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

**Nazanin Omidvar**
**Tarah Wright**
**Karen Beazley**
*Dalhousie University, Canada*

**Daniel Seguin**
*Mount Saint Vincent University, Canada*

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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.

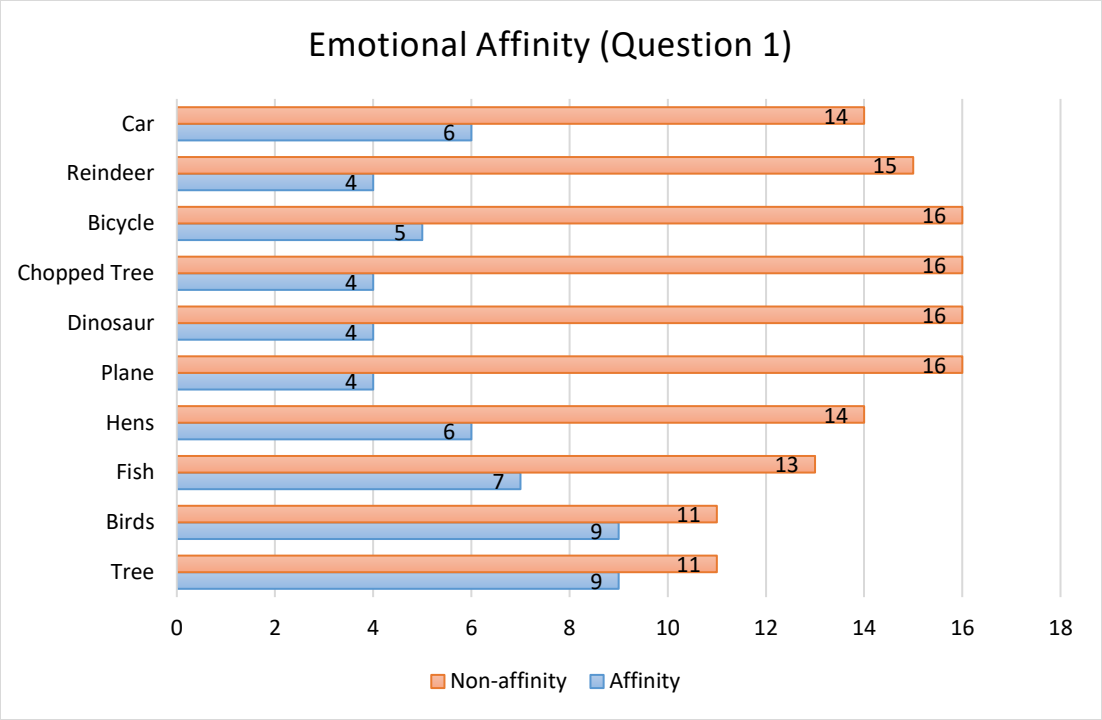


*Figure 1*: Emotional affinity with the biosphere (question 1)

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.

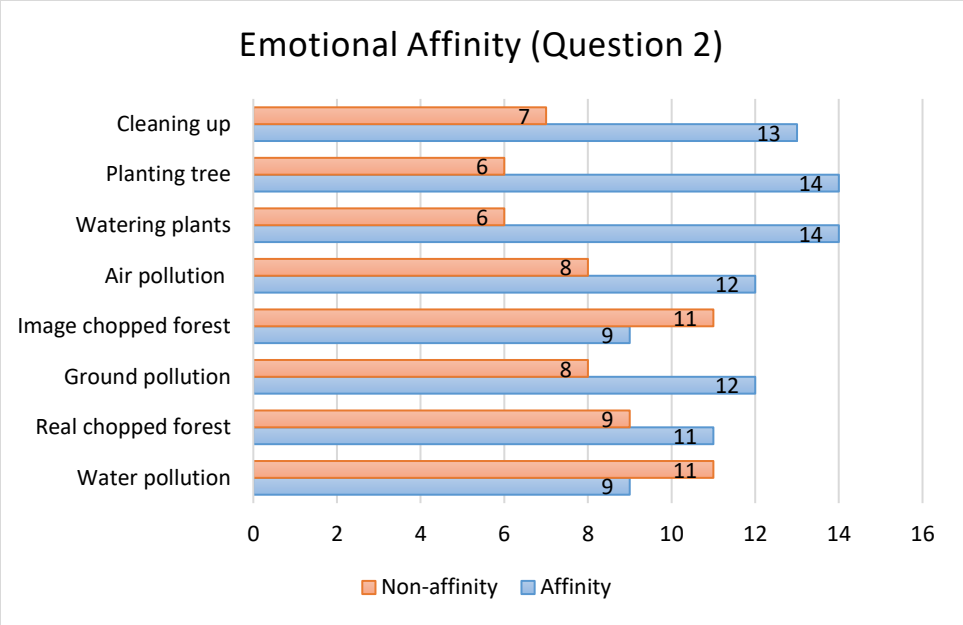


*Figure 2*: Emotional affinity with the biosphere (question 2)

**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.

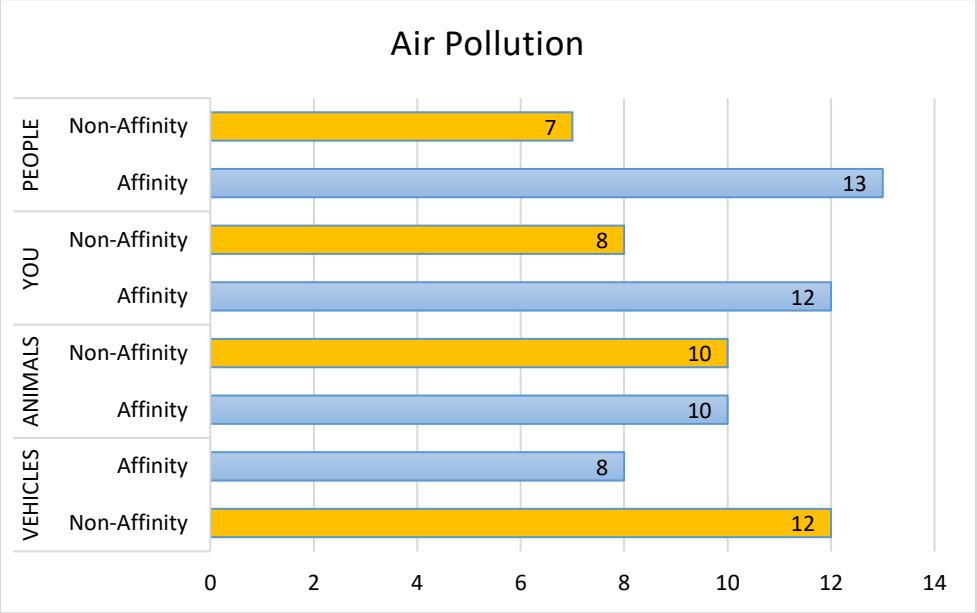


*Figure 3:* Responses to the question of who/what is harmed by air pollution

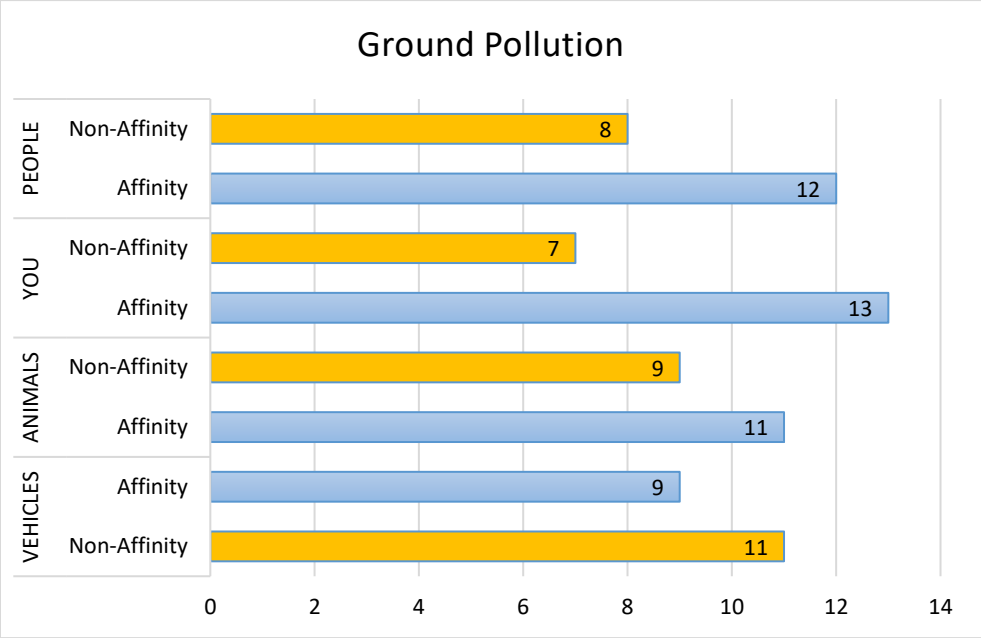


*Figure 4*: Responses to the question of who/what is harmed by ground pollution

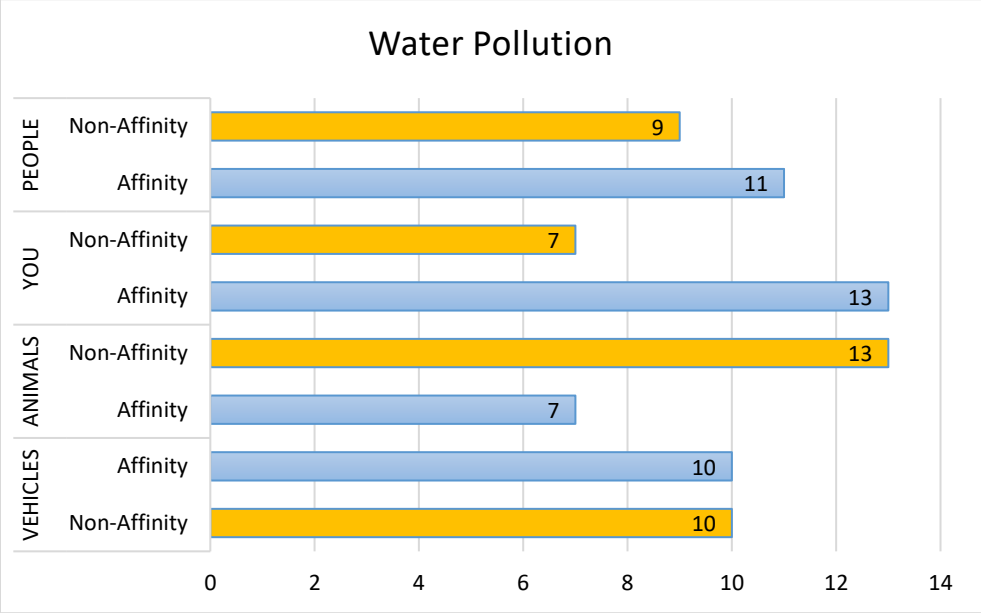


*Figure 5*: Responses to the question of who/what is harmed by water pollution

**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.

[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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Nazanin Omidvar is a Program Coordinator at NSERC CREATE BioActives Program, Dalhousie University. She can be reached at nazanin.omidvar@dal.ca

Dr. Tarah Wright is a professor at Dalhousie University. She can be reached at tarah.wright@dal.ca

Dr. Karen Beazley is a professor at Dalhousie University. She can be reached at karen.beazley@dal.ca

Dr. Daniel Séguin is a professor at Mount Saint Vincent University. He can be reached at daniel.seguin@msvu.ca