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Addressing Policy, Practice, and Research That Matters

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EDITORIAL NOTE

Why are public school children still stuck inside?
At a crossroad between teacher training and nature-based learning

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Consulting Editor

Decades of research articulates why nature-based learning is more than good for kids. It is essential to healthy growth and development. So why is learning still predominantly an indoor experience in public schools? Why are children still plopped behind desks, parked in front of digital devices, and seated inside classrooms for most of each school day?

Nature-based educators see this as a no-brainer. Children need to play and learn outside! We have directly experienced the power of outdoor learning and nature connection. The research clearly demonstrates how nature-based learning is complementary, if not superior, to traditional learning in public schools (Chawla, 2018; Kuo, 2019). So why are we still having this conversation in the context of public schools?

Apparently, research alone isn't enough. Teachers and administrators need proof to justify nature-based learning in the face of high stakes testing (often tied to teacher pay). Although there's no shortage of research that demonstrates its benefits, the onus rests squarely on the shoulders of professionals in nature-based education to spread the word. To that end, the following discussion considers nature-based learning and how we can improve our approach public school education.

GIVE ME A BREAK

Let's begin with recess. Defined by the American Academy of Pediatrics (AAP) as "a necessary break in the day for optimizing a child's social, emotional, physical, and cognitive development", we might assume that all public schools provide recess to boost performance and help kids recharge (AAP, 2013; Ramstetter and Murray, 2017). Yet as many as 40% of school districts have no formal policies on how much recess children are required to have daily (Ramstetter and Murray, 2017). This leaves a lot of wiggle room for individual teachers to decide whether recess can be nixed for punishment or used as time for students to do more work. The AAP firmly states that "recess should be considered a child's personal time, and it should not be withheld for academic or punitive reasons" (AAP, 2013). At minimum, recess is a starting point in our advocacy for unstructured outdoor play in public schools.

Unfortunately, the National Center for Education Statistics finds serious disparities in the amount of recess children are likely to have noting that, "the lowest minutes per day of recess (21 minutes in first grade to 17 minutes in sixth grade) occurred in schools where 75 percent or more of the students were eligible for free or reduced-price lunch" (Parsad and Lewis, 2006). In other words, children who attend the schools with the greatest socio-economic challenges may also face school with less relief from life's stress and academic pressures in the form of recess. (Dettweiler et al, 2017; Ramstetter and Murray, 2017). While recess is not the focus of our discussion, this provides context for the conundrum that outdoor learning may present. If teachers spend a little as 17 minutes a day outdoors with students for recess, how can we expect them to embrace greater doses of outdoor learning each week – or better yet – every day?

THE BENEFITS ARE UNDENIABLE

It may be that teachers and administrators need more information about the benefits of nature-based learning and its significant advantages for academic achievement. In a recent study, researchers plainly state that, "In academic contexts, nature-based instruction outperforms traditional instruction" (Kuo et al, 2019). This powerful declaration comes after analyzing a voluminous body of research to determine cause-and-effect relationships between nature-based learning and student achievement.

Kuo, Barners, and Jordan identify eight distinct pathways between nature and learning:

- Nature has rejuvenating effects on attention
- Nature relieves stress
- Contact with nature boosts self-discipline
- Student motivation, enjoyment, and engagement are better in natural settings
- Time outdoors is tied to higher levels of physical activities and fitness
- Vegetated settings tend to provide calmer, quieter, safer contexts for learning
- Natural settings seem to foster warmer, more cooperative relationships
- Natural settings may afford "loose parts", autonomy, and distinctly beneficial forms of play

Of the eight pathways between nature and learning described in the Kuo, Barnes, and Jordan study, five pathways are learner-centered and three pathways are about the supportive context natural settings and features provide (Kuo et al, 2019).

Significantly, researchers find that, "In school settings, incorporating nature in instruction improves academic achievement over traditional instruction" (Kuo et al, 2019). The researchers reiterate, "experiences with nature do promote children's academic learning and seem to promote children's development as persons and as environmental stewards" (Kuo et al, 2019).

Given such thorough and conclusive research, isn't this the clear choice for more effective education in public schools?

NATURE IS CALLING

As the director of an association of forest and nature schools in the United States, I can attest to the transformation teachers experience when they kindle their own nature connection. More than adorable, muddy video clips; more than well-researched books or useful curriculum guides; more than even the most conclusive research findings: when teachers experience nature connection, they are more likely to engage in outdoor, nature-based learning with children.

But for many teachers, nature connection may be buried, lost, or yet to be revealed. Addressing this disconnect may transform classroom-bound public school education and ultimately get kids outside. The familiar Rachel Carson quote comes to mind, "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" (Carson & Pratt, 1965). If we cultivate appreciation and respect for nature in teachers, they pass it on to children.

Teachers need direct training experiences to understand nature-based learning and its benefits firsthand. Through fun outdoor professional development, steeped in nature connection and best practices, teachers are inspired and encouraged. They are empowered to try a new approach to learning, vastly different than what they may have learned in their college courses or within the realms of public school. As teachers develop relationships with the natural world and with other teachers, these meaningful networks can lend support along the path of nature-based learning. Supportive and engaging teacher training helps teachers tap into the ways nature-based learning supports academic and personal development for children (Kuo, 2019). It's fun, accessible, meaningful, and welcoming.

Teacher training appears to be one vital missing link and one incredibly impactful solution.

We can either ignore the benefits of nature-based learning or reframe the conversation about public school education through our binoculars outside. Teacher training is central to the nature-based education movement and may be our best hope yet for all children to reap the benefits of outdoor learning.

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The Nature and Nurture of Resilience:
Exploring the Impact of Nature Preschools on Young Children's Protective Factors

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ABSTRACT

Resilience, the capacity to cope with stress and adversity, is universally regarded as a positive and valued trait (LeBuffe & Naglieri, 2012). The purpose of this study was to explore the potential for nature preschools to support the development of initiative, self-regulation, and attachment, which are key protective factors that can offset or moderate the effects of stress and adversity and allow a child to thrive or even by transformed by adversity. The Deveraux Early Childhood Assessment for Preschoolers, Second Edition (DECA-P2) was used in a pretest and posttest of a sample of 78 children who attended nature preschools, as well as in a baseline group of 14 children who attended a non-nature preschool. Results suggest a significant strengthening of these protective factors over the course of a school year in preschool participants who attended a nature preschool. Implications are discussed in the context of the study's limitations.

Keywords: nature preschool, resilience, initiative, self-regulation, attachment

A recent multidisciplinary review of literature pertaining to the benefits of nature contact for human health and well-being describes these benefits as being of an "extraordinarily broad range" (Frumkin et al., 2017, p. 1). While the authors acknowledge that this range of benefits is grounded in varying levels of evidentiary support, the current level of scientific interest in studying nature contact, coupled with this growing body of evidence, is encouraging. Among the evidence-based benefits included in Frumkin and colleagues' review were reduced stress, anxiety, and depression, as well as greater happiness, well-being, and life satisfaction.

Psychological resilience, which is defined as a positive, adaptive response to stress and adversity (Masten, 2001), has been extensively studied and reported in the mental health and human development literature, but has yet to make a prominent entry into the literature base regarding the benefits of nature on human health and well-being. However, a recent ethnographic study by Chawla et al. (2014) suggests the potential for children to experience reduced stress and develop protective factors associated with resilience through nature contact in green schoolyards. Additionally, concerns regarding the decline of psychological resilience is surfacing in the academic and popular literature, along with concerns regarding increases in children's stress, anxiety, and depression (Gray, 2013; Twenge et al., 2010). Thus, studying the impact of nature contact on psychological resilience is relevant and timely, particularly as so many children face threats to their healthy development on a daily basis and as societal concern regarding the decline of resilience grows (Children's Defense Fund, 2011).

Definitions of Resilience

Resilience has been defined in a number of ways, as well as used in a variety of contexts. In the biological sciences, resilience is described as an ability to make an adjustment in behavior toward adaptability (Hanson & Gottesman, 2012). Resilience in ecological contexts is the capacity of a system to absorb and adapt to unforeseen future events (Holling, 1973). In the engineering sciences, it is the competency of systems to perform in risk or adversity (Hanson & Gottesman, 2012). The study at hand focused on psychological resilience, which is the human capacity to cope with stress and adversity (Masten, 2001). It is commonly described as the ability to bounce back from difficult times. Other definitions include the human capacity to overcome challenging stressors and become competent, confident, and caring individuals (Benard, 2004), or the positive, adaptive response in the face of significant adversity (Luthar, Cicchetti & Becker, 2000). There are several broad categories that appear in the literature on human development: beating the odds (developing well in the context of high cumulative risk for developmental problems); coping (functioning well under currently adverse circumstances or conditions); self-righting (recovery to normal functioning after catastrophic adversity); and transforming (positive reorganization of systems, such that adaptive functioning is better than it was prior to adverse or traumatic experiences) (Masten, 2007).

The Study of Resilience

The science of resilience in human development has evolved over time. In the 1960s and 1970s, the study of psychosocial resilience emerged in the context of children at risk for developmental and psychopathological problems, due to genetic or experiential circumstances. The study of resilience grew to focus on not only the risk factors, but what enabled children to flourish even under adverse circumstances. Two landmark studies, Werner and Smith's (1988) longitudinal study of 600 Hawaiians, and Garmezy and Rutter's (1983) study of 200 children in mainland U.S., suggested that most children have self-righting tendencies, and that competence, confidence, and caring can flourish even within adverse conditions. Thus, the focus shifted from a problem-based deficit model to a strengths-based model, as positive relationships rather than specific risk factors seemed to have a more profound impact on the direction that lives take (Howard, Dryden, & Johnson, 1999). From this shift in focus, characteristics of children, families, relationships, and environments that seemed to correlate with resilience were extensively studied, as were processes that might explain these correlates (Masten, 2007). Additionally, research focused on how to engage or boost protective processes toward promoting competence and wellness (Cicchetti et al., 2000). Currently, the study of resilience has deepened to explore positive adaptation at cellular or neural levels, such as the role of brain plasticity on adaptive functioning and development (Romer & Walker, 2007).

Through these decades of research, the thinking that children who are resilient in the face of adversity are "invulnerable or invincible" has been replaced by the understanding of "the ordinariness of the phenomena" (Masten, 2001, p. 227). When basic human adaptation systems are protected and in good working order, "development is robust even in the face of severe adversity; if these major systems are impaired, then the risk for developmental problems is much greater, particularly if the environmental hazards are prolonged" (Masten, 2001, p. 227). With advances in the ability to study the neurobiology of resilience, it is now recognized that resilience is embedded in complex, adaptive and interacting systems, and that these interacting systems shape the course of development from the molecular to the macro-levels of physical and sociocultural ecologies (Masten, 2014). Thus, resilience perhaps can more accurately be defined as the capacity of a dynamic system to adapt successfully to disturbances that threaten system function, viability, or development (Masten & Cicchetti, 2016).

Promoting Resilience

It is important to note that resilience is not only dynamic, but also contextual and malleable. It is not a "trait" that children do or do not possess. While there are personality dimensions that may be associated with resilience, it is recognized that experiences shape personality traits, which in turn can influence exposure to adversity; similarly, the same trait can "function as a vulnerability or protective influence, depending on the domain of adaptation, the physical or sociocultural value and meaning of the trait, and the age or gender of the individual" (Masten, 2014, p. 14). There are, however, a set of protective mechanisms that have been remarkably consistent in the literature

across time that seem to give rise to successful adaptation in the face of adversity (Benard, 2004). These protective factors include qualities in a person (such as problem-solving abilities, initiative, a sense of self-efficacy, a sense of purpose in life, self-regulation skills, persistence, belief that life has meaning, etc.), as well as contextual and/or environmental factors, such as positive relationships with caring adults, effective parenting, positive friendships, and effective teachers and schools (Wright & Masten, 2005; Masten, et al., 2008). These protective factors lend insight into how resilience can be promoted.

In light of the dynamic and contextual nature of resilience, Masten (2014) describes a model of resilience that is useful toward thinking about how to promote resilience. According to this model, adaptive success is influenced by threats/risks and protections/assets. Thus, strategies for promoting resilience can be risk-focused (preventing or reducing exposure to risks or adversity) or asset-focused (increasing assets or access to protective resources within or external to the child). Strategies could also be process-focused, with efforts to restore or harness the power of human adaptive systems. Examples include fostering secure attachment relationships, promoting bonds with competent and caring adults, protecting and nurturing brain development, and supporting the development of positive peer friendships (Masten & Reed, 2002; Masten, 2014). A review of outcome studies of strengths-based resilience intervention programs (Brownlee et al., 2013) yielded the following themes that further guide efforts to promote resiliency in children and adults: personal competency, coping strategies, social competency, pro-social involvement, and cultural identity.

Promoting Resilience through Nature Contact

The effect of nature on the mental well-being of children has been well-documented and continues to grow. Benefits include restorative effects from stress and an improved sense of well-being, as well as more positive emotions (Wells & Rollings, 2012). However, "for the most part, the literature on coping and resilience has failed to reflect the importance of positive human connections with the natural world" (Chawla, et al., 2014, p. 2). Consequently, Chawla et al. (2014) sought to investigate the influence of green schoolyards on reducing children's stress and promoting protective factors associated with resilience. Their qualitative findings suggest that not only did children experience peace, calm, and relaxation in their green schoolyards and gardens, but they also experienced opportunities to feel competent and opportunities for the development of supportive social relationships, which are important protective factors for resilience (Chawla, et al., 2014).

Beyond this study by Chawla et al. (2014), there are several other studies that further suggest the potential for nature experiences to support the development of resilience. A 2015 study by Buchecker and Degenhardt, similarly prompted by gaps in the literature, reports on the potential for nearby nature to positively influence individuals' emotional well-being and resilience. Their survey research found that regular outdoor recreation significantly, but marginally, increased urban adults' psychological resilience. While easy access to recreation areas affords regular outdoor recreation participation, their study suggests that other parameters are also important, including satisfaction with the recreation area, as well as the quality of the recreation experience. Findings from a study by Ritchie et al. (2014) suggest the positive impact of a 10-day outdoor adventure leadership experience on the resilience and well-being of First Nations adolescents in Canada, as measured through a 14-item resilience scale.

McArdle, Harrison and Harrison (2013) investigated the effect of the "Nature Nurture" project in Aberdeen, Scotland on the well-being and resilience of four- and five-year old children. This project intentionally used outdoor free play and nurturing relationships toward supporting resilience in children who have had disruptions in attachment relationships during their first three years of life. The qualitative data from their ethnographic study were analyzed using the PERIK (Positive Entwicklung und Resilienz im Kindergartenalltag) model, which is designed for observing and assessing child well-being. The results of their ethnographic study suggest all six dimensions of well-being, including confidence in the face of new challenges, self-control, empathy, motivation, focus, and perseverance, were enhanced through the combination of the nurturing approach and natural environment.

Collectively, these studies suggest the potential of time and experiences in nature to contribute to fostering the strengths and protective factors that children can draw upon in the face of adversity. Further study of the potential of nature experiences to support factors associated with resilience, however, is needed, as are studies focusing

specifically on young children. While resilience can be developed and demonstrated at every age, there are certain windows of opportunity, for example, in early childhood when brain plasticity is surging, where fostering the development of protective factors and harnessing the power of protective systems are especially key (Masten, 2008). Likewise, competence begets competence in the context of resilience, and thus investing early is recommended (Masten, 2008), and there is a documented high return on investment in early child development documented by Heckman (2006). Consequently, the study at hand sought to explore the potential of nature preschools to support the development of protective factors in young children.

METHODOLOGY

Research Purpose

The purpose of this exploratory study was to investigate the influence of nature preschool participation on young children's protective factors (initiative, self-regulation, and attachment) that are associated with resilience. Specifically, the following research question guided this exploratory study: Was there significant growth in nature preschooler's protective factors from the beginning to the end of their preschool year?

Participants

Participants in this study included 78 three- to five-year olds who attended four nature preschools in Minnesota. The average age of these participants was four years old, and 50% were male and 50% were female. Data on race and ethnicity were not collected, due to the homogenous nature of the participants in the nature preschools in this region, and also due to the lack of evidence suggesting variability in protective factors by race or ethnicity (LeBuffe & Naglieri, 2012). In addition, there were 14 participants from a non-nature preschool in the same geographic region who participated in the study, forming a baseline group from which comparisons could be made toward interpreting practical significance of the statistical data. These children were of an average age of four, and 64% were male and 36% were female. All enrolled preschool children at this non-nature preschool, as well as the four nature preschools, were invited to participate, and all but three received parental consent for participation. At the nature preschools, this high parent consent rate was likely due to parents recognizing that the nature preschool movement is relatively new in this region, and that research is needed to support this approach to preschool. The high rate of participation at the non-nature preschool was likely due to it being located at and administered by a university, and thus parents are used to the program being used as a research study site.

Design

This exploratory study used a pre-experimental pretest-posttest design. Initially, the intention was to use a quasi-experimental design (a pretest-posttest nonequivalent control group design), as a true experimental design was not possible due to the intact nature of groups and lack of ability for random assignment. However, there was difficulty finding non-nature preschools who were willing to participate in the study as the control group, due to concerns about further "testing" their children and because of the perceived time intensive nature of the research instrument for both parents and teachers.

Consequently, the one university-administered, non-nature preschool who did grant permission served as a baseline from which general comparisons could be made, toward helping interpret the findings from nature preschools and understanding if any statistically significant growth was also practically significant (meaningful). It was not considered a true control group, due to lack of nonrandom assignment, nor was it treated as a nonequivalent control group due to the small sample size (14 children v. the 78 children from the nature preschools). Instead, it provided a reference for understanding growth in protective factors in the nature preschool children, showing how children in a non-nature preschool classroom might be expected to grow in protective factors over the course of the school year in high quality preschool programming under the care of a consistent, experienced teacher.

Treatment

The treatment for this study was participation at a nature preschool during the 2016-2017 school year. A nature preschool is one that "puts nature at the heart of its program," is based on high-quality early childhood education *and* environmental education practices, and helps lay a foundation for environmental literacy (North American Association for Environmental Education, 2013).   The Natural Start Alliance offers the following three defining criteria: 1) Nature is the central thread that weaves together the preschool's philosophy, methodologies, class-room design, outdoor spaces, and public identity; 2) High-quality early childhood education and environmental education practices ground and guide the program; and 3) The natural world is used to support goals that address both holistic child development and conservation values (North American Association for Environmental Education, 2013).

The four nature preschools in the study met these defining criteria and worked together under an informal collaborative of nature preschools in the same geographic region. They met monthly to share ideas, problem-solve, and provide assistance to other providers who were wanting to incorporate nature play into their preschool programs or start nature preschools of their own. One of the nature preschools was affiliated with a nature center, two were operated out of homes and licensed as family childcare providers, and one operated out of a church under a specialized family childcare license. All four utilized a combination of unmaintained natural settings, natural spaces that were minimally managed for nature play, and natural playscapes designed specifically for nature play. Each had indoor areas that were used minimally throughout the day. A child-directed approach was used at all four of these nature preschools, with the majority of time spent outdoors in free play or guided play outdoors in unmaintained or minimally maintained natural settings. At each of these four nature preschools, there was a caring, responsive lead teacher who had been at that particular nature preschool since its inception, serving not only as the lead teacher, but also the founder and director.

The university-administered, non-nature preschool also had experienced and stable teachers, with a caregiving style that similarly could be described as caring and responsive. This non-nature preschool was connected to the university's early childhood education department and rooted in developmentally-appropriate practices. Their guiding philosophy emphasized child-directed play for supporting cognitive, social, emotional, and physical development. The majority of time in this non-nature preschool was spent inside, with children playing outside for 30-60 minutes daily in a fenced in playground area, with smaller sized, plastic play structures. The cost for attending this non-nature preschool was similar to the costs associated with the nature preschools, and therefore it was assumed that participants across the nature and non-nature preschools were relatively similar in terms of economic background, as well as similar in terms of age, gender, race, and ethnicity. Thus, participants across the preschools shared similar demographic characteristics and experienced a child-centered, play-based, developmentally-appropriate preschool program that aimed to support holistic development across the domains. These shared characteristics allowed for exploring the potential influence of sustained nature play experiences on the development of resilience, beyond what one might expect to see from a high quality, play-based non-nature preschool program.

Instrument

The instrument used in this study was the Devereux Early Childhood Assessment for Preschoolers, Second Edition (DECA-P2) (LeBuffe & Naglieri, 2012). This instrument is a standardized, norm-referenced behavior rating scale that is used to assess within-child protective factors related to resilience. The instrument is completed by parents and teachers/caregivers and evaluates the frequency of 27 positive behaviors (strengths). These 27 items form subscales that assess three within-child protective factors of initiative, self-regulation, and attachment. The *initiative* subscale contains items measuring a child's ability to "use independent thought and action to meet his or her needs; children who score high are often engaged learners who will start or organize activities with other children, are good at solving problems, are responsible, show self-awareness, and enjoy challenges" (LeBuffe & Naglieri, 2012, p 92). The *self-regulation* subscale assesses "the child's ability to express emotions and manage behavior in healthy ways; children who receive high ratings on this scale are generally able to handle frustration and negative emotions without exhibiting challenging behaviors, are often patient and cooperative, and are respectful and considerate of

others" (LeBuffe & Naglieri, 2012, p. 92). The *attachment/relationships* scale assesses "the child's ability to promote and maintain mutual, positive connections with other children and significant adults; children who receive high scores on the attachment/relationship scale actively seek out adults and other children, are effective in gaining positive attention, and tend to be affectionate, trusting, optimistic, and often have a happy disposition" (LeBuffe & Naglieri, 2012).

The scores from these three subscales are combined to form a "total protective factor" score, which provides an overall indication of the child's social and emotional strengths relating to resilience, and is "the most reliable and valid overall indicator of strengths related to resilience." (LeBuffe & Naglieri, 2012, p. 92). It is the score recommended by the instrument developers for outcome measurement and program evaluation; however, because a child can have differing ratings within the subscales (for example, rate "typical" on the total protective factor yet have "an area of need" rating on one of the subscales, it is useful to consider this overall "total protective factor" score alongside the scores from the three subscales. The reported internal reliability coefficient for the overall scale is .92 for parent raters, and .95 for teacher raters (LeBuffe & Naglieri, 2012). For the initiative subscale, the reported internal reliability coefficient was .88 for parents and .92 for teachers, and for self-regulation, .90 and .94 respectively. The attachment/relationships subscale was slightly lower, .79 and .85 respectively, but still at level for sufficient use. Construct validity and criterion validity was established during the test development through literature reviews, focus groups with professionals, and comparisons with performance measures (see LeBuffe & Naglieri, 2012 for details).

LeBuffe and Naglieri (2012) report only minor variability across the 3- through 5-year old age range, "indicating an absence of age trends" in this age range, and thus norms are provided in the testing manual for these ages combined. Due to small differences in gender, particularly in the self-regulation subscale for teacher raters where girls tend to show more behaviors related to self-regulation than boys, raw-score-to-T-score norm-conversion tables are provided for boys and girls. However, only the self-regulation subscale for teacher raters shows a difference that is significant (with a moderate effect size), suggesting the need to take into consideration gender in analyses regarding self-regulation with data from teacher raters.

Data Collection and Scoring Procedures

Prior to administration of the pretest, IRB approval was obtained and consent forms were given to guardians of children at the participating preschools. For children for whom consent was granted, parents were asked to complete the DECA during the first week of the preschool year (early September 2016). Teachers also were asked to complete the DECA for each of the children. However, as guided by the DECA User's Guide and Technical Manual (LeBuffe & Naglieri, 2012), the teachers were asked to complete the DECA four weeks after the preschool year began (early October), to allow them time for getting to know the children and observe them over a period of time prior to rating them on the set of DECA items. Parents and teachers were asked to complete the same DECA instrument near the end of the preschool year (late April 2017).

The DECA rating forms were scored following scoring procedures in DECA User's Guide and Technical Manual (LeBuffe & Nagliei, 2012). Using tables provided in the testing manual, the raw scores for the overall total protective factors as well as the three subscales were converted to standard scores (T-scores) with a mean of 50 and standard deviation of 10. In addition, the manual also contains T-score range descriptions that can aid in interpreting the scores, where T-scores are classified as "strength" (total protective factor T-score of 60-72), "typical" (total protective factor T-score of 41-59), and "area of need" (total protective factor T-score of 28-40). As directed by the manual, the T-scores are to be used in pretest-posttest comparisons at the child- and/or program-levels. Differences in children's scores from across parent to teacher rater are not considered problematic, but instead reflective of how children's behavior can differ across home and school settings, as well as differ under the presence of different adults and circumstances.

RESULTS

Descriptive statistics for the data are reported in Table 1. To investigate if children's resilience significantly increased

from beginning to end of the nature preschool year, repeated measures ANOVA were run for the total protective factors overall scale and for the three subcales of initiative, self-regulation, and attachment/relationships for the data from the teachers and from the parents. Age was not a covariate, per LeBuffe and Naglieri (2012) indicating there is only minor variability due to age across the 3- through 5-year-old age range. Nor was ethnicity or race a covariate in the analyses, due to the lack of variance within the study participants. Also per LeBuffe and Naglieri (2012), gender was a covariate in the analysis of data from teacher raters on the self-regulation subscale, due the significant difference between boys and girls found in the normed data. To control for an inflated Type I error from running multiple inferential tests within the same data set, Bonferroni procedures guided the significance rate of alpha = .01.

Table 1
Pretest and Posttest Means and Standard Deviations for Nature Preschool Participants

	Teacher Rating		Parent Rating	
	Pretest Mean (SD)	Posttest Mean (SD)	Pretest Mean (SD)	Posttest Mean (SD)
Total Protective Factors	54.54 (5.95)	57.71 (7.87)*	50.21 (7.62)	53.13 (8.81)*
Initiative	52.74 (7.98)	56.93 (8.55)*	49.84 (8.45)	53.63 (8.17)*
Self -Regulation	54.49 (6.00)	56.78 (8.05)*	49.31 (7.98)	53.34 (9.34)*
Attachment	55.26 (6.91)	57.21 (7.45)	51.64 (7.24)	51.39 (9.93)

Note. *indicates significant growth from pre to posttest, p = .01.

For data from the teacher raters, there was significant growth pretest to posttest in the total protective factors scores, $F(1, 76) = 16.32$, $p < .001$. Additionally, there was significant growth for the subcales of initiative ($F(1,76) = 32.48$, $p < .001$) and self-regulation ($F(1,76) = 10.65$, $p = .002$). There was not significant growth in attachment when using the Bonferroni-adjusted p value of .01, $F(1,76) = 5.28$, $p = .02$. These results suggest that children in the nature preschool had positive development in their overall social and emotional strengths related to resilience displayed in the school setting, as well as specifically in initiative and self-regulation.

Regarding the data from parent ratings, there was significant growth pretest to posttest in the total protective factors scores, $F(1, 76) = 7.13$, $p = .009$. Additionally, there was significant growth for the subcales of initiative ($F(1,76) = 13.58$, $p < .001$) and self-regulation ($F(1,76) = 10.34$, $p = .002$). There was not significant growth for the subscale of attachment ($F(1,76) = .08$, $p = .78$). These results suggest that children in the nature preschool had positive development in their overall social and emotional strengths related to resilience displayed in the home setting, as well as specifically in initiative and self-regulation.

To guide interpretation of these results toward determining practical significance (meaningfulness), the same set of analyses were run on the data from the baseline group of the students in the non-nature preschool. Descriptive statistics are presented in Table 2.

Table 2
Pretest and Posttest Means and Standard Deviations for Non-Nature Preschool Participants (Baseline Group)

	Teacher Rating		Parent Rating	
	Pretest Mean (SD)	Posttest Mean (SD)	Pretest Mean (SD)	Posttest Mean (SD)
Total Protective Factors	58.78 (6.48)	63.63 (3.75)	54.14 (4.07)	55.27 (6.02)
Initiative	57.93 (7.98)	66.36 (5.62)*	53.21 (6.19)	50.27 (8.60)
Self -Regulation	66.36 (5.63)	61.27 (5.08)	51.71 (4.50)	52.27 (9.12)
Attachment	61.27 (5.08)	60.18 (5.09)	54.57 (7.54)	54.91 (7.26)

Note. *indicates significant growth from pre to posttest, p = .01.

The results from the students in the non-nature preschool indicate significant growth in initiative from the data from the teacher ratings, $F(1,10) = 30.63$, $p < .001$. The results of the other analyses did not show statistical significance at the significance level of p = .01: total protective factors teacher rating, $F(1, 10) = 6.88$, p = .03; self-regulation teacher rating, $F(1,10) = 3.24$, p = .11; attachment teacher rating, $F(1,10) = 2.34$, p = .16; total protective factors parent rating, $F(1,10) = 1.00$, p = .34; initiative parent rating, $F(1,10) = .53$, p = .48; self-regulation parent rating, $F(1,10) = .39$, p = .54; attachment parent rating, $F(1,10) = .16$, p = .70. These results suggest that children in non-nature preschools displayed significant growth in initiative in the school setting from beginning to end of the year, but not in the other areas measured.

Thus, when used to provide a sense of what might be expected through a quality preschool experience without the nature aspect, these results suggest children's initiative may grow over the course of a school year in a quality preschool. Therefore, the statistically significant growth in the nature preschoolers' total protective factors overall and self-regulation displayed in the school setting, and the significant growth in the total protective factors overall, initiative, and self-regulation displayed in the home setting, can be considered practically significant, and potentially a function of the nature aspect of the preschool, as similar significant growth was not seen in the baseline group participating in a quality, but non-nature based, preschool. Because a significant increase in initiative was also seen in school setting for the children in the non-nature preschool, the significant growth in initiative in the nature preschool children could be considered less significant from a practical standpoint (as participation in either type of preschool seems to be associated with an increase in initiative displayed in the school setting).

To further aid in interpreting these results, independent samples T tests were used to compare pretest means in the nature and non-nature preschool children. To account for an inflated Type I error rate from the multiple analyses, the significance level was set at .01. Due to unequal group sizes, equal variances were not assumed. The purpose of these analyses was to explore if either group entered into the preschool year with higher levels on any of the scales. For example, it seems that parents who choose nature preschools might also have a disposition toward other forms of nature engagement, beyond that which happens at the nature preschool. Accordingly, then it would be more difficult to attribute growth in any of these protective factors to the nature preschool, but potentially instead explained by a combination of nature-related experiences within and external to what happens in the nature preschool, or by other experiences in the out-of-preschool time. However, the results of the analyses suggest that the only significant difference in pretest scores was for total protective factors for the parent rating, with children in the non-nature preschool starting significantly higher than children in the nature preschool (Mean Difference = 3.93, $t(32.83) = 2.82$, p = .008). This suggests it is less likely for the significant growth in protective factors seen in the nature preschool participants to be attributed to parental or out-of-school experiences, as if that were the case, children in the nature preschool would likely have started the preschool year with significantly higher scores then the children in the non-nature preschool. Thus, this again adds to the practical significance of these findings overall, with significant growth in protective factors in the nature preschool children that is not observed in the non-nature preschool children, and unlikely to be due (or at least not solely due to) parents' provision of additional nature experiences during out of school time.

DISCUSSION

It is important to consider these findings in the context of the study's limitation. The pre-experimental design limits the internal validity of the study, making it difficult to attribute the significant growth in protective factors to participation in nature preschools. However, this limitation was somewhat addressed through the use of a baseline comparison group, and also through analyses of pretest scores. However, the small sample size of this baseline comparison group suggests cautious interpretation and generalization, as this small sample may have negatively influenced the power of the analyses to detect significant differences.

The results of this study suggest the potential for nature preschools to have a positive influence on children's overall social and emotional strengths related to resilience in both the school and home setting, as well as in self-regulation and initiative in both the home and school settings. This significant growth is not explained by cognitive maturation,

due to the stability of these factors across the three-five year old age range. Further, this growth is different from what was seen in a non-nature, quality preschool that focused on holistic child development through a play-based approach. While there was significant growth in initiative in the non-nature preschool setting, suggesting initiative might grow in a variety of high quality, nature- or non-nature-based preschool settings, significant growth wasn't observed in any other of the protective factors in children attending the non-nature preschool. Similar to findings from the green schoolyards study (Chawla et al., 2014) and the "Nature Nurture" early childhood program (McArdle, Harrison, & Harrison, 2013), these results suggest there likely may be something to the "nature" focus and setting inherent in the nature preschool approach.

Chawla et al. (2014) noted younger elementary school students expressed value in the free movement and free choice during recess in their green schoolyard. They speculate that the "freedom of choice, a great variety of objects for discovery, and loose parts that children could use imaginatively" enabled children to select roles and activities in which they felt comfortable and competent (Chawla et al., 2014, p. 11). They further speculate that this cooperative, imaginative play afforded by the free play, nature environment supported feelings of effectance (seeing they can have a visible impact on their environment) and a sense of efficacy (feelings of mastery and self-esteem that develop through repeated experiences of successfully meeting challenges). For example, they note the example of children guiding their own graduated levels of competency, setting increasingly challenging goals, "such as heavier rocks to lift or more complex techniques for fort construction" (Chawla et al., 2014, p. 11). They also comment on the supportive peer relationships facilitated through children's freedom to choose from a variety of potential activities that afforded cooperative activities and gave them control over social interactions and roles (Chawla et al., 2014). McArdle, Harrison, and Harrison (2013), in their study of the "Nature Nurture" early childhood program, suggest the natural environment provided children with new challenges and appropriate risks, promoted positive self-esteem, persistence and concentration, and contributed to increased calm and relaxation. In the study at hand, similar reasonings could be applied as to the child-initiated, nature play approach affording diverse and expansive opportunities for young children to take appropriate risks, set their own goals, problem-solve, and choose roles and activities that produce feelings of comfort and competence and support positive peer relationships. While child-initiated play in an indoor setting or on a playground might allow for some of this, it seems possible that the opportunities for these experiences are even greater in nature, as the boundaries and variety and holistic challenges are likely to be more extensive.

Children in the nature preschools demonstrated growth in initiative at school and at home; this is the ability to use independent thought and action to meet his or her needs. Children who have high levels of initiative are often engaged learners who will start or organize activities with other children, are good at solving problems, are responsible, show self-awareness, and enjoy challenges (LeBuffe & Naglieri, 2012). While the natural setting was likely conducive to the type of play that can build initiative, also important may have been the style of interactions between the nature preschool teachers and the children. For example, at the nature preschools in this study, children are allowed to play at greater distances from the teacher, sometimes within sight, and other times beyond sight but within established boundaries. At one of the nature preschools studied, children can play at even greater distances from the teacher, through carrying "walkie talkies" in a backpack and being within the reach of the teacher by sound if necessary, not by sight. Thus, interactions with teachers change, and children rely more on themselves and their peers for coming up with ideas regarding what to play, solving problems that arise, assisting each other during challenging activities, and taking care of their own needs rather than relying on their teachers for things they can do themselves. This might be why this growth in initiative seen in the nature preschool children was also observed in the home settings, in contrast with children in the non-nature preschool, where there was growth in the preschool setting but not observed at home. Psychologist Peter Gray, in his book *Free to Learn* (2013), speculates similarly, suggesting that the rise in anxiety and decline is resilience corresponds with a dramatic decline in children's opportunities to play, explore, and pursue their own interests away from adults. He advocates for children having the opportunity to learn to solve their own problems, get into trouble and find their way out, and experience failure and realize they can survive it, all of which can happen in free play in nature.

Children also grew in self-regulation through their experiences in the nature preschools. Self-regulation is the ability to express emotions and manage behavior in healthy ways. Children with high levels of self-regulation are "generally able to handle frustration and negative emotions without exhibiting challenging behaviors, are often patient and

cooperative, and are respectful and considerate of others" (LeBuffe & Naglieri, 2012, p. 92). In a parent guide for building resilience in young children, parents are encouraged to help their children develop self-control and build self-regulation though "encouraging children to keep on trying even when it is hard or frustrating" (Health Nexus Sante, n.d.). Child-initiated free play again might afford opportunities for building self-regulation, as it might be easier for children to persist in a challenging situation when what they are doing is directed toward their goals and intrinsically motivated, rather than their teachers' goals.   In a London study of 4- and 5-year olds, children were significantly more likely to demonstrate self-regulation in child-initiated activity; in adult-initiated activities children, appeared to cede control to adults (Robson, 2015). Peter Gray also asserts how playing with other children, away from adults, is how children learn to control their own emotions and impulses, negotiate differences with others, and learn to make their own decisions (2013). Thus, it may be the degree of child-initiated play, rather than specifically nature, is the operative variable, in the case of self-regulation, although nature seems to offer great opportunities and even arguably more opportunities for this type of play than indoor or maintained outdoor environments.

However, as noted prior, caution in making claims regarding impact is necessary, as is speculating why, due to the pre-experimental design of the study and the small sample size of the non-nature preschool group. Consequently, further research is needed to more definitively state nature preschools have a positive influence on children's protective factors relating to resilience. It would be important for future research to utilize large sampler sizes and also ideally a randomized control group (or at least a non-equivalent control group of a similar size and demographic characteristics).

A second important direction for further research would be toward understanding what about the nature preschool experience is influential in achieving these positive outcomes relating to resilience. Rickinson, Hall, & Reid (2015) raise concerns regarding the research literature in EE being swayed toward studies of program impact, with limited investigation into program influence (how and why programs work). They suggest moving beyond questions of "What works?" to questions of "What is it about this programme that works for whom in what circumstances" (Rickinson, Hall, & Reid, 2015, p. 2). Similarly, in their review of outcome studies of strengths-based resilience programs, Brownlee et al. (2013) also point to the need to better understand what about the programs are associated with the impacts, as this would lead to improvements in interventions. Results of this study suggest participation in the nature preschool seems to have increased protective factors, but the pathway of nature and other likely mediators, such as the role of the teacher, risk, amount of time in play and play in nature, degree of play (free v. guided), degree of "wild" v. smaller-scale nature, etc., was not directly studied.

Thus, while more research is needed, these results are encouraging. As Joan Almon notes, "As with so many aspects of healthy development, children have an innate capacity to be resilient" (2015, p. 5). It appears from this study, nature preschools are helping bring that capacity to fruition, surrounding children "with love and warmth that does not smother them but gives them a strong foundation for meeting life's obstacles" and cultivating a "love of nature and a trust in its cycles of death and rebirth" (Almon, 2015, p. 5). Through strengthening children's internal protective factors, and through supportive contexts and relationships, children will have the capacity to function well in spite of adversity. Not only will this serve them well, but the benefits extend into the communities in which they live, and the ecosystems on which life depends (Chawla, et al., 2014; Tidball & Krasny, 2014).

Acknowledgements

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Using Picture Books to Enhance Ecoliteracy of First-Grade Students

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ABSTRACT

Picture books have the potential to engage students in multimodal ways of learning in early education setting. This pilot study aims to investigate the efficacy of using picture books specifically written to convey increasingly complex ecosystem concepts and their influence on introducing ecoliteracy to first-grade students. Under the central theme of "ecoliteracy" the books introducing four sub-themes (nature, cycles in nature, biodiversity in the rain forest, introducing the phenomenon of bioluminescence) were presented at two-week intervals. The picture books were read aloud and followed by student responses to the text in writing. The questions examined in this pilot study are: What ecoliteracy competencies are highlighted in student responses? How do students demonstrate learning using ecoliteracy-rich books? The texts produced by students were analyzed to understand how students represented ecoliteracy concepts with respect to ecoliteracy domains. Student responses predominantly fell into the cognitive domain as opposed to emotional domain. These responses demonstrated how students extended learning by applying the knowledge to events in daily life, and a willingness to play with concepts. Elaborated in the discussion are the need for matching books with appropriate curriculum to meet the ecoliteracy goals, the significance of producing texts by young readers, and constraints for developing ecoliteracy.

Keywords: ecoliteracy, domains, picture books, cognition, student text

Ecoliteracy is linked to human survival and the planetary well-being (OECD, 2009). Ecoliteracy is the ability to "read" the environment and "act" with the goal of being sustainable with all our needs. This literacy reaches a critical level when we understand the limited resources that we rely on for our comforts. Rivers, fed by snow or glaciers, provide us with transportation, hydroelectricity, and food. We power our gadgets using electricity that may be produced by water, nuclear power, or coal. We fuel our cars and warm our homes, with natural gas and petroleum that is mined from the Earth. Thus, we rely on the limited supply of natural resources to meet many of our basic needs. Due to overuse, we are in danger of depleting critical resources such as petroleum and gas as the Earth is past the peak production capacity of those resources (Wood, 2004). All major rivers in the world are contaminated by pollution and many rivers do not reach the sea due to diversion of water for human consumption (Maybeck, 2013). Deforestation or the removal of forest cover is happening at a rapid pace to meet the needs of the consumers for products such as food, paper and wood. (Hansen et al., 2013). Ecoliteracy is therefore considered to be a critical knowledge and mindset to ensure planetary and human survival. Thus, ecoliteracy should be introduced to students at a young age to build awareness of our limited resources and to encourage thoughtful consideration of planetary health and well-being (Cutter-Mackenzie & Edwards, 2014). This pilot study examines the potential of initiating ecoliteracy study with young children, first-grade students, using familiar tools such as picture books.

Ecoliteracy and Its Significance

The concept of ecoliteracy, first coined by Capra (1997) in his book *The web of life*, suggests that the principles of ecology are applicable to the organization of all living systems. The discourse on ecoliteracy gradually came to include many prominent thinkers across the Humanities (e.g., Capra, 2002; Cutter-Mackenzie & Smith, 2003; Orr,

1992; Wooltorton, 2006) and developed in focus toward the creation of sustainable human communities and society. The Center for Ecoliteracy (2013) was created as a result and distinguished competencies in ecoliteracy that would align people toward ecoliteracy and embracing sustainable behaviors. These competencies fall within four domains.

Domain #1: Head/ Cognitive: the ability to analyze, assess, think critically, and envision long-term impacts of a behavior's impact on the environment.

Domain #2: Heart/ Emotional: concern, love, respect, and empathy for all beings.

Domain #3: Hands/ Action: creativity and making of tools, adjustment in energy, and actions that promote sustainability.

Domain #4: Spirit/ Connection: experiencing wonder and awe toward the natural world.

These four domains are of limited impact to the environment if they are not applied across a range of situations or skill sets within the population at large. As such, Goleman, Bennett, and Barlow (2012) provided a scaffolded series of fifteen core competencies that aligned to these domains of ecoliteracy and demonstrate how a broad range of responses can have an impact. These essential competencies are grouped within the four major domains listed above (Center for Ecoliteracy 2013).

In the context of this study, the competency in Domain #1 refers to a person's understanding of the fundamental ecological principles such as nature, interdependence, species, and ecosystems. Domain #2 refers to the competencies that impel a person to feel concern, empathy, and respect for living things and other people. Domain #3 refers to the skills and competencies that support ecoliteracy and include the ability to create and use tools, objects, and procedures that effectively lead to sustainable communities. Finally, Domain #4 refers to the spiritual competency that enables one to experience wonder and awe towards nature and implies feeling inspired just by the sight of nature.

McBride, Brewer, Berkowitz, and Borrie (2013) note that the last competency, the Spirit/Connection domain, sets ecoliteracy apart from ecological literacy and environmental literacy. Thus, the end goals of each of these fields are slightly different and it is important to recognize the foundations for each of these fields. A person with a mature ecoliteracy competency has well-rounded abilities of the head, heart, hands, and spirit and can serve as an effective member of a sustainable society because such a person understands the interconnections in nature. Ecoliteracy, one could conclude, is a more holistic response to the environment.

Recent studies show that environmental education can be increased in the early childhood years introduce more ecoliteracy-related content into the classroom (Elliot & Davis, 2009; Pilgrim, Smith, & Pretty, 2007; Torquati, Culter, Gilkerson, & Sarver, 2013). While nature play has been advocated as a method for introducing ecoliteracy to young children (Moonstone, 2016) some experts are critical of this being emphasized as an alternative for early childhood ecoliteracy education. They suggest it reinforces the notion that children are incapable of understanding sustainability issues (Elliott & Young, 2016). In their article detailing the resistance to ecoliteracy education, Elliott and Davis (2009) note that early childhood environmental education experiences were overly focused on nature play to the detriment of sustainability education, even though sustainability education can be provided in an age appropriate manner.

Sustainability education can teach children how resources can be sustainable and provide them an awareness of how natural resource are used in their daily lives. Sustainability is a complex, interconnected issue, deemed a 'wicked problem' (Frame, 2008). Stated simply, the goal of various kinds of environmental literacy is to enable citizens of all ages to become aware of the finite nature of their resources. Capra (1997) and Wilson (1984) emphasize that human life and survival are deeply intertwined with the natural world. Because our natural resources are finite, citizens— even young ones—benefit from being critical and careful about the kinds of resources they use and exhaust.

In the context of this study and in consideration of how to address sustainability in a way that would be appropriate for the study population, students in this study were expected to gain two fundamental understandings: the first was to recognize that nature is the source for many of the resources they use on a regular basis; and the second was to know that there are many processes and phenomenon in the natural world that surrounds them.

Interestingly, educating young children in sustainability offers some useful examples of ways that early interventions can provide real-life experiences in practicing sustainable options. In constructing the pilot randomized trial, teachers and researchers took advantage of the "funds of knowledge" of the students and the preference of many young children for fast food. The team built twenty-four learning modules that summarized the flow of resources required in assembling fast-food (Edwards et al., 2016). The study resulted in high engagement from the children. Researchers anticipate that this successful engagement and the children's experiences with the research could have the benefit of facilitating obesity prevention, developing a stronger connection with sustainability, and influencing their everyday choices and practices.

Use of Picture Books as Mentor Texts

There are significant advantages in using picture books as mentor texts for children in early elementary education. The juxtaposition of pictures and words engage and challenge young learners to acquire knowledge in multiple ways. Studies show that using picture books in early childhood can stimulate cognitive development (Debby, 2007; Tien & Wu, 2010). Based on strong ties between cognitive development and the use of picture books, as reported by researchers, Kümmerling-Meibauer and Meibauer (2013) suggest a cognitive theory of picture books. Picture books serve as a perfect tool for both learning and cognitive engagement in young children (Cleveland, 2015). Use of picture books has also been linked with enhanced language development. Debby (2007) noted that thinking and speaking about the pictures and then expressing opinions or emotions about them improved language acquisition. Picture books have also been used successfully for interventions that encourage language development in children. For instance, language development in children from low-income backgrounds greatly improved when they were provided picture book reading intervention sessions (Kim, Lee, & Pae, 2013). Several studies report the successful use of picture books for providing environmental education. Hsiao & Shih (2016) used eight picture books to instruct environmental concepts, especially the problems and the overuse of resources resulting from human activities. As an outcome of the project, children learned to conserve resources by bringing their handkerchiefs to school to replace disposable tissues, using less water while washing their hands and brushing their teeth, and reducing the amount of drawing paper they used for doodling. While their use of plastic bags did not change, the students in this study responded overall by undertaking several important pro-environmental actions. Wordless picture books also promote a special and symbolic relationship between humans and nature (Ramos & Ramos, 2011).

Young children tend to have a positive attitude towards nature and science (Osborne, Simon, & Collins, 2003). Thus, there are more picture books about nature and animals for young children than books about either engineering or technology (Cleveland, 2015). This positive attitude can be leveraged with the use of picture books to tutor critical thinking skills at an early age (Roche, 2014).

Producing Text Output

Child development experts agree that though there are no fixed developmental patterns, oral skills (listening and speaking) mature before written skills (reading and writing skills) (Piaget, 2013; Vygotsky, 1978). Thus, many children with poor or delayed oral language or with a reduced vocabulary may write using fewer words and simpler, shorter sentences. Alternatively, this could also mean that their ideas are simpler and less precise. A recent study (Hooper, Roberts, Nelson, Zeisel, & Kasambira-Fannin, 2010) concluded that the output of oral language frequency was tied to student writing skills. Similarly, children's reading skills have also been linked to their potential writing skills (Abbott & Berninger, 1993; Berninger, 1994). Researchers have reported connections between reading and writing (Abbott, Berninger, & Fayor, 2010) and significant correlations between reading-related and writing-related skills (Berninger, 2000). Children who were poor readers also tended to be poor writers (Chall & Jacobs, 1983; Juel, 1988). Writing is a high cognitive activity involving various skills. Based on these findings, the current study sought student responses in writing to enable students to respond at whatever skill level they had achieved.

Purpose of the Present Study

The purpose of the present pilot study was to examine the effect of specially constructed picture books in conveying increasingly sophisticated ideas that introduce ecoliteracy to young children and, thereby, to determine the way the connections across ecoliteracy domains are built when children assimilate information about nature. There is scant research examining the efficacy of picture books in developing ecoliteracy to young children. So this study addresses the gaps in current research by examining understandings of ecoliteracy in children and determining how picture books support children's attainment of ecoliteracy through the composition of a short text in response to a prompt.

The central questions explored in this paper are: What are the ecoliteracy competencies of the students for each of the four books presented? How do students show a broad representation of the ecoliteracy domains in their responses? In what ways do students demonstrate learning about ecoliteracy using specially constructed books?

METHODS

Creation of Mentor Texts

The author of this study created four original mentor texts (Table 1) written in traditional picture book format for the purposes of this study. They were subsequently illustrated using color photographs. The books presented increasingly complex topics in ecoliteracy at a level appropriate to first grade students. In recent years, research has shown that picture books are an effective medium for this age group because pictures evoke a broader category of responses than books with text alone (Ware, Gelman & Kleinberg, 2013) and because they engage the readers cognitively in making connections between text and images (Kummerling-Meibauer & Meibauer, 2013). These texts were constructed specifically for this study to avoid any artifact introduced by previous familiarity with the book. In a classroom with diverse students, this is an important consideration. Students who have the background, knowledge, and experience with a familiar mentor book might produce detailed and thorough feedback, while students with no familiarity could be synthesizing and grasping it. Research by Horst, Parsons and Bryan (2011) and Horst (2013) showed that repeated reading enables young readers to develop accurate and immediate recall as well as retain the details of the story longer term. Unfamiliar mentor texts minimized the familiarity bias in the study and gave all participants an opportunity to produce unique responses.

Vivid, dynamic, and closeup photographs were used to illustrate the words and themes of the topic presented. Where the pictures provided the students a sense of the place or visual experience of the topic presented, the words explained the concept directly. Photographs take readers closer to the object or place. They also enlarge the background and clarify the context in which the information is situated. Another reason to use photographs is their ability to facilitate easy labelling of objects. Researchers have observed that children are more often able to extend the labels between pictures and objects when realistic photographs and drawings are depicted rather than cartoons, which are less realistic (Ganea, Pickard & DeLoache, 2008; Tare, Chiong, Ganea, & DeLoache, 2010).

The books were printed in color on standard A4 sized pages, illustrated with photographs, and formatted in 32-page standard trade format. The books were assembled in a binder with page protectors. The odd pages faced the reader and the even pages were placed right behind the odd pages. The books were retained in the classroom allowing students to read the texts as many times as they wanted.

The books were written to introduce a series of concepts that ranged from simple to complex so as to consider students with little previous ecological knowledge. For instance, the first book in the series, introducing the concept of nature, titled, *Nature is*…, was more functional than the rest of the books. This book introduced flora and fauna, and the physical, atmospheric aspects of nature. The second book in the series introduced the water cycle. Titled, *A cycle forever*, the book detailed the water cycle using scientific vocabulary. The most complex idea of the set, biodiversity, was presented to the students through a depiction of a *Rain forest*. The last book in the series. *Fifi's Challenge*, introduced the phenomenon of bioluminescence in the form of a brain teaser. More details about the wordcount and the grade level of the texts can be found in Table 1.

Presentation of Mentor Texts

The Institutional Review Board approved the study as being of minimal risk to the students. The teacher presented the mentor texts to students in the following sequence:

Transition activity (10 minutes). Most mornings began with a math worksheet activity in the classroom. Because working on mathematics provides a high cognitive load for the participants, a break was necessary between the morning tasks and the study. This break was facilitated when the teacher led the students to do yoga postures or jumping jacks, thus preparing them to transition into reading and giving them a break in their mental processing prior to the study activity.

Presentation of clues (5 minutes). First, the teacher instructed the students to sit on the reading carpet. Next, the teacher presented clues about the topic of the day and invited students to guess the topic. For example, to introduce the concept of bioluminescence, the teacher asked the students: "Have you seen anything glow in nature?"

Warm-up discussion (5-10 minutes). The students responded variously to the clues provided by the teacher. For example, one student said, "I have seen stars glow in the night." Another student said, "I think the sun glows too." Yet another student said, "I know some bugs can glow." The teacher then asked the students, "Have any of you seen bugs glow?" Followed by questions such as, "Where did you see it?" The teacher provided opportunities for all students to participate if they so wished. The teacher also encouraged participation of shy students by acknowledging their body actions and initiating a dialogue with them in response to their perceived interest. However, it was not necessary that all students participate in the discussion. There were no penalties associated with non-participation.

Reading the book (5-10 minutes). After students discussed the topic and when no new ideas emerged, the teacher said, "I loved our discussion. Today we are going to read a book on bioluminescence. Can you all say the word?" The teacher then wrote the word on the chart board. Next, the teacher encouraged the students to repeat the word three to five times. The teacher paid close attention to English language learners in the classroom and let them repeat the word many more times. The teacher used student questions to lead them into readings. For example, a student asked the next question, "What is bioluminescence?" The teacher said, "Let us read and find out."

Reflection time (15-25 minutes). After reading the book, the teacher instructed the students: "Please draw what you understood about the book we read today. You can use the crayons on your desk or use markers to draw. Please write what your drawing is about." Students returned to their desks and completed a drawing on a sheet of paper and then wrote about their drawing on the reverse side of the page. Students could draw and write for as long as they wanted. They could check their spelling and vocabulary book to assist them in writing their text. Students could also request adults to write for them. Only analysis of that text that was prepared by students is discussed in this manuscript. Analysis of the images produced will be analyzed in another manuscript.

Teacher-student demography

The study was conducted in a public-school in the inland northwest region of Washington State. Of the 25 students in the classroom, one student was not in the class during the time of the study. The students were from varied backgrounds and races, and they spoke many different primary languages. They were six to seven years of age.

Data Analysis/Standardization of Student Text

All texts produced by the students in this study were entered on a spreadsheet (Figure 1). Student texts were corrected for spelling errors and sentences were corrected for proper grammatical format. No effort was made to complete incomplete sentences in student writing. However, such sentences have clarifications added in

parentheses so that the coders could understand the context. Single words were interpreted as sentences produced by students. For example, while explaining the water cycle, students often used one-word sentences such as *Next*. *Evaporate*.

Mapping the Mentor and Student Texts

To allow for comparison between the mentor text and student writing, the mentor text, was read aloud to the students, and the student texts were mapped separately to the domains by using competencies associated with each domain. The texts were organized into themes that answered the research questions by using the constant comparison technique (Strauss & Corbin, 1990). According to Dey (1993), the data can be categorized, organized, and conceptualized based on groups or clusters created by the researcher. Patton (1990) advocates careful judgments that are critical and crucial for appropriate classification of the data in order to derive meaning from it. The redundancy and reliability of coding was established by the author who repeated the coding three times. Both mentor texts and student texts were re-coded during every repetition. Average values of the three coding sessions are presented in this paper. Adjustments to codes were made during these trails. After the reliability was established at ≥90%, the rubric was given to an interrater and trained in establishing the norming. The interrater checked one full text of a book and all student responses for the selected book. For the other three books, spot checks with 10% of the responses and original texts were performed. When the interrater reliability was < 80%, the author retrained the interrater and the coding was repeated. If the repeated coding also yielded <80% reliability the coding was revisited. The interrater reliability in coding for the study was about 95% and fell within the average categories coded by the author.

Coding for the Domains

Coding was undertaken from the subjective understanding and perspective of the author. When coding the texts, the author identified the domain under which a response would fall. To eliminate bias in the coding, and capture a range of subjective variations, coding was repeated three times. Each coding episode was repeated after a gap of a week.

The **Cognition** domain was identified when sentences or phrases or words explained a fundamental ecological principle. All sentences were individually counted. When sentences were split into two or three parts (because they represented more than one domain), each part was designated under appropriate domain. A rule of thumb was to code all facts under the cognition domain. For example: **The water** *flows* **through the Earth** *washing* **minerals and** *watering* **plants**. In this example, all text in bold was coded as cognition and lighter text in italics was coded for action.

Emotions were coded when words or phrases or sentences conveyed concern, empathy, or respect for other people and living things. Some of these phrases also indicated a part of the process, not as a fact, but as an experience. For example, *Icy rocks* in the context was considered as conveying an experience, while *hail* was considered as a fact and coded under cognition. Possessiveness and possessions, in the context which invoked or involved feeling, were also classified under emotions.

Action was conveyed using verbs and the creation and use of tools, objects, and process. Although in the context of ecoliteracy, actions refer to choices towards sustainability, in this study, it has been extended to include the characteristics of the text production. Parts of a sentence or the whole sentence was listed under this domain if students conveyed the context of action. For example, in the phrase *Clinging* moss, clinging was considered an action in the context of the text.

Spirit was coded when the context evoked an experience that conveyed wonder and awe towards nature. These could be conveyed in words, phrases or sentences. Each instance of conveying awe towards nature was coded. The coding for spirit and emotions was differentiated based upon the result. If the experience evoked awe, it was coded as representing the spiritual domain. If the experience evoked concern, empathy, and respect for other people and living things, it was coded under emotion, as it fell under the purview of the emotional domain as indicated earlier.

For example, the phrase, *such abundance of life* was coded under spirit. The coding was also dependent upon the context. Entire sentences could be marked to bear a spiritual meaning or parts of the text. Single words could also be used to convey the context.

The data on ecoliteracy domains were analyzed for both the mentor texts and the student texts and compared using a chi-square. Non-analytical word frequency word-spread representations of mentor and student text were made using the free online software program Wordle. This word-spread enabled the viewing of mentor and response texts and the highlighting of the major themes of each group.

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Analysis and Discussion of Student Responses

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Student attendance for the day determined if students were able to participate in the reading and response session. Further, some students did not respond in writing during some weeks. In sum, students produced 1,282 words and 225 sentences describing their responses to the mentor texts. The mentor texts had a total of 1,002 words and 122 sentences.

Ecoliteracy Competencies for Each of the Four Texts Presented

Both the mentor texts and student writing were represented in all the ecoliteracy domains. Except for one mentor book, *Rain forest*, all other mentor books had a higher frequency of ideas presented in the cognitive domain than the student texts. *Rain forest* had a greater number of examples in the emotion domain. Student texts had a higher representation in the cognitive domain (Table 1). For *Rain forest*, the cognitive responses were higher than the mentor text (Figure 2). The domain of the spirit was poorly represented in student texts, while action was highlighted in responses to two mentor texts- *A cycle forever* and *Fifi's challenge*.

Statistical analysis comparing the averages of coding across domains for the mentor texts and student texts did not show any significant difference. Although the texts had similar representations, the student responses varied across the domains and did not always mirror the mentor texts (Figure 2). The differences were mainly noted in the degree of complexity of the texts produced by the students. Other studies also confirm that young children are capable of crafting complex information when given the opportunity (Duke & Kays, 1998; Newkirk, 1989; Pappas, 1993). Yopp and Yopp (2012) note that young children's exposure to informational text is limited, potentially hindering their response and participation when presented with this type of literature.

In this study, an opportunity for stratified free form response was presented to the participants for the text *Fifi's challenge*. The response was stratified as the students were asked to create their own riddle as a response. The frequency of responses across domains produced from this activity shows a high response in the cognition domain, followed next by the action domain (Table 2). Since the mentor texts had ecology-based themes, the result of high cognitive responses could also be due to the content of the texts. A study by Collado, Staats and Corraliza (2013) showed that when children attended nature camps and were enriched by their immersion in nature, they experienced cognitive and emotional changes in their affinity towards the environment, and thus engaged in pro-environmental activities. With some affinity to the study by Collado et al., (2013), the present study provided an immersion experience in nature visually through the reading of a book with realistic nature photographs. This shows the possibility of expanding the role of picture books to provide high cognitive priming. This finding represents an area for potential future study, as discussed later in this paper.

The Broad Representation of the Ecoliteracy Domains in Student Responses

This study analyzes how sentences were coded for their representation across multiple domains. As indicated in the methods section, the sentences have information that is spread across the domains. Table 3 summarizes the analysis of data pertaining to the number of domain combinations and the words produced by the student responses. During coding, when student texts were found to have representations in more than two domains, the text was marked as "complex." This study shows that student responses become complex when familiar topics are introduced. To illustrate, the author analyzed the mentor texts and their corresponding student responses. The first mentor text

Nature is… introduced the concept of nature. The students in this classroom had heard this word nature on many different occasions from the teacher. They had also heard it from her in somewhat different contexts, although the students might not have understood the subtle differences. Thus, nature was a familiar topic to the students in the classroom. When a familiar topic was presented to the students, they produced richer and more complex texts than the mentor text. The second text *A cycle forever* covered a newly introduced topic, the water cycle. The students produced rich and complex texts but did not quite match the complexity of the mentor text. The *Rain forest* text provided them with many challenges. None of the students had been to a rain forest. Consequently, their experience with the ecosystem was limited and probably resulted in weak conceptualization. When students provided responses without prior knowledge, the texts were less complex as compared to the other two books. For the final text, *Fifi's challenge*, several aspects were stimulating for the students. The concept of bioluminescence is typically introduced in fifth grade or middle school. The students' lack of familiarity of the concept combined with the challenging format of this particular text presented as a riddle or puzzle—likely explains why— this was the most difficult text for the students in the study. Despite these challenges, the cumulative student text output matched the complexity of the mentor book as indicated by a significant relationship between words in text and the number of domain combinations.

To explore other contexts of textual complexity, the author conducted a deeper analysis of the domain combinations in student responses. This analysis revealed the dynamic and diverse student thought process in the form of unique combinations of domains in their text production became evident in this analysis. The student responses showed several unique domain combinations that were not presented in the mentor text as summarized in Table 4.

For the text, *Nature is…*, students produced texts in two novel constructs by combining action-spirit and emotion-spirit domains. However, they did not produce any text with the combination of action and emotion, even as this combination was present in the mentor text. *A cycle forever*, introducing the concept of the water cycle, did not have matching representations in the four domain combinations, but showed one novel construct. Student responses to the title *Rain forest* had four combined domains that were not represented in the mentor text. The unique domain combinations involved presentation of text with action-cognition-spirit domains. This domain was also dominantly represented in the title *Fifi's challenge*.

The samples of complex student text for all mentor texts are presented in Table 5. The analysis demonstrates that young students can generate texts that convey complex information. Given a mentor text, students can produce novel constructs generated from their understanding, and, add to the richness of the materials presented. There is a paucity of studies that analyze the text creation across the domains common to ecoliteracy. Tracy and Headley (2013) report a successful intervention workshop to introduce nonfiction text to young readers. In their study, they reported that success of the intervention was marked by the vocabulary that students shared, and the strategies used by students. Donovan (2001) reports that even the youngest students in kindergarten successfully identified and understood the differences in genre and managed to produce texts with some degree of complexity. Production of complex texts by students demonstrates their ability to extend the skills to create novel meaning within ecoliteracy domains.

Learning by Using Ecoliteracy-Rich Texts

Data demonstrating various aspects of learning as experienced by students shows that students in the study cultivated a well-rounded appreciation of nature and its interconnections. This is demonstrated in many ways: their relationship with nature, their knowledge of the water cycle, their ability to situate and apply the concept in daily life, their grasp of the concept of biodiversity, and their understanding of a playful learning moment in the form of a puzzle. Additionally, students practiced traditional literacy skills such as recalling the text, composing text, the act of writing, and seeking to express their thoughts and ideas. Many of these tasks fall under high cognitive domains, which involve diverse processes. These connections are important to investigate as they constitute the ecoliteracy of young students.

Overall understanding of the mentor texts

In three of the four texts, the dominant themes presented in both the mentor books and the student responses were similar. *Nature is…* , the main theme, was mirrored in the student responses, although the content was not the same (Figure 3). For the book *A cycle forever*, the students were clear in their understanding of the water cycle. With *Rain forest*, responses indicated that students understood trees to be a part of rain forests, but otherwise, they connected with bananas. Student responses also indicated some understanding of the complexity of the layers and diversity of rain forest life. For example, students listed tree, vines, bush, and bamboo as life forms. The most surprising response was for *Fifi's challenge* in which the mentor text emphasized using clues presented as a word play. The responses indicated that students understood the idea, and composed their puzzles based on what they knew. The visual, non-analytical representation of the data comparison of mentor text and student responses is indicated in the Word Map presented in Figure 3.

Connection with nature

Qualitative analysis of student response to the text *Nature is…* reports many kinds of associations with nature as indicated in Table 6. The five top frequent words in the mentor text were *nature*, *every*, *many*, *made*, and *none*. Interestingly, the most frequently used student response word matched the theme of the mentor text, nature, followed by emotion words such as *love* and *like*. This was followed by action as indicated by dynamic nature phenomena such as *volcano*. The responses also substantiated the children's claims using conjunction words such as "because." Technically speaking, the use of subordinating conjunctions like "because" fits the definition of complex sentences (Salsbury, Personal communication). The students' basic connection to nature among students was mediated through the emotional domain.

This is similar to the findings from Capaldi, Dopko and Zelenski (2014), who noted a strong connection between happiness and being connected with nature. In another study, younger children were shown to be more connected with nature than older children (Liefländer, Fröhlich, Bogner, & Schultz, 2013). Several studies point out that pro-environmental attitudes and behaviors are strongly influenced by the nature connection (Cheng & Monroe, 2012; Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009). Ernst and Theimer (2011) note that more cognitive activities are required in order to develop pro-environmental behavior. The emotional connection of children with nature requires closer examination.

Knowledge and extension of the water cycle

The frequent use of the words *water*, *magic*, and *cloud* were highlighted in the analysis of the book, while *water*, *cycle*, *cloud*, *first*, *next*, *goes*, and *bird* were highlighted for the student response texts (Figure 3). The concept of evaporation was highlighted in student responses on at least two occasions. Natural elements that contribute to the water cycle such as sun, rain, mountain, cloud, ocean, and air were also mentioned in the responses. Surprisingly, the connection to extinction without water was also articulated in the student responses. Animals (e.g. butterfly, egg, dinosaurs, bird, and bear) and their life cycles also appeared more frequently. Age, human-managed areas (lawn), and human activities such as hunting were also juxtaposed in students' understandings of the water cycle. The ability of students to extend their knowledge to other situations indicates that their knowledge was in an advanced phase.

Ever since the seminal study by Piaget (1930), which used the water cycle to demonstrate children's cognitive progression, the topic of the water cycle has been well studied in both science and teaching (Taiwo, Ray, Motswiri, & Masene, 1999; Shepardson, Wee, Priddy, Schellenberger, & Harbor 2009). However, few studies explore the learning of this concept from the perspective of ecoliteracy. In the student responses, the extension of the concept was noted by transference to objects (water wheel), gender roles (mother gets them born, father gets them food), routine activities (mowing the lawn and grass re-growing), and the life cycle of the organisms as representing the water cycle. Many of these themes also concur with the emotional connections' students made with the texts.

Conceptualization of biodiversity

The foremost connection indicated by the mentor text is between *water*, *rain forest*, *tree*, *rivers*, and *birds*. In the students' response, *bananas*, *rain forest*, and *trees* are frequent themes (Figure 3). Diverse creatures were also highlighted in the student responses: raccoon, turtle, goat, leopard, deer, turkey, rabbit, bird, monkeys, panda, fish, and wolf. Plant life was represented by vines, tree, bamboo, bushes, apple tree, and simply as plants. Diversity of fruits such as apple, banana, and chocolate (presumably it was meant to be cocoa), were also represented in the texts.

Unlike the responses for the water cycle book, responses were muted for the book *Rain forest*. No text response was provided by six students and most responses included some form of a list. A point of significance to note is that one student unexpectedly explained using a non-biological concept, and as an extension of the student's personal world, reflecting, "My forest is diverse because it is a rainbow forest." The term diversity was not provided in the mentor text, although the concept was elaborated. Finding this term and explanation of the concept in a non-biological fashion is unexpected. It indicates an extension of a student's imagination to understand biodiversity. In another study, it was found that the complex characteristics and function of the rain forest was difficult even for 13-year old students to comprehend (Dove, 2012).

Playing with concepts

Student participation and enthusiasm indicated that they liked the playful approach of using riddles in their mentor text. Riddles have been popularly used in teaching and learning in both traditional and nontraditional situations (Jirata, 2012; Çaya, 2015). Riddles play a significant role in developing children's cognitive skills (Gučienė, 2016). The use of riddles in this study led to considerable engagement by the students and allowed them to show their background knowledge and their learning as was evident in their response to the last mentor text, *Fifi's Challenge*. Their output included diverse themes such as word play, functions of nature, celebrations, day of the week and people. Only one student did not engage declaring, "*I do not know what is a riddle*." Another student creatively produced two riddles or a two-step riddle in response, "I can be built in one season. Can you guess who I am? If you can't move to the next question. I wear a hat. What am I?"

CONCLUSION

Ultimately, the goal of ecoliteracy is to enable holistic experiences with nature based on cognitive understanding, emotional connection, and action in the spirit of honoring these connections. Ecoliteracy can be mediated by any of the domains playing a significant role in facilitating the experience. In the present study, when presented with eco-literacy-rich picture books, students' cognitive responses about nature were mediated through emotional connection. The deeper spiritual connection with nature was absent. It is possible that some maturity is required to establish this connection. However, student actions with nature were both playful and utilitarian, suggesting that deeper connections with nature can be encouraged by active play that can result in a cognitive shift.

This researcher makes a distinction here between the mature ecoliteracy of a person who can embrace sustainability practices in daily life (Goleman et al., 2012) and the first-grade students in this study. The students in this study were not measured for the degree of sustainability in their daily consumption choices. Rather, this study provided them with opportunities to present their current ecoliteracy levels through their responses and connections. This knowledge and understanding of the process is critical for creating programs that support explorations of ecoliteracy in young children.

Book choice and ecoliteracy. Cleveland (2015) showed that reading picture books to children inspired their learning. In this study, in addition to learning, students also expressed their strengths in certain domains of ecoliteracy when they were presented with varied texts. For introducing ecoliteracy, and encouraging further interest in ecology, reading picture books served several functions in the classroom. Books rich in ecoliteracy competencies can be provided to children for general reading to enable informal and spontaneous immersion. Teachers can also use books rich in ecoliteracy to enable students to think or develop mastery over specific areas. These books can be integrated into the regular curriculum so as to establish opportunities for multi-modal. Such multi-modal responses incorporate

aspects of the oral and written channels through which students can articulate their learning. Several studies have suggested that language learning is supported by what students are able to do and is also supported by varied opportunities (Lee, Quinn, & Valdés, 2013). Results of the study show that students are able to present responses that fall in the cognitive domain when the material is presented to them in picture book format. Thus, challenging and stimulating students with picture books is appropriate in the early years. The validity of picture books as a powerful medium has been corroborated in other studies as well (Kiefer, 2015; Lancaster & Flewitt, 2015). Kümmerling-Meibauer and Meibauer (2013) suggest that this connection should be explored with the creation of a cognitive theory of picture books. The choice of picture books to introduce sustainability themes should be made with caution as some books may have erroneous information or convey stereotypical messages (Muthukrishnan & Kelley, 2016).

In the context of this study, it should be noted that although the books provided an enhanced cognitive experience, they cannot replace the importance for students to be outdoors and interact with nature if they are to achieve full ecoliteracy. Several studies show that interaction with nature is far more beneficial for physical health (e.g. Keniger, Gaston, Irvine, & Fuller, 2013), cognitive performance (e.g. Bratman, Hamilton & Daily, 2012), psychological well-being (e.g. Dallimer et al., 2012), social benefits (e.g. ten Brink et al., 2016), and spiritual upliftment (e.g. Russell et al., 2013).

Significance of text production (student writing). The achievements of the young authors are phenomenal. Their combined output produced the same or more input as the mentor text. They demonstrated a grasp of complex ideas as they were presented in pictures and words and they replicated this complexity in pictures and words. Their responses were sophisticated in thought, demonstrated extensions into daily life, or mirrored their confusions when written responses were missing. Students also provided reasons for their thinking and demonstrated an advanced understanding of the water cycle. Lee et al. (2013) underscore the importance of supporting language development and presenting various channels for students to express themselves. Students in this study were able to present complex ideas and thoughts, even if they were unable to produce text that was perfect in terms of grammar or syntax. The author wants to clarify that under the circumstances of this study, there was no expectation that the students would produce grammatically sophisticated text.

The search for a unified theoretical understanding of the translation of thought into written word is not conclusive. Hutchins (1995) noted that translation of the cognition of the thought to word has been problematic historically when the fields of cultural studies, history, and psychology set up boundaries of 'inside' the body and 'outside' the world. In the same line of thinking, the cognition responses provided by the children is not a product of a single activity – that is, reading the mentor texts in this study. Rather, it has been a part of their larger life, provided by various interactions that enabled cognitive effort to be distributed over time. Thus, the output of the students represents a part of the larger cognitive process (Tribble & Sutton, 2012). The absence of understanding rain forests or experience visiting rain forests could be some factors that account for the meager responses to the rainforest book. Matching appropriate texts and scaffolding the students to address the text is also important. From the perspective of ecoliteracy, complex topics could be introduced in a series of books rather than presenting them in a single book in order to account for the limits of possibly unfamiliar and complex topics, as demonstrated by the rainforest book. Despite these drawbacks, students demonstrated learning and extensions from all the mentor texts presented to them.

Barriers to ecoliteracy. Building a strong ecoliteracy foundation for students encourages students to develop a solid connection with nature. Russell et al. (2013) also attribute well-being to interactions with nature. Bratman et al. (2012) note that frequent interactions with nature has a positive influence on mental health and cognition. This facilitates both stress reduction and attention restoration. Dallimer et al. (2012) noted that stress reduction and the attention restorative properties of nature could be attributed to biological diversity. Although children were fascinated by powerful phenomena such as a volcano, they remained cautious about exploring new ecosystems or places. The need for deep personal connection or personalization in response to nature might serve as a pathway for future ecoliteracy studies. The summary of the findings from the study pertaining to each domain of ecoliteracy is presented in Figure 4. To inspire students to be more active, materials can be designed to engage students in personal ways and describe spaces where the personal needs are emphasized. It will be interesting to study at what

point students decide to act and through which route. The results of this study show that an emotional connection is required for establishing and facilitating functionality of all the domains of ecoliteracy. Tam, Lee, and Chao (2013) note that deeper connections were established with nature when nature was presented in an anthropomorphized manner. The sense of connection mediates the conservation behavior of people. Future studies will be able to build on the strengths of this study and work on the areas identified as means for lifting barriers that exist in our attempts to introduce ecoliteracy to young students.

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Appendix 1: Tables

Table 1
Details of Mentor Texts Used in This Study

Title	Theme of the book	Grade level of text
Nature is….	Introducing nature	Grade 3
A cycle forever	Introducing natural cycle – water cycle	Grade 3
Rain forest	Introducing biodiversity and human use of biodiversity	Grade 4
Fifi's challenge	Introducing phenomenon of bioluminescence	Grade 1

Table 2
Comparison of Responses of Student Responses across Ecoliteracy Domains for All the Mentor Texts Used in the Study

Domain	*Nature is…* n=23	*A cycle forever* n=20	*Rain forest* n=18	*Fifi's challenge* n=23
Frequency	student (mentor)	student (mentor)	student (mentor)	student (mentor)
Cognition	41 (24)	45 (58)	63 (21)	51 (32)
Emotion	27 (15)	8 (13)	14 (22)	13 (13)
Action	11 (9)	20 (28)	4 (7)	14 (10)
Spirit	3 (10)	1 (14)	2 (3)	1 (5)

Legend: The mentor text frequency is represented in the parenthesis. T-test indicated no significant differences between the observed frequencies of student responses and mentor text. The number of students participating in the study varied per text and is indicated under the mentor texts used in the study.

Table 3
The Complexity of Student Text Production As Measured by the Combinations of the Domains Represented in the Text

Text book	# Words in text	# Words response	# Domain combinations (student)	#Domain combinations (text)
Nature is…	176	420	7	6
A cycle forever	447	304	7	10
Rain forest	132	267	5	6
Fifi's challenge	247	298	6	6

Legend: The values for the #words in text and #words response indicate the cumulative text production for the class. Values for #Domain combination indicate the average of the coding rounds for the mentor book. Chi-square value 142.938, p-value<0. 00001, p< .05 indicates a significant relationship between the variables.

Table 4.
The Deeper Analysis of the Domain Overlap in Student Text Production

Domain	*Nature is…*	*A cycle forever*	*Rain forest*	*Fifi's challenge*
	Response (Book)	Response (Book)	Response (Book)	Response (Book)
Cognition + emotion	13 (9)	2 (2)	5 (10)	4 (1)
Cognition + action	4 (8)	16 (13)	2 (2)	7 (6)
Cognition + spirit	2 (1)	1 (6)	1 (0)	1 (2)
Action + emotion	0 (1)	0 (1)	0 (1)	1 (0)
Action + spirit	1 (0)	0 (1)	0 (0)	0 (0)
Emotion + spirit	1 (0)	3 (1)	0 (1)	0 (1)
Emotion + cognition + action	3 (1)	1 (2)	0 (1)	2 (1)
Cognition + spirit + emotion	2 (1)	0 (2)	1 (1)	0 (1)
Action + cognition + spirit	0 (0)	2 (2)	1 (0)	10 (0)
Action + cognition + spirit + emotion	0 (0)	0 (1)	0 (0)	0 (0)
Emotion + cognition + spirit	0 (0)	1 (0)	0 (0)	0 (0)

Legend: The values indicate the average frequency of three coding rounds. Categories not represented by the text have 0 value.

Table 5
Examples of Coding of Complex Student Text for Information across the Domains

Mentor Text	Text Type	Coding Examples Spirit
Nature is...	Expository	1. *This is a redwood tree. I made it because they are* big and I like big things! 2. My family *used to live in the country*. It was fun until we moved *to Pullman*. I love nature. *The end.* 3. It is the evil ways *of the evil good sons and these are his ways.* That happens often in life and He *will be back and he means it.*
A cycle forever	Expository	1. *The life cycle of frog* will keep going. The butterfly is pretty. I like *apples.* 2. *First, there is an ocean. Then the water* evaporates *into air. Then it* forms *a cloud. Then the cloud pours rain and it flows into the lake and the cycle starts over again.* This is my natural cycle. 3. *Water cycle.* I like the *water cycle because it is* cool *and that it goes around in a O. And that O it keeps on* going going going. *Until it stops. What is a cycle? A cycle is something goes around in together. End.*
Rain forest;	Expository	1. This is my rain forest. *It has many animals and trees. It has a panda* eating *bamboo and a banana tree.* It has a great big water fall. 2. I like the rain forest *because they have* cute *animals and* there are big *and small trees!* 3. *This is a diverse rain forest plant because* I can see ants trapped in it. It smells.
Fifi's challenge	Puzzle	1. *What is the name of the man* who lost a *mitten pair? Letter.* Secret *Letter l I K* 2. *What goes in snow? Can you* figure *it out?* I know you can do it. 3. *I can be* built *in one season. Can you guess who I am*? If you can't move *to the next question. I wear a hat. What am I?*

Legend: Coded for domains for ecoliteracy *Cognition* Emotion Action Spirit Complex texts created represented more than two ecoliteracy domains.

Table 6
Association with Nature as Indicated in Student Texts

Mentor text title	Types of associations	Example words
Nature is…	Playful	Play, Holiday
	Celebration	Fun, Celebration
	Scary	Evil, Spooky
	Awe	Big, Hundreds
	Abundance	Many, More
	Emotional	Love, Like

Legend: Student texts showed a range of connection with nature. Emotional words had highest frequency representation.

Appendix 2: Figures

Sample student response to 'Nature is…' text

VOlcanos cum run difrit pips is
Sum ik slot sum do not lk: spod.

Sample student response to 'A Cycle Forever' text

I line The Water Clci
because iTis cool ahd that
it gos a cawad in O And Thar
it keops on going going going
In till t staps
What iC a C/cle? a Gcle is
Something gos a cownt in
a Othe end

Sample student response to 'Rainforest' text

This is my rainforest it has many animals
and trees, it has a parde eating bamboo and
a bamband tree, it has a groit big water fal.

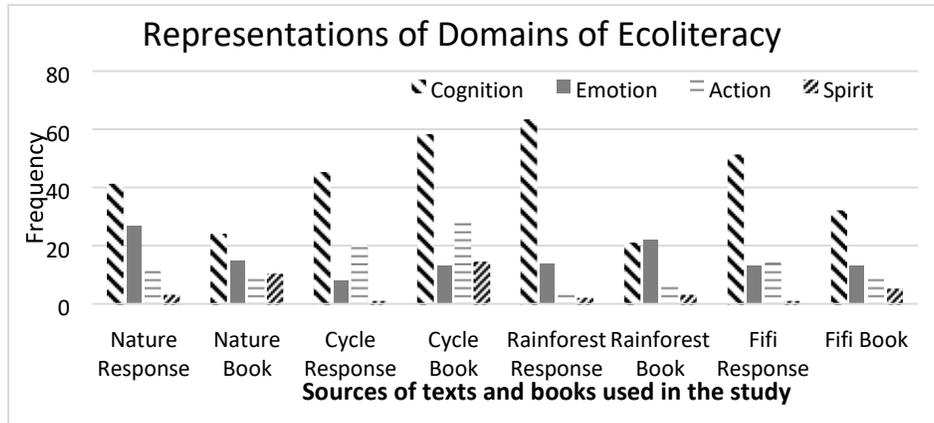Sample student respond to 'Fifi's Challenge' text

Wac to you lev behind
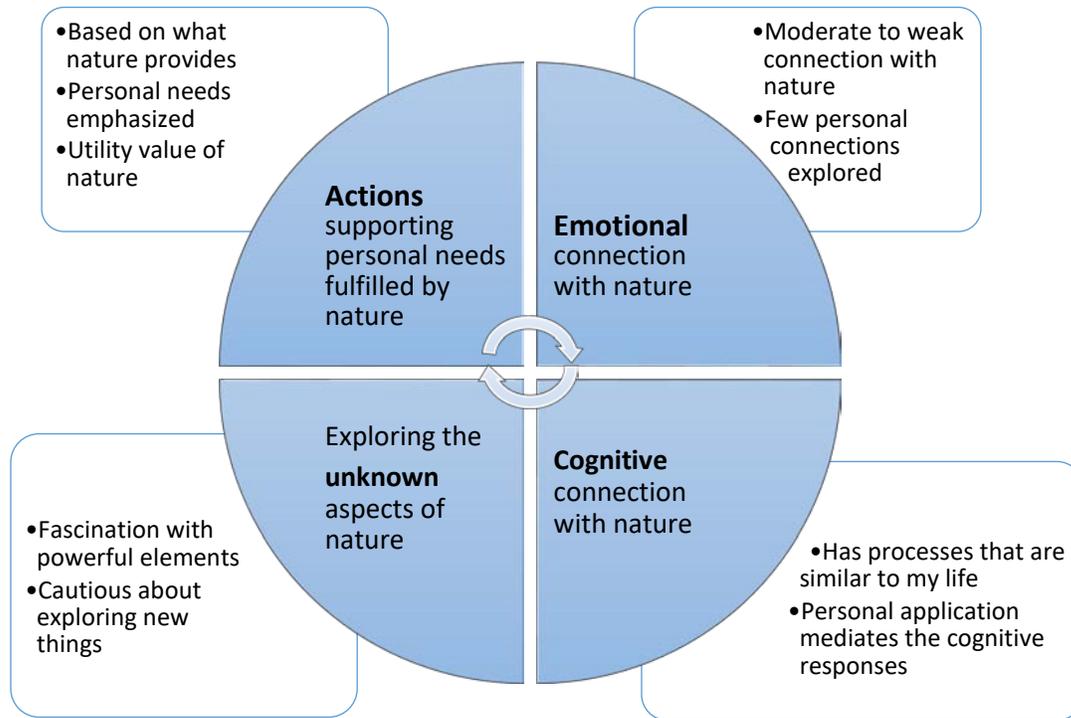Wen you walk away

your kool pits

Figure 1. Sample student responses to various texts

Legend: The student responses to expository texts mirrored the mentor texts provided. Although some domains were represented more frequently in one or the other sample, the differences were not statistically significant.

Figure 2. Visual Representation of the Eco-Literacy Domains Indicated in the Mentor Texts and Student Responses

a. Mentor text title: *Nature is…*

Mentor text representation   Student response representation

b. Mentor text title: *A cycle forever*

Mentor text representation   Student response representation

c. Mentor text title: *Rain forest*

Mentor text representation   Student response representation

d. Mentor text title: **Fifi's Challenge**

Mentor text representation   Student response representation

Figure 3. Visual Representation of the Text Data

•Based on what nature provides
•Personal needs emphasized
•Utility value of nature

Actions supporting personal needs fulfilled by nature

Emotional connection with nature

•Moderate to weak connection with nature
•Few personal connections explored

Exploring the **unknown** aspects of nature

Cognitive connection with nature

•Fascination with powerful elements
•Cautious about exploring new things

•Has processes that are similar to my life
•Personal application mediates the cognitive responses

Legend: Barriers to strong ecoliteracy knowledge and practice based on the domains of ecoliteracy. Students displayed contradictory traits such as curiosity and caution in their approach to learning new ideas

Figure 4. Barriers to Strong Ecoliteracy Knowledge and Practice in Students

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Investigating Nature-Related Routines and
Preschool Children's Affinity to Nature at Halifax Children's Centers

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ABSTRACT

The importance of spending time in nature is undeniable for child development, yet from an early age most children's time in nature is restricted. Beginning in preschool, the range and quality of a child's nature experience is restricted by accessibility to nature experiences and pedagogical approaches. This is a problem for building a sustainable future as the scholarly literature clearly demonstrates that children's environmental affinity is strongly affected by indoor and outdoor learning experiences, and can impact their pro-environmental behaviour in the future. Some pedagogical philosophies, like the Reggio-Emilia approach, attempt to increase nature exposure for children. This study uses a mixed-methods approach, including game testing, to examine the cognitive, emotional, and attitudinal bio-affinity of preschool children after being enrolled in Reggio-Emilia preschools for at least one year. Results suggest that although the Reggio-Emilia-inspired curriculum followed at the preschools provided various opportunities for children to be exposed to nature, the children's cognitive, emotional, and attitudinal affinity with nature was weak.

Keywords: early childhood environmental education, Reggio-Emilia pedagogical approach, bio-affinity, games testing

Scholars have shown a trend toward children spending more time engaging in indoor sedentary activities rather than in outdoor play (Mainella, Agate, & Clark, 2011). In Canada, youth spend on average one hour or less per day outdoors (David Suzuki Foundation, 2012). In the United Kingdom, the National Trust found that on average, children play outside for just over four hours a week (National Trust, 2012). In the United States, one study found that only 10 percent of children spend time outdoors every day (The Nature Conservancy, 2011). The lack of outdoor activities can have a major impact on a child's physical and mental health and development, as well as their affinity for nature (also known as "biophilia" [Wilson, 1984]). Spending time in nature during early childhood positively impacts children's physical, mental, and emotional development (Bratman, Dailyb, Levyc, & Grossd, 2015, Richardson, Pearce, Mitchell, & Kingham, 2013). Based on evidence presented by stress reduction theory (SRT), the restorative impact of nature exposure leads to declining levels of stress, relaxation in an individual's autonomic nervous system, and activation of an innate sense of connectedness with nature (Gladwell et al., 2012). Further, research shows that children who lack exposure to the natural environment, what Louv (2005) describes as 'nature deficit disorder', and who do not engage in outdoor play, become more disconnected from nature, which can strongly influence their behaviour toward the environment over their lifetime (Collado, Staats, & Corraliza, 2013). Previous studies have also demonstrated that positive and frequent nature experiences during childhood improve children's environmental attitudes and knowledge (Rickinson, 2001), increase the probability of conservation behaviours later in life (Zhang,

Goodale, & Chen, 2014), and form their positive pro-environmental cognitive connections and affections (Giusti et al., 2014; Stern, 2000). A trend toward children spending less time with nature is, therefore, of great concern.

One solution to mitigate children's deprivation of nature exposure is environmental education (EE), which can improve children's environmental knowledge, concerns, skills, and behaviours (Bonnett & Williams, 1998). EE programs aim to expand a child's knowledge in terms of different scientific aspects of nature, develop environmental values and attitudes, and encourage them to behave in a more environmentally-friendly manner (Palmer, 2002).

Previous studies have revealed that early childhood is the most important phase of an individuals' cognitive and affective development (Meiboudi, 2013; Nutbrown, 2006). Childhood experiences have a significant impact on individuals' perceptions of their relation to themselves, to others, and to nature (Samuelsson & Kaga, 2008). This need for early childhood EE has been recognized by some preschools, which have modified their pedagogical approaches in the direction of a more purposeful integration of EE into their curriculum (Ärlemalm-Hagsér & Sandberg, 2017). One example is Reggio-Emilia preschools, which are considered integrated and productive educational centres (Vandermaas, McClain, & Fair, 2017). The Reggio-Emilia approach, developed by Italian educationist Loris Malaguzzi, is a belief system that has changed the image of the child, the teacher, and the environment in the realm of early childhood education (Vandermaas et al., 2017). According to this approach, preschoolers become active researchers who observe, form their own enquires, hypothesize potential solutions, and make conclusions (Hewett, 2001). In this environment, children's opinions are listened to and valued, and they are encouraged to express themselves through multiple 'languages', including expressive, communicative, symbolic, cognitive, etc. (Vandermaas et al., 2017). Reggio-Emilia-inspired teachers are listeners and co-learners who facilitate different possibilities for actions on the environment by taking advantage of various materials and experiences (Vandermaas et al., 2017). Moreover, another common characteristic of Reggio-Emilia-inspired educators is their respect for nature as a 'third educator' (Cadwell, 1997). They believe that children's nature-related experiences not only enhance their empathic connectedness to their surroundings, but also improve their intellectual and social skills, as well as empowering them to protect nature (Hewett, 2001).

This paper adds to the evolving body of literature in nature exposure and EE by investigating preschool children's emotional, cognitive, and attitudinal affinity with nature after being enrolled in a Reggio-Emilia preschool for at least 1 year. To do this, we used the "Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere" instrument developed by Giusti et. al. (2014). This instrument includes 3 sets of image-based tasks evaluating affective and cognitive aspects of children's connectedness with nature, as well as a short interview about their motivations and intentions of playing in nature-related settings. In addition to using the instrument to assess preschoolers' affinity, our study also sought to assess the applicability of this instrument for preschool students in the Canadian context.

Nature Experiences and Bio-affinity

Early childhood nature-related experiences are a determinative factor that can result in adult pro-environmental attitudes and behaviors (Giusti et al., 2014). Several studies have found that positive and frequent childhood nature-related experiences are the foundation of adult environmentalists' commitment to advocate for environmental protection (Zhang et al., 2014; Collado et al., 2013; Torquati et al., 2010).

Several scholars have defined a nature experience as any human interaction with non-human species and natural environments (Finch, 2008; Giusti's et al., 2014; Miller, 2005; Pyle, 1993). Thus, interacting with a tangible aspect of nature (e.g., animals, plants, etc.) in a human-made natural area (e.g., zoo or botanical gardens) or in a more pristine natural area (e.g., forest or natural shore line) are both considered a 'nature experience'. In this research study, we used the same definition.

Kellert (1996) categorized the experiences of the natural environment for children into 3 classifications: direct, indirect, and vicarious. Direct nature experiences are gained by unplanned actual physical interactions with nature that take place in outside areas that are not built or modified by humans (e.g., children's free and spontaneous activities in a nearby forest; Kahn & Kellert, 2002). Children's indirect nature experiences are restricted and pre-

planned actual physical encounters with nature, provided by zoos, botanical gardens, and other nature centers (Kahn & Kellert, 2002). Finally, vicarious experiences are not physical encounters with nature, but occur through realistic or metaphorical depicted scenes of nature, such as watching movies about nature, or reading nature-oriented books (Kahn & Kellert, 2002). The range of benefits can vary based on types of nature experiences and duration of experiences. More direct and long duration interactions with nature can lead to more affective and cognitive benefits (Keniger, Gaston, Irvine, & Fuller, 2013).

Previous studies have found that cognitive considerations may not always bring about pro-environmental behaviors (Zhang et al., 2014). As Martín-López, Montes & Benayas (2007) found, there is a weak correlation between being a environmentally knowledgeable person and supporting pro-environmental actions. To fill this gap between cognitive considerations and behaviors, scholars have introduced the concept of environmental attitudes and biophilia as significant factors influencing the development of individuals' environmental-friendly behaviors (Martín-López et al., 2007). The concept of biophilia, developed by Wilson in 1984, is defined as a person's instinctive affinity to the natural environment (Hinds & Sparks, 2008). Moreover, it has been found that although biophilia is an inherent psychological affection, it can be learned and enhanced by interacting with nature (Ballouard, Provost, Barre, & Bonnet, 2012). According to neurological science research, children's frequent nature experiences can develop their mindset in a direction that is more intimate with the biosphere (Giusti et al., 2014).

Considering the amount of time children spend in preschools (7 hours of their waking time, per day), preschools and childcare centers that facilitate a wide range of nature experiences can play a determinative role in improving children's environmental understanding, developing comfort with nature, and making a respectful and affective relationship between preschoolers and nature (Gandini, 1993).

Children's Cognitive and Emotional Development

According to contemporary early childhood psychologists, children's cognitive and emotional development is the consequence of a complex and dynamic interaction of nature (Bjorklund & Causey, 2017, Wilson & Wilson, 2015). Developmental psychologists have developed several models of gene-environment interactions, which postulate the impact of the active role of the child in his/her development but put differing emphases on the influences of biology and/or experience on children's development. In recent decades, the number of advocates of the sociocultural perspective of development has grown (Marginson & Dang, 2017). They believe cognitive development cannot be investigated without considering an individuals' cultural context (Cole, 2006). As Vygotsky (1978), the founder of this sociocultural theory believed, learning and development have evolved in a cultural context, and social interactions are what construct meanings in a human's mind. In other words, children's surrounding sociocultural environment, and the practices, values, and the intellectual tools their culture provides, formulate their understanding of their physical world and establish their brains' functions (Nelson, 1998; Bjorklund & Causey, 2017). This does not mean that scientists with a sociocultural perspective ignore the influence of biological bases of cognitive development, but they realize that to develop typical cognitive abilities, individuals should interact with typical social environments over the course of early childhood (Bjorklund & Causey, 2017).

From an emotional developmental perspective, by 3 years of age children have regulated a wide range of emotions, from primary feelings including love, fear and anger, to secondary emotions such as guilt, sympathy, empathy and sorrow (Wilson & Wilson, 2015). Similar to cognitive development, the expansion of emotions in early childhood is under the influence of the environmental conditions of the child (Dehart, Sroufe, & Cooper, 2000). In comparison with younger children, having the chance of interacting with a wider and more complex social context allows preschoolers a more comprehensive experience of life, and they show considerable gain in emotional understanding and empathy (Hestenes et al., 2015). Moreover, it is known that preschoolers' developing cognition, by providing them with a more intense thinking and memorizing ability, directly and indirectly impacts their emotional development (Wilson & Wilson, 2015).

As a result, preschoolers are biologically able to develop cognitive and emotional relationships with their surrounding environment. The extent of their cognitive and emotional development is influenced, however, by the amount and quality of their exposures to nature during early childhood. Accordingly, this matter should be taken

into consideration while designing and developing environmental educational programs for preschoolers. However, Vandermaas et al. (2017) argued that simply providing children with natural outdoor play spaces is not sufficient for nurturing individuals with pro-environmental attitudes and behaviors. They concluded that "a dynamic relationship between the physical context and early childhood pedagogies and philosophies" and early childhood educators' conceptualization of EE are significant factors as well (p. 196). In our earlier research (Omidvar et al., submitted), we evaluated the outdoor and indoor routines of preschoolers, as well as the preschool teachers' educational approaches and goals for preschool children's development in nature. In this paper, we report the results of 'Games Testing' with preschool children, intended to reveal the impact of children's preschool life on their cognitive, emotional, and attitudinal affinity with nature.

Measure of Connectedness with Nature

To date, different scales have been developed to measure various aspects of the human-nature relationship (Table 1). Nonetheless, the only imperial studies that are adjusted to the mental and verbal abilities of preschool children are the Role-Playing Biophilia Interview (Rice & Torquati, 2013) and Games Testing (Giusti et al., 2014). Giusti et al. (2014) adopted developmental methods in harmony with children's conception of the world. The Reggio-Emilia approach believes that children are equipped with *Hundred Languages,* and encourage children to employ all their available expressive, communicative, and cognitive tools (Edwards, Gandini, & Forman, 1998). Thus, in developing their research instrument, Giusti et al. (2014) minimized the use of self-reporting questions, which could restrict children's expressions to verbal answers, and developed an image-based child-oriented technique, named 'Games Testing' (Giusti et al., 2014). The PI of this study tested the Role-Playing Biophilia Interview, and the results and limitations of the method have been published (Shobeiri, Meiboudi, & Omidvar, 2014).

To the best of our knowledge, there is no published research examining preschooler's affinity to nature by using Games Testing except for Giusti et al. (2014). Further, while there have been some studies that look at the environmental attitudes and behaviors of children in Canada (Eagles & Demare, 1999; Huang & Yore, 2005; Legault & Pelletier, 2000), this study is the first within a Canadian context to use Games Testing to attempt to assess bio-affinity. Results contribute to a better understanding of the impact of nature experiences on preschoolers' emotional, cognitive and attitudinal affinity, as well as insight into the applicability of this research instrument for Reggio-Emilia preschoolers, living in Halifax, NS, Canada.

Table 1.
Connection to nature measures

Initials	Scale's Name	Number of Questions	Target Group	Types of questions	Aspects of Connection to Nature
CNS	Connection to Nature Scale (Mayer & Frantz, 2004)	14	Adults	Likert-type	Emotional
NRS	Nature-relatedness Scale (Nisbet et al., 2008)	21	Adults	Likert-type	Affective, Cognitive and Experimental
INS	Inclusion of Nature with Self (Schultz, 2002)	-	Adults and Children	Schematic-type	Affective, Cognitive and Experimental
EIS	Environmental Identity Scale (Clayton, 2003)	14	Adults	Likert-type	Affective, Cognitive and Experimental
EAN	Emotional Affinity to Nature (Kals, Schumacher & Montada, 1999)	16	Adults	Likert-type	Emotional

CNI	Connection to Nature Index (Cheng & Monroe, 2012)	15	Children – 4th Grade	Likert-type	Affective, Cognitive and Experimental
NCI	Nature Connectedness Inventory (Ernst & Theimer, 2011)	16	Children – Elementary Students	Likert-type	Affective, Cognitive and Experimental
RPBI	Role-Playing Biophilia Interview (Rice & Torquati, 2013)	11	Children - preschool	Two-Choices Questions	Affective, Cognitive and Experimental

METHODS

This paper is a part of a larger mixed-methods study that evaluates the bio-affinity and indoor and outdoor nature exposures of children, as well as the pedagogical approaches to nature exposure taken by the teachers, at two Reggio-Emilia-inspired preschools in Halifax, Nova Scotia, Canada. We purposefully chose to sample from Reggio-Emilia preschools, as the nature-related philosophy affords children the opportunity of being exposed to nature in their daily lives. As part of the larger study, we previously reported on measures of preschooler's indoor and outdoor nature exposures and interviews with teachers that focused on the children's interactions with nature (see Omidvar et al., submitted). In this paper, we focus on measures of bio-affinity amongst these preschoolers as determined through Games Testing and discuss the results with reference to earlier research.

To assess children's bio-affinity, we recruited children from 2 preschools in Halifax that follow the Reggio-Emilia approach. In these 2 preschools, 3- to 4-year-old children and 4- to 5-year-old students are studying in the full-day Toddler and 4Plus classrooms, respectively, and the adult/child ratio is 1 to 5.

The directors of each preschool distributed a recruitment email, including an information bulletin about the project and a parental consent form to 46 families whose children had been in the preschool for at least the past full year. Children whose parents consented became the cohort of students for this study. Twenty children aged 3 to 5 years (11 female and 9 male) participated. To create a trustful and friendly connection with the participating children, the interviews were begun with warm-up questions about the children's favourite foods, games, colors, etc. Games testing (GT) with the children was conducted in a quiet space within the preschools, during school time, lasting between 30-40 minutes per child. At the end of the interview, each child received a certificate of participation in the study.

We used the "Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere" instrument developed by Guisti et al. (2014). The GT process is divided into 3 phases. In the first phase, children's emotional affinity with nature is evaluated using 2 games. The purpose of the first phase is to understand children's level of empathy for other ecological living elements and their feelings regarding positive and negative environmental behaviors.

The second phase is designed to measure children's environmental awareness, which has both a knowledge-based component and a perception-based component (Giusti et al., 2014). This phase evaluates children's awareness of the interconnection between human needs and the ecological services provided by nature, and the harmful impacts of environmental pollution on people, animals, plants and vehicles.

The Third phase of the GT focuses on children's attitudinal affinity with the biosphere by asking 2 sets of questions about where they usually play, their preferred playing areas, and where they feel safe and free to play. Children answer these questions by selecting among the images of various environments. Then, in a short interview, they rationalize their choices using their own words. All answers were audio-recorded and transcribed.

Considering the small sample size (n = 20), statistical tests were not applicable. Thus, the first 2 sections of the GT were examined using descriptive statistics to determine the scores preschoolers gained in each section. To understand the open-ended verbal responses associated with section 3, the transcriptions of children's verbal explanations were analyzed using an inductive approach in NVivo software (Bazeley & Jackson, 2013). To keep children's identities confidential, participant codes were assigned (C1 through to C20).

RESULTS AND DISCUSSION

In the following sections, we summarize the results of each phase of the GT, and discuss the applicability of this instrument for preschool students in the Canadian context.

Phase One: Children's Emotional Affinity with the Biosphere

To evaluate the children's level of empathy for the biosphere, the children were shown ten images of various animals, plants, and vehicles, and asked, "Does this [image] have feelings?". It's interesting to note that many of the children (11 out of 20) did not seem able to understand this question, which is demonstrated by 8 of the 11 children answering either all 'yes' or all 'no' to the pictures, no matter what they were shown, and 3 children not responding to these questions at all. A difficulty with answering these questions was not reported by Giusti et al. (2014), and we are uncertain why our cohort experienced such difficulties, since the questions seemed quite straight forward. While we did not perform a specific evaluation of this question, it should be noted for future use of this tool.

Of the 9 children who answered the questions, many identified animals as having feelings (Figure 1). For example, fish (7/9), hens (6/9) and birds (9/9) were all deemed to be able to feel. Each child had a different explanation for why an animal might have feelings. For example, C5 elaborated that as birds fly and turn away from people, it shows that they feel a sense of fear. Except for birds (9/9), trees were the only item that received unanimous votes for having feelings. C17 believed that trees feel good because of all the water and sunshine they receive. When presented with a picture of reindeer, the number of children reporting that it had feelings declined to 4 out of 9. As C11 explained, reindeer are so strong and fight with each other that they do not feel anything, specifically pain. It seems that, to C11, feelings are associated with pain or extreme emotion. It is also interesting to note that things that adults do not normally associate with having feelings were identified by children as having them. Children often identified non-living items such as chopped trees (5/9), airplanes (5/9), bicycles (4/9) and cars (3/9) as having feelings. While children identified non-living items as having feelings, when analyzing the responses using the established scale for emotional affinity with nature, the responses show that these children do have some emotional affinity with nature (Mean = 5.8, SD = 1.98, n = 9), which dominated over the non-affinity answers (Mean=3.2, SD=1.98, n = 9). If we are to add on the scores of the children who did not answer the questions at all, the mean of the answers representing emotional affinity goes down significantly (Mean = 2.9, SD = 1.98, n = 20) and the non-affinity answers soars (Mean = 7.1, SD = 1.98, n = 20). This suggests that the cohort does not have emotional affinity with nature.
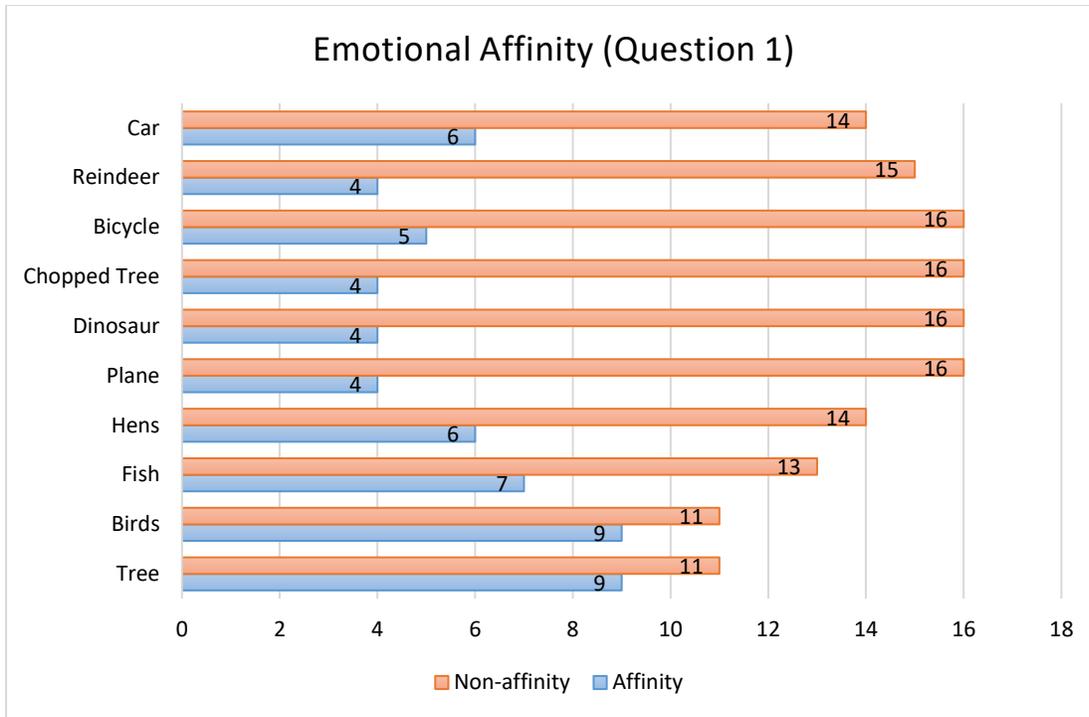
Figure 1: Emotional affinity with the biosphere (question 1)

For Game 2 in Phase 1, children were shown what are considered 3 pro-environmental activity images (i.e. watering plants, planting trees, and cleaning the streets) and 5 negative environmental issues and behavior images (i.e. ground, air, and water pollution; real and cartoon chopped trees). They were asked to express their feelings for each picture by using the image of a smiling or a sad face. As Figure 2 depicts, the majority of the children felt happy about watering plants and planting trees, as well as cleaning up the streets. A slightly lesser majority felt sad about the pictures that depicted air pollution and ground pollution and photographs of 'real' chopped trees. Just less than half of the children picked a sad face when responding to the images of cartoon chopped trees and water pollution. As a result, the ratio of the answers representing emotional affinity with nature (Mean = 11.75, SD = 2.13, n = 20) is greater than that of the answers representing non-affinity with nature (Mean = 8.25, SD = 1.98, n = 20), but it should be noted that the emotional affinity mean is not very high.

Although it was mentioned by the teachers that the children spend almost 3 hours per day in outdoor nature-related environments and are provided with rich indoor nature exposures, this cohort of children were not emotionally affiliated with nature, based on the results of the Games Testing research instrument. This result is not aligned with the results of Giusti et al. (2014), who found that children with nature-rich routines show strong empathic concerns towards nature and are sensitive towards harmful environmental behaviors. Furthermore, the failure of the 2 Reggio-Emilia preschools in developing emotional bio-affinity among children is in contradiction to Vandermaas's et al. (2017) conclusion, which showed that children in Reggio-Emilia preschools show strong positive emotional relationships with nature, specifically with plants and animals. In the current study, children's weak emotional bio-affinity may be due to the deficiencies of the pedagogical approach itself, its implementation in the 2 preschools tested, the research instrument in testing bio-affinity amongst this age group, or its application in this context. However, it would be interesting to compare these results with children who came from preschools with different pedagogical approaches to see if there is any significant difference in their emotional affinity with nature.
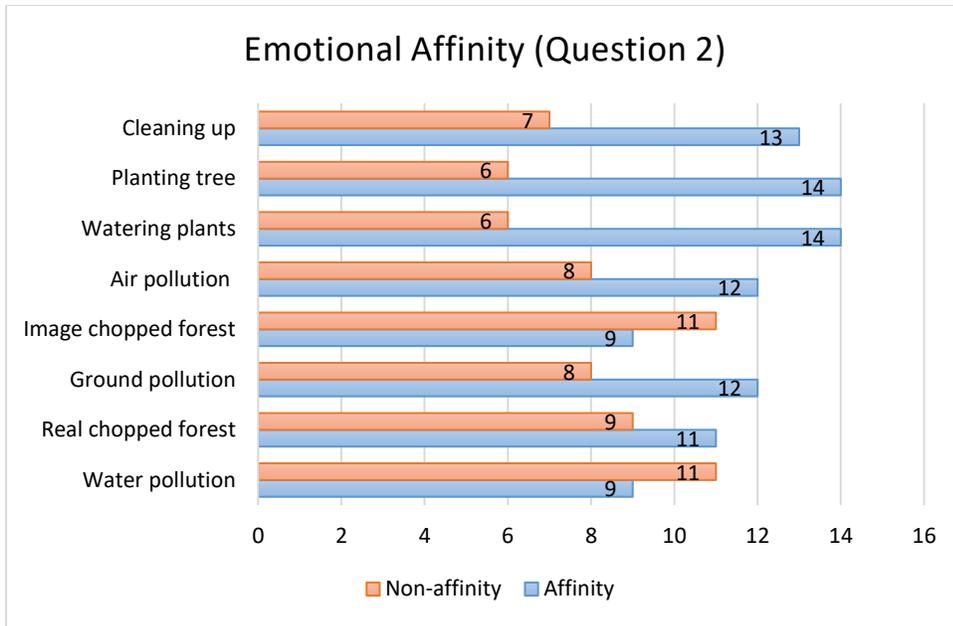
Emotional Affinity (Question 2)

Figure 2: Emotional affinity with the biosphere (question 2)

Phase 2: Children's Cognitive Affinity with the Biosphere

To evaluate the children's knowledge of the interconnections between human needs and the ecological services provided by nature, the children were asked to couple the images of 10 products to associated natural resources and some associated human-made objects (Question 3). Table 2 demonstrates how the responses are categorized in analysis. For example, a child with less than 2 correct answers is environmentally unaware, and a child with 6 correct answers is strongly environmentally aware.

Table 2.
Cognitive affinity with the biosphere (Question 3)

	environmentally unaware (<2 correct answers)	weak environmental awareness (2-4 correct answers)	average environmental awareness (5 correct answers)	strong environmental awareness (6-7 correct answers)	environmentally aware (>8 correct answers)
Responses	11	4	3	1	1

A small majority (11/20) of the preschoolers gave less than 2 correct answers, and the results are skewed heavily to having lower environmental awareness. Some examples of the incorrect answers given by the children were matching eggs with pigs, paper sheets with lettuce, and carrots with bunnies and horses. Thus, most of the preschoolers who participated in this study lack the knowledge related to interconnections between human needs and natural sources. Only 10% had strong environmental awareness or higher. These results are in stark contrast to the findings of Giusti et al. (2014), who found that of the children who had nature-rich routines in their lives, 77% of them had strong environmental awareness or higher.

In Game 4 of Phase 2, children were asked about the harmful impacts of environmental pollution on people, animals, plants and vehicles. Although the responses representing cognitive capacities to affiliate with nature outnumber the responses representing non-affinity with nature, most of the children's responses were anthropocentric in nature

(see Figures 3, 4 & 5). The preschoolers responded that all types of pollution are harmful for people, and in particular for themselves, but scores were slightly lower for animals. One of the potential reasons for these anthropocentric responses can be explained by Piaget's theory (Bretherton, Beeghly, 1982). Piaget (1973) believes that one of the remarkable characteristics of 3- to 5-year-olds is selfishness and egocentrism, which means they are unable to take the point of view of others, and consider themselves the most important element of existence. Moreover, Malone (2007) is of the idea that parents' perceptions of safety and risk is influential on children's perceptions of the world. She believes that the 'culture of fear of nature' spread among North American parents has resulted in exposing children to frightening issues and how they as human beings can be harmed. As a result, children may have developed a mindset in which every unfamiliar condition is considered a high-risk and harmful situation, without having knowledge about its nature. So, when they are asked, while looking at a picture of polluted ocean, whether it is harmful for you, their answer is "yes".

These results may also be explained as a consequence of this cohort of children not yet being exposed to different sorts of environmental pollution, and not having a full sense of the various aspects of current newsworthy environmental issues. Further, Piaget (1973) believed that preschoolers are not able to comprehend complex concepts such as causes and effects. This is potentially true in this study as the children were not cognitively able to predict the consequences of pollution on other creatures. As Teacher #3 explained: "We haven't seen too much of air or water pollution. When we take ferry rides, or walk along the waterfront, they do notice that there is some pollution in the water. Other areas we go to don't have as much pollution. When we talk about things that the kids cannot see, it's a little bit harder, especially with this age group…."

While we note that Game 4 reveals the children as having moderately strong bio-affinity in their responses, the responses are anthropocentric. Further, when compared with the results of Giusti et al. (2014), we notice that this cohort of children has weaker results in terms of cognitive affinity with the biosphere. They had a weak cognitive ability to recognize the connections between finite products and relevant ecological resources, as well as the harmful impacts of pollution on animals. This may stem from our cohort interacting with a social and cultural context that has not provided sufficient learning and cognitive development opportunities (Bjorklund & Causey, 2017). Further, the difference between our study and that of Giusti et al. (2014) may be a result of differences in the curriculum presented to the students in our Reggio-Emilia preschools and that of the Swedish students in Giusti's study. Alternatively, it may be a result of a difference in sample size (in Giusti's study, N = 37), and/or a familiarity of the children with images presented, as they were taken directly from the Giusti et al. study and may have been more familiar to a European audience.
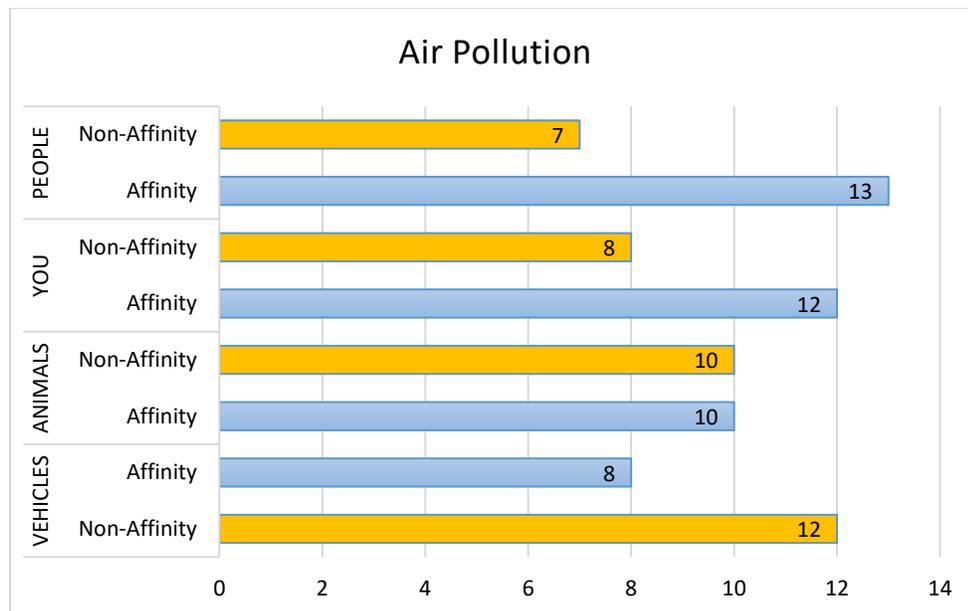

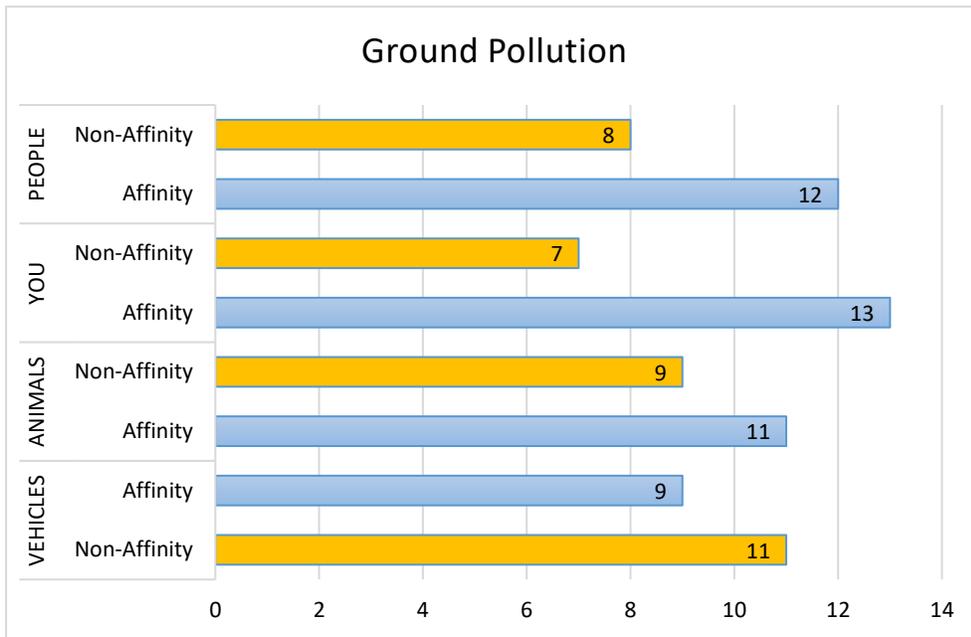*Figure 3:* Responses to the question of who/what is harmed by air pollution

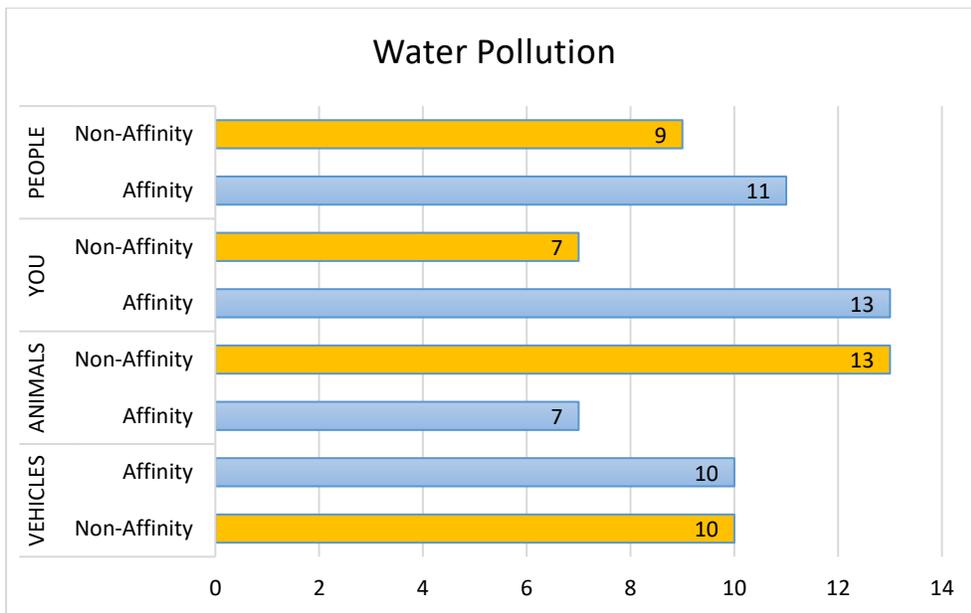*Figure 4*: Responses to the question of who/what is harmed by ground pollution

Figure 5: Responses to the question of who/what is harmed by water pollution

Phase 3: Children's Attitudinal Affinity with the Biosphere

To evaluate the children's attitudinal affinity with nature, the children were asked about where they usually play, their preferred playing areas, and where they feel safe and free to play (children could choose more than 1 picture) (Question 5). Results show that this cohort of children most prefer to play in an outdoor setting, with playground (11/20), and farm (7/20) being the top choices. It is interesting to note that playgrounds are also where the children play the most (14/20), yet none reported to ever play on farms (0/20). When asked to elaborate on the reasons for their preferences, the children's responses were varied:

C2:   "I like the playground. I like to slide down the slides. I like the farm, too, because there are animals there. I like to play inside, because I want to stay warm"

C12:   "There are horses in the farms. I like to run fast with horses"

However, 8/20 children said that they play most inside with toys, and 6/20 children stated that playing with toys inside was their preferred location. When asked where they feel the most free to play, 9/20 children said they felt most free on the playground. As a child explained: "I am free on the playground. My mom tells me to go there to play with my brother. There are lots of slides" (C10).

Yet, indoor play such videogames (5/20) and playing inside with toys (8/20) show that some of the children prefer non-nature-exposure related activities:

C6:   "I feel free in preschool. There are cows and chickens and tractors in the farms. I should keep safe from the cows and chickens"

C18:   "Inside! There are lots of books and toys here. I do not like if my pants get wet"

Further, playing indoors with toys was where the children said they felt most safe to play (15/20), although playgrounds were also identified by 9 of the children as safe. Some examples of children's elaborations are: "daycare is safe, because there are no bad guys" (C16); and, "if you play in the room, you will not get scratches!" (C17).

This wariness of outdoor spaces was echoed in the negatively worded questions where green areas (12/20), outdoor streets (8/20) and forests (8/20) were identified as the top areas where the students do not play. These same places were the top areas that students did not feel safe to play. Some children explained: "If I go outside and play on a road, a car hit me by the tires and I have blood" (C2); "In forest, fox will come and catch me!" (C4); and, "I don't like the forest. There is bad stuff there. They had a bear!" (C12).

Further, several of the children reported that they do not feel free and safe on farms. They explained:

C12:   "Farms are not safe, because if the horses are out of their cage, they might kick us or something!"

C10:   "Because if I stay in the farm by myself, I would never see my mom and dad and I never find them"

C17:   "Sometimes grass can hurt, you know. The farm is the only picture that I don't feel safe there. I just don't like all that animals gather around me. That makes me a little nervous or scared

The results of Games 5 and 6 offer mixed results for bio-affinity (see Table 3). While they show that children prefer to play in outdoor settings, they also report that they feel the safest indoors. These results are similar to what Giusti et al. (2014) reported in his article. According to them, due to having the fear of getting lost, wild animals, and getting injured, indoor environments and wild environments are the most- and the least-safe places, respectively, for both children with nature-rich and nature-deficit routines. They found that social factors, parents' environmental attitudes, and children's exposures to nature during family activities are the most influential factors on children's attitudinal affinity with the biosphere. The results of this study lend support to the idea that children are spending much more time indoors (Mainella et al., 2011), and children who are not exposed to natural experiences will fear nature (Bixler, Carlisle, & Hammitt, 1994), and have less affinity for it (Giusti et al., 2014).

Table 3.
Attitudinal affinity with the biosphere (Question 5 & 6)

POSITIVE QUESTIONS (5)	Grass	Indoor videogames	Play-ground	Farm	Indoor toys	Green area	Outdoor street	Forest	Cannot answer
Where do you usually play the most?	4	2	14	0	8	0	1	0	0
Where do you like to play, and why?	3	2	11	7	6	2	1	3	0
Where do you feel the most free to play, and why?	2	5	9	2	8	0	2	2	0
Where do you feel the most safe to play, and why?	3	6	9	2	15	2	2	1	0
NEGATIVE QUESTIONS (6)	**Grass**	**Indoor videogames**	**Play-ground**	**Farm**	**Indoor toys**	**Green area**	**Outdoor street**	**Forest**	**Cannot answer**
Where do you NOT usually play?	2	3	0	3	0	12	8	8	3
Where do you NOT like to play, and why?	1	5	1	1	0	0	5	8	3
Where do you NOT feel free to play and why?	1	1	2	5	1	1	7	1	7
Where do you NOT feel safe to play? and why?	1	1	1	5	0	0	5	5	7

Applicability of this instrument in the Canadian context

It is possible that the Games Testing procedure that was used was not an appropriate test for measuring emotional, cognitive and attitudinal bio-affinity. In using this test, we noted a number of issues associated with the procedure as it related to our cohort of children in the study.

Issue 1. Employing this method showed that the impact of children's imaginary world during early childhood may not have been considered in developing this research instrument's questions and analysis methods. For instance, in the first Game, believing in the notion that "airplanes/dinosaurs/bicycles have feelings", and not being able to distinguish living from non-living elements are considered as responses that represent preschoolers' non-affinity with nature. However, it is known that by 2 years of age, children are engaged in pretend play and are able to understand the features of pretense (Harris, 2000). During the first 3 years of life, "children use fantasy, make-believe, and symbolic behavior in representing one object as another" (Kaugars & Russ, 2009, p. 733). Thus, from a preschooler perspective, an airplane may have the same characteristics as a bird, which may not necessarily reflect

a lack of emotional affinity with nature.

Issue 2. More than half of the children that participated in this study (11/20) could not understand the point of the first question of the Games Testing, which is: "Does this [image] have feelings?", and as such the question was not able to actually evaluate the preschoolers' emotional bio-affinity. It is uncertain whether this confusion around the question is a common issue among 3- to 5-year-old children, or if this particular age group are cognitively and emotionally able to comprehend the meaning of this question. This issue draws attention to the importance of modifying the Games Testing questions to a particular audience to gain optimum results.

Issue 3. The other issue is related to the duration of playing the Games Testing. The total amount of time needed to perform a complete set of games is approximately 30 - 40 minutes for every child. Since 3- to 5-year-old children's normal attention span is around 10-15 minutes (Neville & Neville, 2007), asking them to stay concentrated on an activity for about 30 minutes can end up in children getting bored, distracted, and upset. As a result, decreasing the duration of performing a complete set of games, by reducing the number of pictures, choosing more meaningful and purposeful images, and modifying the questions, could be helpful in assessing bio-affinity.

Issue 4. To be able to compare the results of the current research with Giusti's et al. (2014) conclusions, we used the same set of pictures that was previously used by Giusti et al. (2014). As Appendix B shows, Giusti et al. (2014) used a combination of real and image (cartoon) pictures. For example, in the first question, they used both photographic and cartoon images of chopped trees. During implementation of the Games Testing, we found that some children had difficulties in understanding the cartoon images. Thus, choosing more meaningful and easily understandable pictures and using the images of local locations may help children in better comprehending and relating to the question. Additionally, children may not see paper images of nature in the same way as they see nature, when they are immersed in it. Future studies can evaluate children's bio-affinity while they are present in nature and show them real items, instead of using paper pictures.

CONCLUSION

This paper is part of a larger study that examined the frequency and variety of indoor and outdoor nature experiences for children at 2 childcare centers (see Omidvar et al., submitted). The results from the first paper showed that the Reggio-Emilia preschools have provided the preschoolers with multiple opportunities for education 'in', 'about', and 'for' the environment, through direct, indirect, and vicarious experiences with nature. The interior design of the preschools offered a great number of indirect and vicarious indoor nature experiences. Moreover, children were exposed to a wide variety of direct outdoor nature-related activities in their daily curriculum for almost 3 hours per day, including playing in nature, observing and studying natural creatures, collecting and making a display of ecological elements, and small-scale cultivation. This paper focuses on how experiencing nature during preschool life influences children's cognitive, emotional, and attitudinal bio-affinity. In this study, we used the GT research instrument (Giusti et al., 2014) to evaluate 20 preschool children's emotional, cognitive, and attitudinal affinity with nature in Reggio-Emilia preschools. As Table 4 shows, the results are mixed.

Table 4
The results of the games testing

Game	Measuring	Strong	Moderate	Low
1	Emotional Bio-Affinity			*
2	Emotional Bio-Affinity		*	
3	Cognitive Bio-Affinity			*
4	Cognitive Bio-Affinity	*		
5	Attitudinal Bio-Affinity			*
6	Attitudinal Bio-Affinity			*

In general, the results indicate that this cohort of preschoolers is not emotionally affiliated with nature. Although children showed moderate concern for negative environmental behaviors, 11 children had difficulties with answering the questions related to non-human feelings and some children were not able to distinguish living from lifeless entities. Thus, the quantity of responses reflecting empathy for nature was lesser than the non-affinity answers[1].

Further, this cohort of children was not able to successfully recognize the role of natural resources in producing everyday products and they showed a weak cognitive ability to recognize the harmful impacts of different sorts of pollution on animals.

Moreover, results reveal that the children's negative attitudes towards nature, which can be the result of fear of both wild and domesticated animals and of getting lost or injured, have resulted in the children feeling safer and more free in indoor environments and playgrounds, and reluctant to spend time outdoors in green and natural environments.

This paper contributes to the evolving body of the literature on early childhood EE by examining bio-affinity of children in preschools who have nature as a part of their curriculum. The results show that the Reggio-Emilia pedagogical approach implemented in these preschools has not resulted in developing strong bio-affinity amongst the children. This may be due to the influence of children's socio-cultural background, the pedagogical approach itself or its implementation at these schools, but may also be due to the research instrument's ability to test for bio-affinity amongst this age group in Canada, or its implementation in this study. Future studies should continue to explore young children's environmental affinity throughout the country and globally, with emphasis on determining whether an increased sample size might change the results. Further, the tests should be conducted in different seasons, cultures, languages, and programs. Given the mixed results from our GT, but the relatively high degree of nature exposure that this cohort experiences compared to national averages, it is highly recommended that the Guisti et al. (2014) instrument be further tested for its' appropriateness for various settings, ages, and cultures.

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[1] This score is for the full 20 children – if evaluating only the 9 children that answered the question there is a moderate level of emotional affinity.

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The Case for Nature Connectedness as a Distinct Goal of Early Childhood Education

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ABSTRACT

The importance of young children learning about the natural environment has been recognised in policy and curricular frameworks around the world. Moreover, there has been a call for children to spend more time outdoors and to reconnect with nature. However, the distinct construct of nature connectedness has not been examined in detail in relation to early childhood education. This article aims to bring together environmental psychology literature and early years' policy in an attempt to make the case for nature connectedness becoming a distinct goal in early childhood curricular frameworks. Furthermore, it aims to highlight gaps in the research literature and offer clear directions for future research.

Keywords: nature Connectedness; young children; early childhood; curriculum; policy; outdoor learning

It is generally agreed that good quality early education can play an important role towards the optimal development of children (Pianta et al., 2016). The effects of good quality early education are not merely transitory, but can be seen long after that phase of life has finished and well into adult life (Barnett, 1998; Ramey et al., 2000; Reynolds and Ou, 2011). The effects in question include cognitive skills and academic achievement (Ramey et al., 2000), but also encompass aspects of psychological wellbeing, in this case defined as smaller likelihood of depressive symptoms (Reynolds and Ou, 2011).

These advances in our understanding of the effects of quality early education and care have informed both policy and practice in most developed countries. Early years' curricula and frameworks for early childhood are now shaped around children's developmental needs (Kostelnik, Soderman, Whiren & Rupiper, 2007). Moreover, many modern early years' frameworks, such as that of Australia (Australian Government, 2009) and Scotland (Scottish Government, 2008) tend to value wellbeing[1] as a distinct outcome of this educational phase.

The aim of this conceptual paper is to put forward and substantiate the thesis that nature connectedness should be seen as a worthwhile goal, and a possible distinct outcome in early years' education. Nature connectedness is the extent to which a person identifies themselves as being a part of nature, also defined as a "sense of oneness with the natural world" (Mayer and Frantz, 2004, p. 504). To this effect, it will first outline the construct of nature connectedness and its correlates. The aims of early years' education as they are currently articulated in several curricula, will be looked at in conjunction. The argument that nature connectedness is a positive characteristic for both the individual, but also society as a whole will be unfolded, with reference to the current state of the literature.

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[1] For the purposes of this paper the author will use wellbeing in the broadest sense possible, as defined by Dodge, Daly, Huyton & Sanders, 2012). Their multi-faceted definition focuses on a state of equilibrium, or the ability to maintain a state of homestasis. This ability is dependent upon having the psychological, social and physical resources to meet life's challenges. When the term 'wellbeing' is used within the paper in different ways, this will be defined in the relevant section. This is necessary when referring to other studies that have used the same term to describe subtly different constructs.

Ways in which nature connectedness can be promoted in the early years will be explored and, finally, directions for future research in this area will be presented. The central themes of this paper are presented in the image below (figure 1). This paper should be of interest to policy makers and practitioners involved in early childhood education, as well as a useful addition to the existing literature in informing further research.
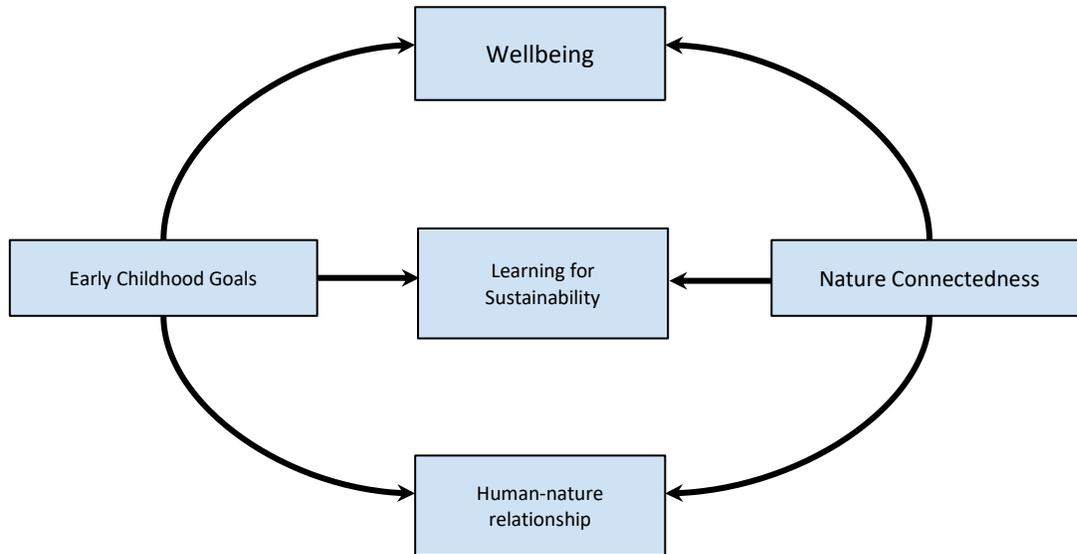

Figure 1. Relationship between Early Childhood Goals and Nature Connectedness.

Nature connectedness

Nature connectedness is the most common term used to describe a positive human-nature relationship. Other terms, such as Nature Relatedness (Nisbet et al, 2009) and Inclusion of Self in Nature (Martin and Czellar, 2016) have also been used and have largely similar characteristics. For the purposes of this article nature connectedness is the subjective perception of the self being a part of nature (Schultz, 2002). Nature connectedness as a construct has several elements, namely cognitive and affective strands (Mayer and Frantz, 2004; Schultz, 2002), as well as experiential and behavioural aspects (Nisbet et al., 2009). The cognitive strands mentioned above relate to the thoughts we have towards the environment (e.g. "I have a deep understanding of how my actions affect the natural world"), while the affective strands towards our feelings and emotions towards the natural world (e.g. "I often feel part of the web of life."; Mayer and Frantz, 2004). The experiential and behavioural aspects, particularly measured through the Nature Relatedness scale (Nisbet at al., 2009) are mostly referring to choosing to spend time outdoors (e.g. "I enjoy being outdoors, even in unpleasant weather" and "I enjoy digging in the earth and getting dirt on my hands.") and pro-environmental behaviours (e.g. "Nothing I do will change problems in other places on the planet[2]").

It should be noted that nature connectedness can be seen both as a personality trait (Kals, Schumacher & Montada, 1999), meaning that is largely stable across time, as well as a state (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009), which can be changeable according to our experiences. In fact, positive experiences of nature, as well as learning experiences outdoors, have been found to increase nature connectedness in a host of studies (Barrable & Lakin, under review; Lumber, Richardson & Sheffield, 2017; Mayer et al., 2009; Vining, Merrick & Price, 2008). The kind of experiences that promote nature connectedness will be looked at in more detail in a separate section of the article.

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[2] This item is reverse-scored.

Nature Connectedness and wellbeing

A host of empirical studies strongly suggest that simply being in contact with natural environments[3] is good for both our mental wellbeing (Grinde & Patil, 2009; Russel et al., 2013) and our physical health (Health Council of the Netherlands, 2008; Mitchell & Popham, 2008). Specific research on the benefits of nature contact for children has outlined green and other natural areas as "essential elements of healthy communities for children" (Chawla, 2015, p. 433). A recent large longitudinal study from Scotland has found that access to natural space in the neighbourhood may reduce social, behavioural and emotional difficulties. This effect is stronger in children who have access to private gardens (Richardson, Pierce, Shortt & Mitchell, 2017). Moreover, positive cognitive effects have been observed after exposure to natural and green environments (Faber Taylor & Kuo, 2009), while other studies have discovered the restorative benefits of being in nature (Hartig, Evans, Jamner, Davis & Gärling, 2003; Van den Berg, Hartig & Staats, 2007).

Feeling connected with nature has been found to be associated with more frequent visits to green spaces (Lin et al., 2014), therefore perhaps partially explaining what nature connectedness itself is correlated with increased wellbeing (Nisbet & Zelenski, 2014). However, the element of connection in itself should be highlighted as one of great importance in this relationship (Zelenski & Nisbet, 2014). Although it should be highlighted that all the evidence in the area of wellbeing and nature connectedness is correlational, with all the limitations this has, the relationship has been documented in several studies.

Wellbeing, as a psychological construct, is usually conceptualised in two separate but often interrelated dimensions: hedonic and eudaimonic wellbeing (McMahan & Estes, 2011). Hedonic wellbeing mainly relates to the experience of pleasure and the satisfaction of desires (Kahnemann, 1999), while eudaimonic wellbeing is mainly focused on the 'good life' in the Aristotelian sense, and the finding of meaning in one's life (Ryff, 1995). A large meta-analysis of a total sample size of 8523 found that there was a positive correlation between positive affect and nature connectedness ($r = .22$) and life satisfaction ($r = .17$; Capaldi, Dopko & Zelenski, 2014). Vitality was also used as a measure of wellbeing in the above study, with a correlation of $r=.24$ with nature connectedness. It is worth noting that although this may look like a small correlation it is comparable to that of income and education level in relation to wellbeing (Capaldi et al., 2014).

A 2018 study in preschool children, the first of its kind, found that nature connectedness was positively associated with enhanced psychological functioning (Sobko, Jia and Brown, 2018). The study, which used a parental report measure, found increased connectedness to nature to positively correlate with improved prosocial behaviour, fewer behaviour and emotional difficulties. This study signals the beginning of more research into young children's connectedness to nature, its correlates and hopefully ways to promote such a relationship.

Nature Connectedness and Sustainability

Another positive construct related to nature connectedness is pro-environmental attitudes and behaviours (Nisbet et al., 2011). As environmental destruction and climate destabilisation are most likely to be central concerns for this and the next generation(Sundblad, Biel & Garling, 2007) environmental education is often seen as one of the key ways to enact behaviour change in respect to protecting the environment (Jacobson, Carlton & Devitt, 2012). However, knowledge alone is not enough to initiate the major behaviour changes that are needed and there is a notable gap between acknowledging environmental dangers and acting in a pro-environmental way (Kollmuss & Agyeman, 2010). This is where nature connectedness which comprises of cognitive, affective and behavioural elements (Schultz, 2002) could be seen as gateway to inspiring pro-environmental attitudes and behaviours in the

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[3] While different studies define natural environments in different ways, for the purpose of this paper the author will use the definition of Mausner (1996) to encompass all four types, including 'totally natural', 'civilized natural', 'semi-natural' and 'quasi-natural'. These four types are in contrast to 'non-natural' environments. This kaleidoscope version of the term is used in order to include the maximum possible settings that may be identified as 'natural', as different studies that will be reported in this paper may have present different definitions.

next generation of citizens. Although research to date has not causally linked nature connectedness in early childhood with adult pro-environmental behaviours, there are studies that have demonstrated a correlation in adults between nature connection and both concern for the environment and pro-environmental behaviours (Nisbet, Zelenski & Murphy, 2009). In general connection to nature has been seen as a driver of behaviour, linked to the deep motivation of feeling connected and part of a greater whole, or what Frantz and Mayer call the "we-ness" aspect (2013, p. 85). Finally, adult environmentalism has been shown to have its roots deep in childhood, and positive childhood experiences in nature (Wells & Lekies, 2006).

Early childhood as the time to start developing nature connectedness

It is generally accepted, and usually based on various evolutionary theories, including that of Biophilia (Kellert & Wilson, 1993), that humans have an innate predisposition to connecting with their natural environment. However, it was David Orr (1993) who first put forward the idea that there may exist a 'critical period' during which one's positive experiences in nature get translated into biophilic tendencies, and therefore precede a later positive relationship with the natural world.

If we were to look at nature connectedness as part of one's identity, related to an environmental identity we should keep in mind that the creation of someone's identity, for example a national or ethnic identity, can have roots in childhood, and environmental identity is no different. It is through our personal history and emotional attachment that we develop an 'environmental identity' (Clayton, 2003). This can then often be reinforced through societal, affective and historical affiliations. In a retrospective study, Tam (2013) found that adults with higher nature connectedness recalled spending greater amounts of time in nature during their childhood, than those with lower levels of nature connectedness. Another study of similar design found a correlation between childhood nature experiences, and adult environmentalism (Wells & Lekies, 2006). Both studies indicate that childhood could be an ideal time to start nurturing our connection to nature. Finally, Chawla (2009) further looks into the process of socialisation for care towards nature, in childhood and early adolescence, with childhood experiences playing a central role in later attitudes and behaviours. Evidence from an empirical study that looked at environmental education programme evaluations showed that sustained changes in nature connectedness, measured at a follow-up 4 weeks post intervention, were significantly higher in children aged nine and ten years old, than in older children or university students (Liefländer, Fröhlich, Bogner & Schultz, 2013). The researchers suggest that strengthening nature connectedness are more sustainable when made before the age of eleven. High quality longitudinal studies are needed to confirm this.

Current state of the early childhood policy around the world

The following section will examine current early years' policy in different English-speaking countries around the world, in an effort to make links with the literature on nature connectedness which was outlined above. This section has a two-fold aim: to highlight how there are existing early years' curricula in various countries which implicitly hint at human-nature relationships as a distinct goal, and at the same time to draw out other elements of these curricula that would be directly enriched by the inclusion of nature connectedness as a distinct goal. These elements include wellbeing and sustainability.

Human-human relationships and human-nature relationships in the early years (EY)

Most early years' frameworks place human-human relationships at the centre of early childhood education and care. The Scottish government, in a supporting document for guidance to practitioners places great importance on the early attachment process, most notably with the primary caregiver(s) (Scottish Government, 2014). The document focuses on attachment between child and parent, but also highlights the role of the practitioner in building secure relationships. In the English framework, personal, social and emotional development, and the formation of positive relationships in this respect, consists of its own area of learning, central to the philosophy of the framework (Department for Education, 2017).

The "Practice of Relationships" has a significant role in *Play, Participation and Possibilities*, the early learning curriculum framework for Alberta, Canada (Makovichuk, Hewes, Lirette & Thomas, 2014, p. 11). And yet, although these relationships encompass the relationships between the educator, the child and the family, a meaningful relationship with the environment is not articulated. Current policy in these countries focuses on nurturing human-human relationship, but not on the human-nature relationship.

The Australian Early Years Learning Framework moves closer to identifying a relationship with nature as a worthwhile outcome in itself (Australian Government, 2009). It puts an emphasis on a greater connection with the whole planet when it presents "Children are connected with and contribute to their world" (Australian Government, 2009, p. 28) as one of the outcomes of the framework. Moreover, this particular framework identifies a connection and respect for nature as a worthwhile goal as "children become socially responsible and show respect for the environment" (p. 32). Finally, *Belonging, Being and Becoming* clearly identifies a "connectedness to the land" (p. 32) in the context of different community protocols and interdependence of humans and the non-human world. In this sense, the Australian framework exemplifies the importance of nature connectedness as a worthwhile early years' outcome, although without explicitly articulating it as such.

Wellbeing in EY policy

The World Health Organisation (WHO) places emotional and social wellbeing as a responsibility of educational establishments (WHO, 2003), while UNICEF regularly collects and publishes data on children's wellbeing signalling the importance it places on the construct (Adamson, 2013; Fanzul, 2014; UNICEF, 2016).

Wellbeing is a common desired outcome in early childhood education and is often found in national early years' frameworks. It is explicitly stated in the Australian, Irish and Scottish frameworks (Australian Government, 2009; CECDE, 2006; Scottish Government, 2008), as well as that of Alberta and Nova Scotia in Canada (Makovichuk et al., 2014; Nova Scotia, 2018).

Education for Sustainable Development in the EY

Education for Sustainable Development has been promoted by UNESCO since 1992, and part of the Sustainable Development Goals (SDG) include both wellbeing at all ages, as well as protection of the natural environment in all its forms (UNESCO, 2017). In many ways, education has been seen by UNESCO as the ultimate vehicle to promote the SDG, but education systems and curricular frameworks have not necessarily been quick to respond to this call. The Scottish Government has set Learning for Sustainability as a priority for all sectors of education, and this is reflected on the Curriculum for Excellence, which underpins education from 3-18 (Scottish Government, 2008b).

Other countries, such as Australia have also included some aspects of sustainability education in their early years frameworks (Australian Government, 2009), while Nova Scotia, in Canada has included some aspect of environmental awareness and respect for the environment in its very recent curricular guidance titled Capable, Confident and Curious (Nova Scotia, 2018). Moreover, echoing the Australia early years' document it urges practitioners to "consider the nature of children's connectedness to the land and demonstrate respect for community protocols" (p. 81). Finally, sustainability as a concept is further mentioned as a worthwhile outcome in both of these frameworks (Australian Government, 2014; Nova Scotia, 2018).

Ways to promote nature connectedness in the early years

In this first part of this article, the point has been developed that nature connectedness is a useful and worthwhile goal for all education, but particularly suited to the holistic development of early years' frameworks. In the following second part of this article, we will explore ways in which nature connectedness can be promoted within an early years' setting, as well as examine some areas for further research into childhood experiences and nature connectedness.

Outdoor learning

As mentioned above contact with the natural world is one of the ways to nurture nature connectedness for all ages. Outdoor learning gives the opportunity for such sustained contact and meaningful engagement. The importance of outdoor learning is being recognised by education leaders and has become part of educational policy in England and Wales (DfES, 2006), and part of the Curriculum for Excellence in Scotland (Brown, 2010). National and regional curricula have introduced outdoor learning expectations in Australia (ACARA, n.d.), in New Brunswick, Canada (Department for Education, 2017), and Ireland (CECDE, 2006). Such developments have often sought to address the decline in outdoor play and learning opportunities for young people outside of formal education (Waite, 2010), as well as what has been named as Nature Deficit Disorder (Louv, 2008).

At the same time, outdoor early years education settings have seen a rise in the last decade in several countries around the globe. In Europe, and countries such as Germany, forest preschools (Waldkindergaarten) started in the 1960s, found approval in the 1990s, while today there are more than 1500 (BVNW, 2018). In Denmark more than 10% of preschools are in forests and other natural settings (Danish Ministry of Foreign Affairs, 2017). Different types of nature preschool practice have developed in countries such as South Africa, Portugal, Brazil, Slovenia, India and Italy (Knight, 2013). In the US nature-based preschools are a growing trend, with the rate of growth having greatly increased in the last 5 years. A Natural Start Alliance (NSA) national survey concluded that there are over 250 of them operating in 43 states (NSA, 2017). In Australia, Bush Kindergarten, adapted from European forest school to fit the climate and cultural identity of the country, has also become increasingly popular (Victoria Department of Education, n.d.; Campbell & Speldewinde, 2018).

However, while there is unprecedented growth in outdoor early childhood education and care settings, the frameworks that guide the outcomes for early childhood education are not always applicable to such nature-based establishments. It is, therefore, an aim of this article to encourage both policy makers and educators in nature-settings internationally to embed nature connectedness as an outcome of outdoor learning.

A pedagogy for connectedness

Although time spent in nature has been found to correlate with nature connectedness (Nisbet, Zelenski & Murphy, 2009; Sobel, 1996), further refining the ways that we engage with it can promote lasting changes in the way children relate to the natural environment. Knowledge-based curricula and environmental education programmes have been found to have an effect on nature connectedness (Barrable & Lakin, under review; Ernst & Theimer, 2011). However, other work has highlighted the affective side of our engagement with nature seems to be key in building life-long relationships with it. Kals, Schumacher and Montada (1999) outlined the process through which positive experiences in nature during childhood translate themselves into greater emotional affinity in adolescence and adulthood. Moreover, this is further linked with nature-protective behaviours. Breaking down this affective relationship with nature four aspects emerge: love, feelings of freedom when in nature, feeling secure when in natural environments and being part of or "oneness" with nature (Müller, Kals & Pansa, 2009; p. 60). It is this element of freedom, and child-led pedagogy that can be crucial in creating the positive experiences that will enhance children's connection to nature. Moreover, supporting children's autonomy when playing and learning in natural settings can lead to gains in overall wellbeing too (Barrable & Arvanitis, 2018). More recent studies looking at the pathways towards nature connectedness have attempted to further explore the roles of emotion. An empirical study into nature connectedness determined that beyond knowledge and mere contact, emotionally engaging with nature, as well as compassion, meaning and beauty are all pathways to nature connectedness in adults (Lumber, Richardson & Sheffield, 2017).

Future directions for nature connectedness in early childhood education

As seen above, the current state of the literature provides us with some idea of how a relationship to the natural environment develops through the life-span, with childhood being a crucial time for development (Müller, 2009; Wells & Lekies, 2006). It also provides us with a theoretical background of how nature connectedness can be nurtured in children (Kals et al., 1999), and features empirical studies, mostly performed on adults, on increasing

nature connectedness through various activities (Lumber et al., 2017; Richardson, Cormack, McRobert & Underhill, 2016; Richardson & Sheffield, 2017; Tam, Lee & Chao, 2013). A summary of this research would bring together the following important points: 1) anthropomorphising nature could lead to increases in nature connection (Tam et al., 2013); 2) *noticing* beauty in the nature around us can enhance how connected we feel to it (Richardson et al., 2017) and 3) engaging with nature through emotion, compassion and empathy, as well as with nature's beauty can be pathways to nature connectedness (Lumber et al., 2017).

Although there is nothing to suggest that the above are not also pertinent to children too, there are also a few empirical studies that have focused specifically on children when it comes to increasing nature connectedness. A 2011 study that focused on fifth-grade students in the US found links between time spent outside and nature connection, and found that nature connectedness partially mediated the effect of time outdoors on environmental stewardship (Andrejewski, Mowen & Kerstetter, 2011). However, the types of activities the children engaged in were not looked at in detail.

This was indeed explored in a study of the educational programme Get to Know (Bruni, Winter, Schultz, Omoto & Tabanico, 2017). The Get to Know programme was designed to promote connection to nature through a variety of activities, of which only a subset were evaluated for the article. These included a creative arts competition, an outdoor nature trail treasure hunt and a virtual hike. Of the three interventions, only the creative arts competition showed a significant increase in nature connectedness after participation (Bruni et al., 2017). This is in line with some of the previous studies suggesting that engaging with nature's beauty, through artistic endeavours in this case, can promote feelings of connection. It is somewhat surprising to see that the outdoor trail did not promote changes in nature connectedness, as previous research in adults has indicated increases in nature connectedness after time spent outdoors, but the authors suggest that more time spent during the hike, or more frequent visits may well give different results. The above study was conducted in primary-age children, the youngest of which was 6 years of age. The point stands that what we, as practitioners might believe promotes nature connectedness may not be supported by the evidence. In this respect, more research is needed.

The process and promotion of nature connectedness in early childhood has only been studied in two recent small studies, one a field report (Tsevreni & Tigka, 2018) and another an evaluation of an ongoing forest school programme (McCree, Cutting, & Sherwin, 2018). In the report, which is from a nursery in Greece, the role of the children as agents of establishing a human-nature relationship is emphasised, as opposed to a more official, adult-driven approach (Tsevreni & Tigka, 2018). This may link to previous theoretical suggestions by Müller et al. (2009) and Barrable and Arvanitis (2018) both of which have supported a drive for freedom and autonomy in nature. The evaluation of the forest school programme was a longitudinal mixed methods project that tracked a small number of children (*n*=11), who were between five and seven years of age upon entry, across the duration of the programme, which lasted for three years (McCree et al., 2018). As at the time of the evaluation there was no scale for use with children of that age, the cohort were only measured upon finishing the programme, with no comparison data from the beginning. However, these nature connectedness scores were compared with matched peers from a local schools. The cohort's nature connectedness scores were significantly higher than those of matched peers who had not participated in forest school.

It should be noted that in a systematic review of nature connectedness interventions (Barrable, in preparation) 26 studies were identified. Eleven of those had children as participants, but only one, reported above (McCree at al., 2018) had children younger than eight years of age participating. This may be attributed to the fact that a validated measure did not exist for this age group before 2018.

In conclusion of this section, there is certainly need for further empirical research on the types of experiences that nurture nature connectedness in children. One way of doing that would be through evaluations of nature programmes such as the one described above (McCree et al., 2018). Moreover, research that will focus on promoting the building of an *affective* relationship with the environment in early years' settings would provide valuable evidence with which to build a basis for pedagogical practice in early childhood settings around the world. One of the challenges that practitioners may face in incorporating nature connectedness as an outcome is difficulties in accurately measuring it, as an age-appropriate validate measure does not currently exist.

Measuring nature connectedness in children

A variety of validated instruments exist in order to measure nature connectedness in adults, such as the Nature Relatedness Scale (NR; Nisbet et al., 2009) the Nature in Self Scale (INS; Schultz, 2001) Connectedness to Nature Scale (CNS; Mayer & Frantz, 2014). All of these scales were found to interrelate with each other to a high degree (Tam, 2013). A scale for use specifically in children was developed and validated by Cheng and Monroe (2012) and was named the Connection to Nature Index (CNI).

The other scales mentioned above were initially designed for use with adults, but two of them have since been adapted for use with children, aged 8-12 (Bragg, Wood, Barton & Pretty 2013). These comprise the short-form NR scale (NR-6; Nisbet et al., 2009; 2011) and the single-item INS (Schultz, 2001). Of these measures, both the NR and CNI scales showed good internal consistency and there was a correlation between all three measures. The CNI was found to be the most preferred measure, by the children who took part in the study (Bragg et al., 2013). These measures have since been used in several studies evaluating outdoor learning and other environmental education programmes (Crawford, Holder & O'Connor, 2017; Razani et al., 2016; San Jose & Nelson, 2017).

Sobko, Jia and Brown (2018), acknowledging the need for measuring nature connectedness in young children devised a parental report measure, based on the CNI (Cheng & Monroe, 2012). The measure, termed CNI-PPC was tested for both internal consistency (n= 299) and external validity (n=194). It was, moreover, compared with the Strengths and Difficulties Questionnaire (SDQ; Goodman, Meltzer & Bailey, 1998) to measure convergent and divergent validity. The CNI PPC was found to be a valid and reliable measure for nature connectedness in preschool children. Its use in further research will shed light on the processes through which children's nature connectedness can be nurtured, as well as further associations of nature connectedness in early childhood.

Conclusion

Several decades ago, in the UNESCO declaration of Tbilisi highlighted the role of education in solving environmental problems (UNESCO, 1978). Environmental education that would focus on the learner's environmental sensitivity at "every age, but with special emphasis on environmental sensitivity to the learner's own community inearly years" (UNESCO, 1978, p 26) was stated as a goal. This, however, never came into fruition in relation to early years' policy in the following decades. Perhaps it is time that this is changed.

This paper has attempted to make the case for the inclusion of nature connectedness in early year curricula, as a distinct and valid goal. The author has outlined both the benefits of nature connectedness, as well as the ways in which nature connectedness aligns with current policy and curricular goals in several countries around the world. Moreover, this article brings together evidence on some of the ways that nature connectedness can be promoted in the early years. Finally, we have presented a clear direction for future research in relation to nature connectedness and early years. It is the author's hope that this article will bring attention to nature connectedness well beyond the usual scope of environmental education professionals and that it will be of use to educators, policy makers, as well as researchers in the field of early childhood.

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Editor's Note: Dr. Carla Gull is the Book and Resource Review Editor. She teaches beginning college classes online with the University of Phoenix, hosts the podcast *Loose Parts Nature Play*, leads nature programming in her local area, facilitates professional development in early childhood, and shares insights on *Loose Parts Play* on social media. Her passion for children's literature stems from searching for the perfect book to share with children. If you have ideas or would like to contribute book or resource reviews, please contact Dr. Gull at Carla.Gull@phoenix.edu.

Embracing More Diverse Representations of Children in Nature Inspired Books

Carla Gull
University of Phoenix, USA
Book and Resource Editor

I love sharing book suggestions and have been asked a few times about nature related books that show more diversity in the cultural/racial identity of the children. Some educators have mentioned not sharing picture books about nature play because they do not depict the skin colors of the children in their care. However, more publishers and illustrators are striving to show nature play as a part of childhood for all children, regardless of skin color. I chatted with Carol Malnor from Dawn Publishing, a publisher focusing on nature related books. She mentioned, ""Nature is such a unifier across cultures. We talk about diversity in nature, but nature can be a real bridge for bringing people together. We've seen that with educators again and again." Additionally, she mentioned, "Our books are for those children who don't have a lot of access to nature. Our books can be an entry to nature for them with the stories, ecosystems depicted, and rich illustrations with nature. We make sure to have a diversity of children represented. We want children to see kids that look like them interacting with nature. We want to show "YOU" in nature. Many of our books depict urban settings. We can still notice animals around us in urban areas. Nature isn't just off and away in the mountains, but it is right under our noses. Our books become an introduction or a spark to nature" (C. Malnor, personal communication, March 7, 2019).

This collection of books merely focuses on nature play with children of more diverse skin colors; however, this conversation can go much deeper. Find additional resources at the end of the article that look at environmental equity, explore the barriers some people of color have in getting outside, and resources on finding more diverse books.
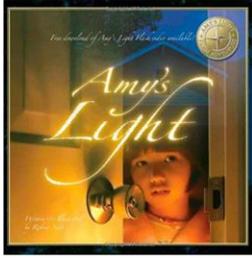
*Amy's Light* by Robert Nutt, ill. Robert Nutt (2010)

Amy notices the lights flashing outside in the night. She grabs a jar and catches the fireflies, yet finds they do not glow in the jar in her room. When she lets them go, they light up her room and help her feel less lonely in this rhyming book.

*Because Your Mommy Loves You* by Andrew Clement, ill. R.W. Alley (2015)
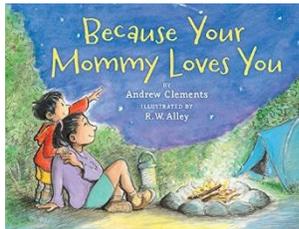
This book shows a mother and son camping as they boy learns the ins and outs of forging a river, putting up a tent, and roasting marshmallows. The mom could rescue him from all these learning experiences, but she doesn't. She lovingly allows him to burn marshmallows, struggle through putting up a tent, and being cold while helping him learn independence and how to be outside. She shows her love by taking him camping and letting him learn and grow.

Bringing the Outside In by Mary McKenna Siddals, ill. Patrice Barton (2016)
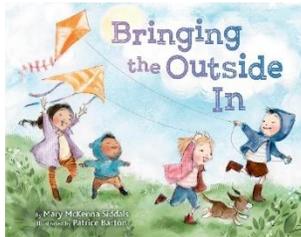
This lyrical book explores how a group of diverse children enjoy being outside playing in nature and consequently bring the outside in. This seasonal book follows them spring puddles, beach visits, fall leaves, and snow angels. The normalness of "cleaning up" after being in nature is portrayed, as mittens dry over the fireplace, leaves are brought back outside, and mud is mopped up. They enjoy looking at pictures of all their adventures again and again!
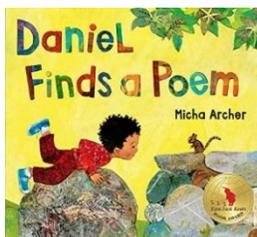
Daniel Finds a Poem by Micha Archer (2016)

Daniel is well acquainted with his local park. When he sees a sign for Poetry in the Park, he asks the spider, squirrel, and other critters what poetry is. Each has a unique perspective when morning dew glistens or crisp leaves crunch. The book shows we can all find poetry as we pay attention to nature around us.
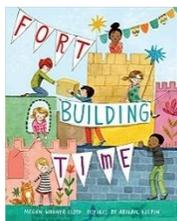
*Fort-Building Time* by Megan Wagner Lloyed, ill. Abigail Halpin (2017)

This book goes through the seasons as children create forts in whatever the weather. The friends make snow forts, sheet forts, sand and driftwood forts, and tree forts as each season changes. The children engage in a variety of nature play, imaginative, and literacy opportunities, as well as more traditional blanket and box forts inside.
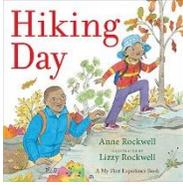
Hiking Day by Anne Rockwell, ill. Lizzy Rockwell (2018)

An African American family drives out of the city in the fall to a nearby trail. They discover forest animals, such as the toad, woodpecker, chipmunk, deer and porcupine. They climb higher and higher until they reach the summit.

I Am the Rain by John Paterson (2018)
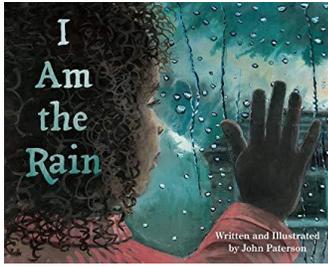
This rhyming story is told from the perspective of water, sharing the many ways water can present itself as part of the water cycle. In the book, water takes on the form of rain cloud, storm water drainage, waterfall, wave for surfing, snowflakes, icy ponds, a bay, a stream through a canyon, fog, and more. Great seasonal approach to the water cycle as well. There is a visual of the water cycle at the end, along with more details on the science behind the different states of water. Also find curricular connections and water saving tips.
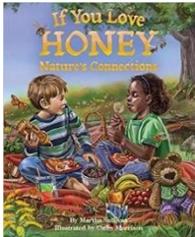
If You Love Honey: Nature's Connections by Martha Sullivan, ill. Cathy Morrison (2015)

While honeybees are important, this circular story shows how making honey is really a big connected web with contributions from dandelions, earthworms, mushrooms, the oak tree, and blue jay. The book includes a seek and find, a section on how nectar becomes honey, and additional resources.
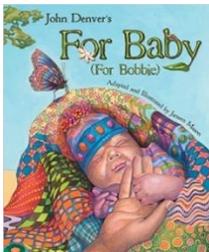
John Denver's For Baby (For Bobbie) Adapted and Illustrated by Janeen Mason (2009)

Love for little ones is shown in many settings across the world, sharing depictions of local culture, people, animals and their babies. John Denver's song for his son is beautifully illustrated to show the universal love families have for their babies.
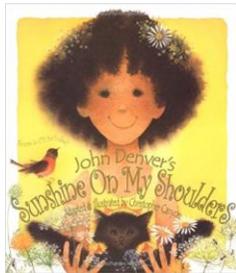
John Denver's Sunshine on my Shoulders Adapted and Illustrated by Christopher Canyon (2003)

A young girl explores the outdoors in a canoe with an adult, enjoying the sunshine and all it illuminates. This is a fun book and you can't help but sing the song in your head. The sheet music and information on John Denver are also included. Illustrations and whimsical and make you long for sun! Various perspectives are used between pages keeping things fresh, yet very natural.

Sometimes Rain by Meg Fleming, ill Diana Sudyka (2018)

Diverse children explore the seasons as they play outside. Another lyrical rhyming picture book that celebrates the seasons and how children interact with nature in very playful ways. Sometimes is a key word as we must seize the seasonal opportunities that nature affords like sledding, stomping in rain puddles, piles of crunchy leaves, etc.

Stick! by Irene Dickson, (2018).

This delightful book explores a boy's adventures with his dog, taking only a stick with him. Imagination kicks in and the stick is used in many ways during their day outside. The stick floats down the water, creates pictures in the sand, assists in walking, helps with balance, becomes a throwing stick, and helps as he meets new people. A stick can be anything!
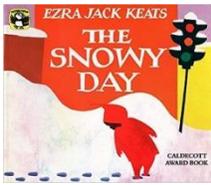
The Snowy Day by Ezra Jack Keats (1976)

This classic book really captures the magic of a first snowfall in an urban setting. In his snowsuit, Peter experiments with his tracks, explores the high piles of snow, and plays with a stick as a tool to knock the snow.
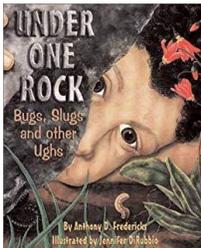
Under One Rock: Bugs, Slugs, and other Ughs by Anthony D. Fredericks, ill. Jennifer Dirubbio (2001)

A simple rhyming story about what you might find under one rock. Explore insects, worms, spiders, beetles, and slugs that may be found under a rock. Field notes are offered at the end for additional scientific information about what is hiding under a rock.

*Water is Water* by Miranda Paul, ill. Jason Chin (2015)
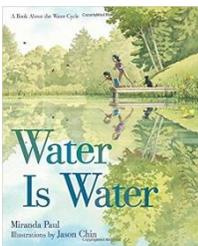
Two children experience the water cycle through their everyday interactions of making cocoa, waiting for the bus, splashing in puddles after school, gliding on the frozen pond building a snowman, and changing of the seasons. They live in a very nature filled setting, catching turtles, frogs, and more. They pick apples, make cider, and go swimming in the pond. A few pages at the back share the technical side of the children's journey, statistics on water, and books for further reading. Fun shape and movement to part of the text.
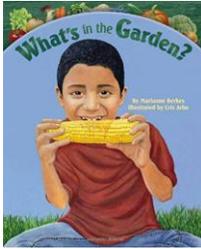
What's in the Garden? By Marianne Berkes, ill. Cris Arbo (2013)

Rhyming clues help us guess what is growing in the garden! The answer page shows a child harvesting the fruit or vegetable and includes a child friendly recipe featuring the food. This tasty connection to local food encourages our connection to gardening with additional information and resources in the back.
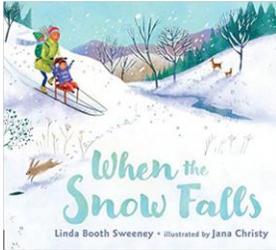
When the Snow Falls by Linda Booth Sweeny, Ill. Jana Christy (2017)

A simple rhyming book looking at what happens when it snows, from getting bundled up, hearing wildlife under the snow, helping dig out of the snow, and going sledding. Ingeneration family togetherness and the magic of a snowfall are a great combination in this book.
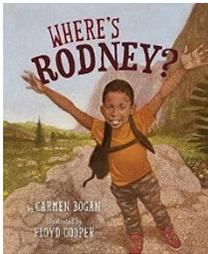
Where's Rodney? by Carmen Bogan, ill. Floyd Cooper (2017)

Rodney always wants to be outside, even during school. When the class goes on a field trip to the "park", Rodney just things it is the small neighborhood park. However, the bus keeps driving until they reach "outside" and he can experience nature up close as he is higher, lower, bigger, smaller, louder, quieter, faster, and slower. Rodney finally understands what majestic means from his time at the park.
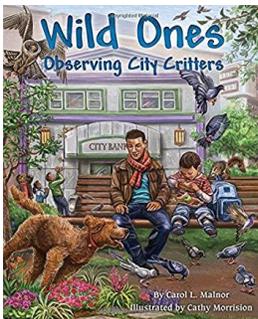
Wild Ones: Observing City Critters by Carol L. Malnor, ill. Cathy Morrision (2016)

Scooter, a friendly dog, gets loose from his family and explores the nature-filled city. While the dog misses many of the nearby nature like bats under the bridge or the fox kits in the drainage pipes, he does notice other nature and has an adventure. At night he finally heads home to a family happy to see him. Information pages in the back give details on nature and cautions in the city.

Additional Resources:

Black Faces, White Spaces: Re-Imagining the Relationship of African Americans to the Great Outdoors— (2014) Carolyn Finney explores the historical context, geography, and race studies to understand the relationship of the natural environment and black Americans in this book. Janelle Phillips wrote this book "was helpful for me in understanding some barriers the African American community faces in accessing the outdoors."

Building Cultural Empathy and Celebrating Diversity in Nature-based Early Childhood Education—In this article, Sarah Fogelsong suggests tips for embracing and celebrating multicultural experiences, including reflection, being curious and listening, doing research, analyzing hidden messages in the curriculum, including students' cultures as part of the regular routine, and inviting family and community members to visit the program. There is also a good list of recommendations for further reading.
https://naturalstart.org/feature-stories/building-cultural-empathy-and-celebrating-diversity-nature-based-early-childhood

Diverse Book Finder—a collection of over 2,000 picture books highlighting people of color and indigenous people. They offer a search tool, interlibrary loan, and analysis of racial/cultural groups represented in various books.
https://diversebookfinder.org/

Forest Kindergartens: A Multicultural Perspective—The author of this article, Samantha Leder, shares her perspective of learning through the cultural differences while participating in an internship in a Danish forest kindergarten. She suggests lessons learned from the Danish culture in regards to accommodating differences, freedom to play, spontaneity of learning, and risky play.
https://naturalstart.org/feature-stories/forest-kindergartens-multicultural-perspective

Hashtag— #WeNeedDiverseBooks

Outdoor Afro: Where Black People and Nature Meet—This non-profit organization works to create a network committed to inspiring African Americans to connect to nature and build leadership in the outdoors. They also have a good book list geared toward adults.
http://outdoorafro.com/

The Nature Book Nook Book—Michael Barton shares children's books about nature on this Facebook page, highlighting representations of diversity when applicable.
https://www.facebook.com/naturebooknook/

Nature-inspired Children's Book and Storytelling Facebook group—A great place to ask questions about and share resources around children's books related to nature. Hosted by Nicolette Sowder from Wilder Child.
https://www.facebook.com/groups/naturechildrensbooks/

The Ultimate List of Diverse & Inclusive Books to Support Nature-based Learning—The Wonderkin website just released this great book list as we were going to press with this edition of book reviews. Wonderkin quotes Rudine Sims Bishop, saying, "When children cannot find themselves in the books they read, or when the images they see are distorted, negative, or laughable, they learn a powerful lesson about how they are devalued in the society of which they are a part." Wonderkin lists 23 diverse books. While a few are also included in this IJECEE review, most are additional titles to add to your repertoire.
https://www.wonderkin.com/blog-home/diverse-and-inclusive-books-to-support-nature-based-learning

Urban Environmental Education—(2015) Editor Alex Russ brings together a wealth of information on urban environmental education. In particular, Chapters 15 and 16 look more in depth at environmental justice, underserved populations, and environmental equity. https://naaee.org/eepro/resources/urban-environmental-education

INTERNATIONAL JOURNAL OF EARLY CHILDHOOD ENVIRONMENTAL EDUCATION (IJECEE)
Addressing Issues, Policies, Practices, and Research That Matter

Information for Authors

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(b) To reach an extensive global readership in order to maximize the impact of the thoughtful information.

Thoughtful information may manifest through book reviews, description of educational approaches and programs, research investigations, and development or interpretation of theoretical perspectives. Associations among and between the following will be emphasized:

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- Family circumstances
- Community opportunities
- Policy mandates or recommendations
- Environmental activities, education, or experiences
- Mechanisms or processes related to knowledge acquisition
- Attachment or maintenance of affective dispositions
- Abilities, behaviors, or skills development related to good decision making in a range of environmental contexts; and
- Cognitive, economic, and social influences or impacts.

In order to reach an extensive global leadership, the journal will be available electronically, at no cost. NAAEE will permanently post all issues of the journal on the *Publications* link on its website. Translation of the articles into other languages is encouraged.

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