.
Q64. Biophilia vs ecophobia. 65.12% (28) of the total survey participants answered Question 64 regarding how they would react if a child walked up to them holding a giant centipede; 5 participants elected not to respond, and 10 participants had dropped out of the survey before this question. These results were a little surprising. First, participant responses were analyzed for whether they showed biophilia (including a sense of respect or appreciation) or ecophobia (a fear-based response). One participant made note that giant centipedes can bite, and they would ask the child to put the insect on the ground instead of holding it so they could watch it. This was coded as biophilia and not ecophobia.

92.86% (26) of the participants responded in a way that reflected biophilia while 7.69% (2) reflected fear. Of those two, one honestly responded that they try not to let children know they don’t like insects but would not be able to help responding by asking the child to take it outside. 69.23% (18) of the participants would ask the child to immediately put the centipede back or to place it in an appropriate container for observation. Of those, people suggested follow-up activities of observing the insect, conducting research on centipedes, drawing the centipede, looking for the centipede’s habitat, counting its legs, and taking a sensorial approach such as discussing its color. 29% explicitly mentioned safe handling such as being respectful, mentioning the centipede needs care as it is a living creature, or that it was safer to watch the insect in a container or as it’s on the ground.

Two participants had more unique answers. One mentioned asking the child if they had thought about whether or not the centipede was safe before they had picked up the insect. The second highlighted the importance of connecting and speaking with children who seem uncomfortable around insects:
“I will provide a container that is safe for the centipede, and ask the child to gently place the centipede into the container so that we can observe it closely, and then take it outside together. I will also ask the child to then wash their hands. I love this question – my Grandpa was an Entomologist, and I have always been able to comfortably model curiosity over found insects . . . I will often share a story or two about my Grandpa if there is a child who appears uncomfortable around insects.”

Q65. Connecting wonder to the natural world. See Table 29 for the thematic results.

Six of the total survey participants elected to skip Question 65 regarding how they connect wonder to the natural world, and 10 participants had dropped out of the survey before this question.

Table 31

<table>
<thead>
<tr>
<th>Question 65: Methods for Connecting Wonder to the Natural World (n=27)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow time to observe – bird watching, observing the weather, watching water flow, examining early plant shoots, taking walks, noting seasonal changes, noticing the small things</td>
<td>11</td>
<td>40.74%</td>
</tr>
<tr>
<td>Role modeling (without mentions of excitement or curiosity)</td>
<td>11</td>
<td>40.74%</td>
</tr>
<tr>
<td>Literature and books</td>
<td>6</td>
<td>22.22%</td>
</tr>
<tr>
<td>Discussion</td>
<td>6</td>
<td>22.22%</td>
</tr>
<tr>
<td>Showing own curiosity (coded separately from role modeling)</td>
<td>5</td>
<td>18.52%</td>
</tr>
<tr>
<td>Showing own excitement (coded separately from role modeling)</td>
<td>4</td>
<td>14.81%</td>
</tr>
<tr>
<td>Giving children time to explore, discover, or pausing when they express wonder</td>
<td>4</td>
<td>14.81%</td>
</tr>
</tbody>
</table>
Two participants mentioned their spiritual or religious beliefs in the following comments:

- “Tell children to enjoy all of God’s gifts to us.”
- “modeling awe of all God’s creations”

Another participant had a thorough answer that really highlighted the ongoing theme of role modeling, showing excitement, and showing curiosity that was expressed by a combined 15 participants (55.56% of the respondents to this question):

“My innate sense of wonder and awe for the natural world is heightened when observing young children interact with their natural world using all of their senses. I feel connected when watching my dog lead with her nose while taking a walk; I skygaze/stargaze; I am an avid birder; I draw sound maps & nature journal; I feel renewed when canoeing & swimming in freshwater lakes… I do these things in order to stay authentically connected with my wonder. And as I teach, I model curiosity and inquiry-based learning with the youngest of my students: in person in the natural world, through children’s literature, and, throughout discussions/connections in the classroom.”

**Q66. Endangered species, local or global.** See Table 30 for results. Ten of the total survey participants had dropped out of the survey before Question 66 regarding whether or not they covered endangered species and if it was on a local or global level.

Table 32

*Question 66: Endangered Species: Local, Global, or Both? (n=33)*
<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, global level only</td>
<td>13</td>
<td>39.39%</td>
</tr>
<tr>
<td>Yes, local or regional level</td>
<td>3</td>
<td>9.09%</td>
</tr>
<tr>
<td>only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, both</td>
<td>13</td>
<td>39.39%</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>12.12%</td>
</tr>
</tbody>
</table>

**Q67. Climate change.** 76.74% (33) of the total survey participants answered Question 67 regarding if their lessons or materials cover climate change; 10 participants had dropped out of the survey before this question. 42.42% (14) of participants answered they covered climate change while 57.58% (19) participants answered they did not.

**Q68. Integration of social systems with natural systems.** 39.53% (17) of the total survey participants answered Question 68 regarding how integrate social systems (culture, families, ideas, concepts, individuals) with natural systems in their lessons, materials, and prepared environment; 16 participants elected to skip this question, and 10 participants had dropped out of the survey before this question. Participants were asked to include if they discuss how people have an impact on nature, how systems are made of parts, or how systems may not continue to function if any of their parts are missing.

23.53% (4) of the participants who answered Question 68 highlighted how the Montessori cultural curriculum integrates social systems and natural systems already. Some selections from their comments:

- “We study a continent a semester and learn everything we can - how children go to school, names of countries, river ways, how families live, where they work, what they wear, etc. We have guest speakers come in and talk about growing up
or living in that place. Recently we talked about the Amazon Rain Forest of South America.”

- “We talk about different continents and cultures. If I'm discussing South America then I will talk about the countries, cultures, landscapes, animals, plants, etc.”
- “Whenever we are having a cultural lesson there seems to be opportunity to discuss these concepts.”

23.53% (4) of the participants stated they use informal discussions to integrate the two systems. One participant said, “We discuss daily our impact on nature and environment and how all we do has repercussions. We see it in our own garden and environment being so close to the beach.”

17.65% (3) of the participants stated they do not integrate social systems and natural systems.

17.65% (3) of the participants explained they naturally integrate the concepts into the full Montessori curriculum, one of whom stated, “Cosmic education, as we practice it, prepares the child to be a good steward of the earth.”

11.76% (2) of the participants stated that they focus on interdependence and interaction. One of these said, “The concept of how people have an impact on nature arises in a variety of conversations, including: forms of transportation, when separating garbage/recycling/compost, gardening, etc. Some of these concepts are a little abstract for 3-6 year olds, but I try to connect social systems (families) with natural systems (specific plants/animals/weather) and how these systems within our indoor & outdoor prepared environments interact. I have introduced systems made of parts through introductory gardening programming (parts of plants; pollinators interacting within the garden space; role of compost; role of decomposers). I have also
introduced what could happen within a pond habitat if certain elements of the food chain are missing, and how that impacts the greater natural environment.”

One participant described how they used hands-on experiential learning in permaculture to embed these concepts and gave further information (not included) on permaculture and how it relates: “Permaculture is a way to design human habitats (homes, gardens, farms, or cities) that cooperate with and sustain the earth while providing for human needs. It as an organic approach in which both natural systems and human communities meet their needs, now and in the future . . . Plants, animals, and structures are placed in beneficial relationships, the yields of one supporting the needs of the other. There is little waste and eventually less work, but, most importantly, the wealth and health of nature is secured and we are surrounded by nature. Montessori students, using nature as a model, imitate and intensify what nature does. For example, in nature worms do the tilling, so we, in turn, abstain from plowing and turning over the soil and simply feed the worms in a somewhat organized way called sheet mulching . . . The word permaculture originally referred to “permanent agriculture” but was expanded to stand also for “permanent culture,” as it was seen that social aspects were integral to a truly sustainable system. . . . We continue to grow and develop the systems concepts of our curriculum AND how to integrate culture and families in our environments. We could do more work in discussing how people have an impact on nature, how systems are made of parts and how systems may not continue to function if any of their parts are missing on a larger scale that the garden and local environment... but we are doing good work nevertheless.”

**Q69. Barriers to time outdoors.** See Table 31 for results. One of the total survey participants elected not to answer Question 69 regarding the barriers to providing time outdoors, and 10 participants had dropped out of the survey before this question.
Table 33

Question 69: Barriers to Time Outdoors (n=32)

<table>
<thead>
<tr>
<th>Answer option</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather</td>
<td>20</td>
<td>62.50%</td>
</tr>
<tr>
<td>Not enough time in the day</td>
<td>19</td>
<td>59.38%</td>
</tr>
<tr>
<td>Lack of natural space</td>
<td>14</td>
<td>43.75%</td>
</tr>
<tr>
<td>Licensing</td>
<td>8</td>
<td>25.00%</td>
</tr>
<tr>
<td>Transportation is costly or difficult to arrange</td>
<td>7</td>
<td>21.88%</td>
</tr>
<tr>
<td>Outdoor time is scheduled by someone else</td>
<td>6</td>
<td>18.75%</td>
</tr>
<tr>
<td>Allergies</td>
<td>3</td>
<td>9.38%</td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>9.38%</td>
</tr>
<tr>
<td>Parents do not want their children to get dirty</td>
<td>2</td>
<td>6.25%</td>
</tr>
<tr>
<td>Physical disabilities or sensory integration disorder</td>
<td>1</td>
<td>3.13%</td>
</tr>
<tr>
<td>I don’t feel comfortable</td>
<td>1</td>
<td>3.13%</td>
</tr>
</tbody>
</table>

Two participants additionally noted in the “other” block that parents do not always provide weather-appropriate clothing. The three participants who stated there were no barriers lived in CA, FL, and NC. Weather in those states tends to be harsher in the summer; if these participants worked only during the typical school year, they may not experience weather as a barrier.

Q70. Barriers to environmental education. See Table 32 for results. Four of the total survey participants elected not to answer Question 70 regarding what they feel are barriers to being able to provide environmental education, and 10 participants had dropped out of the survey before this question. This question had a disproportionate amount of write-in answers and thus
was re-coded based on what was written in. All italicized categories were created from the written-in responses.

Table 34

*Question 69: Barriers to Environmental Education (n=29)*

<table>
<thead>
<tr>
<th>Answer option</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental education is not as important as other curricular areas to</td>
<td>12</td>
<td>41.38%</td>
</tr>
<tr>
<td>parents</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>I don’t feel there are any barriers</em></td>
<td>6</td>
<td>20.69%</td>
</tr>
<tr>
<td>I’m not comfortable</td>
<td>5</td>
<td>17.24%</td>
</tr>
<tr>
<td><em>I don’t have enough time</em></td>
<td>5</td>
<td>17.24%</td>
</tr>
<tr>
<td>Environmental education is not as important as other curricular areas to</td>
<td>3</td>
<td>10.34%</td>
</tr>
<tr>
<td>head of school</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Limited access to natural areas</em></td>
<td>3</td>
<td>10.34%</td>
</tr>
<tr>
<td>Environmental education is not as important as other curricular areas to</td>
<td>2</td>
<td>6.90%</td>
</tr>
<tr>
<td>to the larger school community</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lack of staff</em></td>
<td>2</td>
<td>6.90%</td>
</tr>
<tr>
<td><em>Lack of money</em></td>
<td>1</td>
<td>3.45%</td>
</tr>
<tr>
<td>Environmental education is not as important as other curricular areas to</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>me</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some respondents in the write-in comments seemed to feel general education and environmental education were mutually exclusive while some felt it was a primary focus of Montessori education:
• “We trained as Montessori teachers. It takes adjustment to the way you are taught to include this. That is hard when you are just getting on your feet as a new Montessori teacher. Normalization and concentration were what I was focussed (sic) on. We are now starting to get trained in EE. But it feels like we are compromising ‘traditional’ Montessori (sic). I know this is not true - but it is what it feels like!”

• “[T]here are so many hours of the day so I try to balance environmental education with other important things, such as teaching they young children how to read.”

• “There is so much to include in a diverse curriculum. Providing a good balance between traditional academics and environment studies can be tricky.”

• “We do TONS of environmental education. Montessori lends itself to this really well.”

• “A lack of awareness of what Environmental Education IS within traditional Education, and that it is treated as a mostly separate/nebulous/less developed area within Montessori Education . . . I hope that misperceptions regarding how/where to integrate EE (in urban and rural areas) can decrease for the sake of more fully integrating EE into all forms of education.”