INVESTIGATING THE EFFECT OF NATURE-RELATED ROUTINES ON PRESCHOOL CHILDREN'S AFFINITY TO NATURE AT HALIFAX CHILDREN'S CENTRES

by

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Abstract

Early childhood environmental education focuses on expanding children's bio-affinity, developing their environmental attitudes, and encouraging them to behave in a more environmentally-friendly manner. One example of the educational methods that is based on high-quality practices of both early childhood education and environmental education is the Reggio-Emilia pedagogical approach, which provides children with various nature-related experiences. This study investigated how indoor and outdoor nature experiences facilitated by 2 Reggio-Emilia preschools located in Halifax, Canada contribute to preschoolers' cognitive, affective, and attitudinal bio-affinity. To do this, first-hand observations, teacher interviews, and a previously established Game Testing instrument were employed. Results suggest that the Reggio-Emilia curriculum followed at the preschools provided various opportunities for children to be exposed to nature. However, regardless of the emphasis of nature-related experiences in the Reggio-Emelia curriculum, the children's cognitive, emotional, and attitudinal affinity with nature was weak.

List of Abbreviations and Symbols Used

EE Environmental Education

PGH Peter Green Hall

BSP Beech Street Preschool

UN United Nations

UNEP United Nations Environment Program

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Chapter 1: Introduction

1.1 Motivation

Spending time in nature during early childhood has a lifelong positive influence on various aspects of a child's development (Clements, 2004; Louv, 2005; Rice & Torquati, 2013; Torquati, Gabriel, Jones-Branch & Miller, 2010). Scholars have found strong positive impacts between children's exposure to natural environments and children's self-esteem, creativity, independence, and problem-solving skills (Kellert, 2005; Maynard, Waters & Clements, 2011). Further, studies show that there are benefits of nature exposure to children's physical wellbeing including their muscle growth, and heart and lung development (Richardson, Pearce, Mitchell & Kingham, 2013; Wilson, 2012). Moreover, previous studies have revealed that positive and frequent nature experiences during childhood not only enhance children's pro-environmental attitudes, knowledge and beliefs (Rickinson, 2001), but also increase the probability of conservation behaviors and attitudes later in life (Zhang, Goodale & Chen, 2014). Numerous studies have shown that developing positive pro-environmental cognitive connections and affections during childhood can play a remarkable role in forming an adolescent's education, recreation, and work preferences (Bixler, Floyd & Hammitt, 2002), as well as their environmental knowledge and environmental attitudes (Chipeniuk, 1995; Ewert, Place & Sibthorp, 2005).

Since the industrial revolution, however, several barriers have restricted youths' opportunity to engage in nature-related experiences, including the influence of technology and a shift toward excessive use of electronic media (Jordan, Hersey,

McDvitt, & Heitzler, 2006), parents' perceptions of dangers in outdoor settings (Carver, Timperio, & Crawford, 2008), and lack of accessible green spaces in urban areas (Louv, 2008). People's lifestyles have shifted away from regular nature exposure, and have children spending more time in indoor sedentary settings rather than exploring in nature (Mainella, Agate & Clark, 2011). A study in the United Kingdom found, on average, children were playing outside for just over 4 hours a week (England, 2009). In Canada, a recent survey concluded that 70% of sampled youth spent one hour or less per day outdoors (David Suzuki Foundation, 2012). According to Statistic Canada (2016), Canadian 7- to 14-year-old children spend only 2.3 hours per day outdoors, while they spend 8.3 hours per day engaging in sedentary behaviors.

Exposure to nature can have a significant impact on a child's general well-being and development, as well as their "biophilia" (term coined by E. O. Wilson in 1984) – which is a person's inherent affiliation with the natural environment (Rice & Torquati, 2013; Hinds & Sparks, 2008). A number of scholars are concerned that a lack of nature exposure leads to a phenomenon called 'nature deficit disorder', where individuals become more and more disconnected from nature (Barton & Pretty, 2010; Chawla, 2006; Louv, 2005; Wells & Ledkies, 2003). This can negatively influence the development of individuals' environmentally responsible behaviors over their lifetime (Chawla, 2015; Collado, Staats & Corraliza, 2013), and cause complex obstacles in moving toward a more sustainable future. Without nurturing a generation who has affinity for, and advocates for, the environment, a sustainable future is unachievable (Folk et al., 2011; Davis & Elliott, 2009).

Environmental education (EE) has been considered a solution to mitigate children's deprivation of nature exposures (Cheeseman, 2016; Orr, 2004). The primary focus of EE programs is to expand an individual's knowledge in terms of different scientific aspects of nature, developing environmental values and attitudes, and encouraging them to behave in a more environmentally friendly manner (Palmer, 2002). Researchers have found that early childhood experiences, by influencing significantly children's cognitive and affective development (Meiboudi, 2013; Nutbrown, 2006), can determine their perception of their relation to themselves, to others, and to non-human nature (Samuelsson & Kaga, 2008). Early childhood environmental education can develop life-long environmental awareness, attitudes, values, and behaviors by developing a mindset which is familiar and accustomed with the biosphere (Giusti et al., 2014, Liefländer & Bogner, 2014).

To accomplish the aims of EE, some scholars have modified early childhood educational approaches and integrated more purposeful and intensive nature experiences into preschools' curriculums (Ärlemalm-Hagsér & Sandberg, 2017; Barratt Hacking, Barratt & Scott, 2007; Davis, 2009). One example of a pedagogical method that is based on high-quality practices of both early childhood education and environmental education is the Reggio-Emilia pedagogical approach. The Reggio-Emilia method is internationally considered an integrated and productive educational method that provides children with various nature-related experiences during preschool life (Chartier & Geneix, 2007; Vandermaas, McClain & Fair, 2017). The outcomes of Reggio-Emilia programs have been studied and reported within the environmental education literature. For example, Giusti, Barthel & Marcus (2014) compared children's environmental affections,

knowledge, and attitudes in Swedish Reggio-Emilia preschools with those of children with nature-deficit routines. They found that nature-rich routines in Reggio-Emilia preschools positively affected children's ability to develop empathy and concerns about non-human creatures. They also concluded that having more exposures to nature resulted in children's higher cognitive, emotional, and attitudinal bio-affinity (Giusti et al., 2014). Vandermaas, McClain & Fair (2017) evaluated the impacts of educational programs that provide young children with positive relationships with nature and revealed that "children's ongoing, sustained, and engaging experiences foster not only information about the natural world but also respect and appreciation for their surroundings" (p. 208).

Additionally, studies have demonstrated that the competences of the educators in delivering knowledge and appreciation for nature is a significant factor in the effectiveness of environmental education programs (Stevenson, 2007a, Ernst, 2009). Educators' personal beliefs and attitudes, socio-economic status, and educational and professional backgrounds greatly affect their willingness and success in integrating environmental education within their classes' indoor and outdoor routines (Ernst, 2009). Educators can influence children's opportunities to expand their knowledge and develop pro-environmental attitudes, as well as encourage them to develop environmentally-friendly behaviours (Chawla & Cushing, 2007). Environmental educators determine the variety and quality of nature experiences in their indoor and outdoor classrooms, create opportunities for children to explore nature, set goals and manageable sub-goals, and help children to accomplish them (Chawla & Cushing, 2007; Spence, 2011).

A focus on evaluating nature experiences and their outcomes, especially during early childhood, can be valuable for planning environmental education interventions and

encouraging an affinity to nature. Moreover, the results of assessing the strength and weaknesses of Reggio-Emilia preschools in reaching their nature-related goals can be useful for formal and non-formal environmental educational planners, developers, and educators, and help them to decrease the gap between the real outcomes of this approach and their ideal goals.

This study contributes to the evolving body of literature on nature exposure and young children's environmental education by examining the frequency and variety of indoor and outdoor nature experiences for children and the preschool teachers' educational approaches and goals for children's development in nature in a Reggio-Emilia preschools context. Moreover, the study investigates preschool children's emotional, cognitive, and attitudinal affinity with nature after being enrolled in a Reggio-Emilia school for at least one year by applying the "Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere" instrument developed by Giusti et. al. (2014). Furthermore, this is an opportunity to assess the applicability of the Games Testing as a research instrument for evaluating preschool students' cognitive, emotional, and attitudinal bio-affinity in the Canadian context. This may assist researchers in understanding the instrument's key weakness that need to be mitigated and also, its innovative strengths.

This research attempts to gain insights about the quantity of preschoolers' nature exposures, the quality and kind of nature experiences the children have, significant elements of environmental educational approaches in Reggio-Emilia preschools, and the influence of the implemented Reggio-Emilia pedagogical approach on preschoolers' bio-affinity in a Canadian context. To examine these variables, a mixed-methods approach

was employed. First, to make an assessment of outdoor nature exposures and to gain insights into the teachers' approaches to nature exposure, 5head teachers (4 female and one male) from 2 Reggio-Emilia preschools in Halifax, Nova Scotia Canada were interviewed (for a list of questions see Appendix A). Then, to evaluate indoor nature exposures for the children in each center, we inventoried indoor nature exposures based on the recognized features of the natural world in the built environment of the classrooms. Finally, interviews were conducted with 20 children from the aforementioned preschools to make an assessment of their emotional, cognitive and attitudinal bio-affinity, by using the Games Testing (Giusti et al., 2014).

1.2 Definitions

This thesis draws from the fields and literature associated with environmental education, nature experience, and biophilia. There are numerous definitions associated with these terms. As such, the context and definitions used for these terms in this thesis are described below.

Environmental Education. After the publication of the "Journal of Environmental Education" in 1969, and the first Earth Day celebration and establishment of the National Environmental Education Act in 1970, environmental education has been considered a well-defined scholarly field (Adkins & Simmons, 2002). However, it was after the Belgrade Charter in 1976 and the Tbilisi Declaration in 1978 that scholars reached a consensus on environmental education's main goals. According to the Tbilisi Declaration, the goal of environmental education is:

> "to help individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their

> biological, physical, social, economic, and cultural aspects, and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and in the management of the quality of the environment." (UNESCO-UNEP, 1977, p. 92)

This definition goes beyond the acquisition of knowledge, but also includes developing skills and attitudes toward the environment, which is distinctly different than most traditional conceptualizations of education and curriculum. Based on the UNESCO-UNEP (1978) definition, Hungerford, Peyton, and Wilke (1980) suggested that the aim of environmental education is to foster environmental awareness and skills among citizens and to encourage them to work, individually and collectively, toward attaining a dynamic balance between the quality of humans' life and the quality of nature (Adkins & Simmons, 2002). As such, EE is seen as translating knowledge and skills into some sort of pro-environmental action on the part of the learner. Moreover, Spence (2011) believes that environmental education should develop concerns for discovering and analyzing the causes and consequences of environmental issues among people, and motivate them to take actions towards solving the local, national, and international environmental problems.

For this thesis, we define environmental education as a process "to foster an awareness of the environment, to provide every person with opportunities to acquire the skills needed for environmental protection, and to create positive patterns of behaviour towards the environment" (UNESCO, 1978, p. 3).

Nature Experience. Nature experiences have been defined by many scholars as any human interaction with non-human species and natural environments (Finch, 2008;

Giusti's et al., 2014; Miller, 2005; Pyle, 1993; Samways, 2007). Based on this, the definition used in this thesis for nature experience is defined as any interaction with tangible aspects of nature (e.g., animals, plants, rocks, sticks, etc.) in both human-constructed natural areas (e.g., zoo or botanical gardens) and in more natural areas (e.g., forest or natural shore line).

Biophilia. Frequent and high-quality nature experiences can positively influence an individual's biophilia (Rice & Torquati, 2013; Hinds & Sparks, 2008; Nisbet et al., 2008). The definition adopted for biophilia in this thesis is: an inner psychological affection for nature, which can be reinforced by positively interacting with natural elements (Ballouard, Provost, Barre & Bonnet, 2012).

1.3 Literature and Knowledge Gaps

It is important to note that several knowledge gaps have emerged in the area of environmental education, biophilia and nature experience. First, many authors have noted that, due to researchers' belief about children's inadequate verbal and intellectual competences to explain their experiences, adults, including parents, caregivers, and/or teachers, are typically the sole participants in research studies that relate to children (Docherty & Sandelowski, 1999). Curtin (2001) emphasized the importance of listening to children's voices, and including them as active contributors to the research, who have invaluable perspectives to share. Tammivaara and Enright (1986) introduced a phenomenon called "adult-centerism", which has resulted in underestimating children's abilities. They suggested that adult-centrist researchers tend to stay with their own perspective to avoid unexpected findings, instead of being open to learning from children's perspectives and experiences (Tammivaara & Enright, 1986). In most

childhood studies, children are “objects of inquiry rather than informants” (Curtin, 2001, p. 2). Furthermore, Cheeseman (2016) found that most of the results reported in the literature about the outcome of children’s environmental education programs are provided by the adult researchers, program developers, administrators, etc. in lieu of directly asking young people about their experiences and beliefs.

Additionally, 60% of children in early childhood (between birth and 5 years old) spend almost 7hours of their waking time each day in preschools (Aud et al., 2013). Considering the life-long influences of childhood nature experiences on individuals’ environmental knowledge, attitudes, concerns, and behaviors (Giusti et al., 2014; Stern, 2000; Schultz, 2000; Dunlap et al., 2000), conducting research on understanding the real outcomes and impacts of childhood nature-oriented educational programs is crucial. However, reviewing the literature demonstrates that there is little documentation as to how much of preschoolers’ time is spent in nature, what the quality of their nature experiences are, and how the time spent in nature affects different aspects of children’s bio-affinity.

Another important knowledge gap to consider is related to the growing consensus on the importance of integrating more environmental education opportunities in early childhood curriculum. This has resulted in the development of some pedagogical philosophies like the Reggio-Emilia approach that purposefully integrate nature exposures with early childhood curriculum. There are few research studies that evaluate the influence of Reggio-Emilia preschools’ curricula on preschoolers’ environmental cognitive, emotional, and attitudinal affinity.

In addition to these gaps, since there are very few research instruments adjusted to the mental and verbal abilities of preschool children (Giusti *et al.*, 2014), it is very important to assess the applicability, strengths, and weaknesses of current methodological instruments that can be used to evaluate young children's relationships with nature. It not only helps to modify the current methodological approaches, but also provides a better understanding of the challenges of conducting qualitative research with children, how to facilitate the development of a working researcher-child relationship, how to improve the style of the communication with child participants, and how to improve the quality of the collected data (Curtin, 2001).

Although environmental education, nature experience, and biophilia have been featured in the literature, the need for systematic research in the realm of early childhood environmental education has been increasingly discussed by many scholars (Davis, 2009; Reid & Scott, 2006; Vandermass-Peeler et al., 2017). For instance, Davis (2009), after reviewing 14 prominent journals in environmental education, revealed that fewer than 5% of articles published between 1996 and 2007 focused on early childhood education. Specifically, it is hoped that this thesis will advance an understanding of how the experience of spending preschool life in a Reggio-Emilia preschool can cognitively and emotionally change children' affiliation for nature.

1.4 Research Goals & Objectives

The objective of this study was to investigate how indoor and outdoor nature experiences facilitated by Reggio-Emilia preschools contributes to preschoolers' cognitive, affective, and attitudinal affinity to nature. To complete this objective, a mixed-method approach consisting of conducting interviews with preschool teachers,

observing and inventorying indoor nature exposures in the preschools' built environments, and interviewing children by using the Games Testing was employed. The interview with teachers provided an understanding of various types of outdoor and indoor nature-related activities that children are involved in while at school, as well as the pedagogical philosophies of the teachers in creating nature-related experiences for the students. Furthermore, observing the indoor environments of the preschools helped the researcher to gain a clearer insight into the opportunities for environmental education provided in the 2 Reggio-Emilia preschool facilities. The purpose of the Games Testing was to assess children's emotional, cognitive and attitudinal affinity with nature after attending for at least one year a Reggio-Emilia school, located in Halifax, Canada.

1.5 Research Questions

This study aimed to meet its objectives by answering the following questions:

(1) What kind of indoor and outdoor nature experiences are provided by 2 Reggio-Emilia preschools located in Halifax? How often and how long are children exposed to these nature experiences?

(2) What are the Reggio-Emilia preschool teachers' educational approaches and goals for children's development in nature?

(3) How much do children show cognitive, emotional, and attitudinal affinity to nature after attending a Reggio-Emilia preschool for at least one year?

1.6 Scope

Since early childhood environmental education in Canadian Reggio-Emilia preschools is not adequately investigated by environmental education scholars, this

research focuses on filling the literature gaps related to this topic and providing some recommendations for future studies. Specifically, this research explores the impacts of children's indoor and outdoor nature experiences, facilitated by Reggio-Emilia preschools, on their cognitive, emotional, and attitudinal bio-affinity. In addition, while this study seeks to evaluate the impact of 2 Reggio-Emilia preschools' curriculum on children's bio-affinity, results are not generalizable for other implementations of the Reggio-Emilia preschool programs.

This study was conducted at the Beech Street Preschool, 1747 Beech St, Halifax, NS B3H 4B7, and Peter Green Hall Children's Center, 1094 Wellington St, Halifax, NS B3H 2Z9. In order to answer the research questions, teachers' interviews were conducted during the month of November 2016, and the interviews with 3 to five-year-old children were conducted in December 2016.

1.7 Structure of Thesis

This thesis is structured in 5chapters. Chapter 1 has provided an introduction to the literature related to environmental education and nature experiences and also highlights the goals of objectives of this study. Chapter 2 provides an in-depth exploration of methods used in this study. Specifically, it provides an overview of theory used to inform the methods, provides rationale for the selected methods, and describes data collection tools and analysis procedures. Chapter 3 and 4 are 2 independent manuscripts that have been prepared for submission to relevant academic journals. Each of these chapters includes its own abstract, introduction, methods, results and discussion, and conclusion sections. Together, they describe the results obtained through this thesis research. Chapter 3 was prepared for submission to *Environmental Education Research*

and reports on data collected from teachers' interviews and the lead researcher's observations highlighting indoor and outdoor nature experiences at 2 Reggio-Emilia preschools located in Halifax. Chapter 4 was prepared for submission to *International Journal of Early Childhood Environmental Education.* It reports on preschoolers' interview data and explores children's cognitive, emotional, and attitudinal affinity to nature, based on application of the Games Testing. Finally, Chapter 5 summarizes the findings of the research as a whole and discusses the contributions of this thesis, its significance, areas of future research, and recommendations for environmental education researchers and practitioners.

Chapter 2: Methods

2.1 Introduction

Using a mixed-methods approach, this research explores the impacts of children's indoor and outdoor nature experiences, facilitated by Reggio-Emilia preschools, on their cognitive, emotional, and attitudinal bio-affinity. This study was conducted at the Beech Street Preschool, 1747 Beech St, Halifax, NS B3H 4B7, and Peter Green Hall Children's Center, 1094 Wellington St, Halifax, NS B3H 2Z9. The thesis research can be divided into 2 separate but related studies as described below.

The first study (Chapter 3) examines children's indoor and outdoor nature exposures, and nature-related pedagogical approaches of teachers at the 2 aforementioned Reggio-Emilia preschools in Halifax. Using observational analysis techniques (Adler & Adler, 1994; Kothari, 2004), the preschool classrooms were examined for potential for indoor environmental exposures (Kellert, 2011) and the following features were inventoried: color, water, air, sunlight, plants, animals, natural materials, views, habitats and fire. Teachers at each of the preschools were interviewed in order to assess the outdoor nature exposures that the children had in their daily lives at the preschools, and to gain insights into the teachers' beliefs about, and approaches to, nature exposures (for a list of interview questions see Appendix A).

The second study (Chapter 4) is an investigation of the effect of nature-related routines on the preschool children's affinity to nature. To investigate preschool children's emotional, cognitive, and attitudinal affinity with nature after being enrolled in a Reggio-Emilia school for at least one year, we used the "Games Testing for Emotional, Cognitive

and Attitudinal Affinity with the Biosphere" instrument developed by Giusti *et. al.* (2014).

The following sections describe the methods used for each of these studies and for the study as a whole, describing sampling, data collection and data analysis.

2.2 Sample and sampling techniques

This study was conducted at the Beech Street Preschool and Peter Green Hall Children's Center, Halifax, NS. These locations were purposively and practically chosen because of their use of the Reggio-Emilia approach and due to their proximity to the Primary Investigator at Dalhousie University. Since the main objective of this study is assessing the impact of nature-related experiences on children's bio-affinity, we purposefully chose to sample from Reggio-Emilia schools as the nature-related philosophy affords children the opportunity of being exposed to nature (indoor and outdoor) in their daily lives. Within the 2 schools, there were 2 identified study populations: teachers and students. Sampling for each of these populations was as follows.

In the first study, the head teachers at each of the schools (junior and senior preschool classes) were asked to participate in semi-structured interviews. Sampling in this case was non-probabilistic and purposive. A recruitment email was sent to the head teachers, which included an information bulletin about the study and a consent form. All 5teachers responded positively and were interviewed for this study.

In the second study, the preschool children (3- to 5-years-old) who had been at the same preschool for at least one year were recruited using non-probabilistic and purposive sampling techniques. The reason that we required students to have been enrolled at the

preschool for at least one year is supported by neurological research and practices which demonstrate that persistent access to nature is “related to the development of a mindset more neurologically familiar and accustomed with the biosphere" (Giusti et al., 2014, p. 18). Further, research shows interactions with nature increase the level of an individuals' environmental identity and facilitates the possibility of pro-environmental cognitive decision making (Giusti et al., 2014; Hinds & Sparks, 2008). While we could not control for “access to nature” outside of the preschool, requiring participants to have been in the preschools for at least one year assured us that they had some access to nature via the Reggio-inspired curriculum for at least 12 months prior to the study.

For this study, the Directors of the preschools sent an email on behalf of the Primary Investigator (PI) to the parents of 46 eligible preschool children. This email included a consent form and an information bulletin about the study, which was a summary of the proposed research objectives, the PI’s background and contact information, what was required of the participants, and other relevant information related to the study. Parents were asked to indicate their interest by replying to the Primary Investigator’s email, and by returning the signed consent form. A total of 20 parents consented to participate in the study.

2.3 Procedures for Data Collection

2.3.1 Study One

Interviewing is one of the most frequently employed qualitative research methods (Lewis-Beck, Bryman, & Futing Liao, 2004). Interviews are an inexpensive, but invaluable tool to elicit participants’ points of view, understand their ways of living, and what constructs their perspectives on different phenomenon (Kvale, 1996). Interviews are

an effective research tool for gaining an understanding of individuals' views, experiences, and beliefs, which can be useful in theoretical, qualitative, quantitative, and applied research (Gill, Stewart, Treasure & Chadwick, 2008; Warren, 2002). Thus, for obtaining detailed information about a preschools' daily curriculum, and for gaining an understanding of teachers' nature-related experiences and Reggio-Emilia goals, we interviewed 5 head teachers of the seniors' and juniors' preschool classes. These interviews were face-to-face and semi-structured (see Appendix A for a full list of interview questions), which allowed the interviewee to share any relevant experiences he/she would like to share with the interviewer. The time needed to conduct a complete interview was ~45 minutes. All interviews were audio recorded for data accuracy purposes.

In addition to the interviews, the Primary Investigator observed the interior design of the preschools to gather data on the nature exposures embedded in the indoor environment. Using *a priori* categories established by Kellert, Heerwagen & Mador (2011), the following features of the indoor classrooms were inventoried: natural colors, water, fresh air, sunlight, plants, animals, natural materials, views of nature, habitats and fire. Due to the preschools' regulations, these observations were done after school hours.

2.3.2 Study Two

To date, various tools and scales have been developed to measure different aspects of the human-nature relationship. Bragg *et al*. (2013) conducted a meta-analysis of the literature and found that the key measures include: Connection to Nature Scale (CNS; Mayer & Frantz, 2004); Nature-relatedness Scale (NRS; Nisbet *et al.*, 2008); Inclusion of Nature with Self (INS; Schultz, 2002); Environmental Identity Scale (EIS;

Clayton, 2003); and, Emotional Affinity to Nature (EAN; Kals, Schumacher & Montada, 1999). In addition, there are scales that have been developed exclusively for use with young children, such as the Connection to Nature Index (CNI; Cheng & Monroe, 2012) and Nature Connectedness Inventory (NCI, Ernst & Theimer, 2011). However, none of the aforementioned imperial studies are adjusted to the mental and verbal abilities of preschool children. Since 3- to 5-years-old children are not able to deal with the complexities of verbalizing their emotions and beliefs and have a very limited linguistic capacity, instead of using self-reporting questionnaires, Giusti *et al.* (2014) adopted an image-based technique, which helps children to easily express their feelings and thoughts.

In this study, to assess the preschool children's emotional, cognitive and attitudinal affinity with nature, the Games Testing technique (Giusti *et al.,* 2014) was used. Before the Games Testing implementation stage, a pilot test was conducted with a group of 4 3- to 5-year-old children to provide a better understanding about potential errors or interferences. Games testing was conducted with the preschool children during the month of December 2016 in a quiet space within the preschools and during school time.

The Game Testing process was divided into 3 phases. In the first phase, children's emotional affinity with nature was evaluated using 2 games. The purpose of the first game was to understand children's level of empathy for other ecological living elements, their perception of life, and their capacity to place themselves "in the shoes" of natural elements (Giusti et al., 2014). During the first game, 10 images of different animals, plants, vehicles and tools were shown sequentially, while asking the children: "Does this

[image] have feelings?" Answering negatively to images of vehicles and tools, and answering positively to images of animals and plants is considered to represent affinity to nature (Giusti et al., 2014). Then, in Game 2, after showing each of 8 images of positive and negative environmental behaviors one at a time, children were asked to express their reactions by using the image of a smiling or sad face. Choosing a smiling face as a response to a positive environmental behavior and choosing a sad face as a response to a negative environmental issue is considered to represent affinity with nature (Giusti et al., 2014).

The second phase of Games Testing is designed to measure children's environmental awareness, which has both a cognitive, knowledge-based component and an affective, perception-based component; its central elements are both knowing and feeling part of ecological processes (Giusti et al., 2014). This phase addressed children's awareness of the interconnection between human needs and the ecological services provided by the environment. In Game 3 (the first game of Phase 2), children were asked to match the images of 10 products (e.g., milk, wooden table, paper) to some required natural resources (e.g., cow, forest, and tree) or some human-made resources (e.g., factory, money, etc.) (Giusti et al., 2014). Coupling the products with the correct resources (natural and human-made) is considered as representing affinity with nature (Giusti et al., 2014). In Game 4, children were asked about the harmful impacts of environmental pollution on people, animals, plants and vehicles. Negative answers about vehicles and positive answers about people, animals, and plants are considered as representing affinity with nature (Giusti et al., 2014).

In Phase 3, the preschool children's attitudinal affinity with the biosphere was assessed by asking 2 sets of questions over 2 separate games. Game 5 asked: "Where do you usually play the most?", "Where do you like to play?" and "Why?", "Where do you feel the most free to play?" and "Why?", "Where do you feel the most safe to play?" and "Why?". Game 6 asked "Where do you not usually play?", "Where do you not like to play?" and "Why?", "Where do you not feel free to play?" and "Why?", "Where do you not feel safe to play?" and "Why?" Children answered these questions by selecting among the images of various environments (e.g., park, indoor videogames, farm, outdoor street, etc.; Giusti *et al.*, 2014) Then, during a short interview, they rationalized their choices using their own words. All answers were audio-recorded and transcribed for further analysis.

2.4 Data Analysis

2.4.1 Study One

The method of analysis chosen for this study was a mix of inductive and deductive approaches. Inductive analysis refers to the process of deriving themes and concepts through "careful reading and re-reading of the data" (Rice & Ezzy, 1999, p. 258). By using the inductive approach, a researcher intends to recognize forms of patterns within the raw data and encode them (Thomas, 2006). Encoding the information helps to organize the data and develop significant themes from them (Thomas, 2006). In addition to the inductive approach, a deductive method is used in this research project, which refers to "data analyses that set out to test whether data are consistent with prior assumptions, theories, or hypotheses identified or constructed by an investigator" (Thomas, 2006, p. 238). To do this, the text is encoded based on the codes that are

defined and developed in advance based on reviewing the literature, research questions, theoretical frameworks, etc.

After conducting the interviews with teachers, all the interviews were transcribed to ensure all answers were completely captured, and then coded using NVivo qualitative software (See Figure 1) (Bazeley & Jackson, 2013). All nature-related indoor and outdoor exposures mentioned by teachers during the interviews were coded and categorized. In addition, after analyzing the interviews, it was found that many of the teachers offered information and contemplations about the Reggio-Emilia approach that were relevant to the study. Therefore, in our analyses, all the Reggio-Emilia goals mentioned by the teachers during the interviews were coded and analyzed by both deductive and inductive approaches. The deductive themes were generated based on the literature on Reggio-Emilia principles and goals. Also, new themes found in the interviews were categorized inductively. To keep teachers' personal information confidential, each teacher was assigned a participant code (T1 – T5).

Moreover, indoor nature exposures were inventoried based on the recognized features of the natural world in the built environment as established by Kellert, Heerwagen & Mador (2011), which include: natural colors, water, fresh air, sunlight, plants, animals, natural materials, views of nature, habitats and fire. Table 1 shows, the analytic framework used for inventorying these features. The specific exposures for the participants are qualitatively described in the third chapter of this thesis. The PI's notes taken during her observations of the nature exposures facilitated in preschools' indoor environments were categorized by using Microsoft Excel.

Table 1: Analytic framework used for inventorying natural features

Feature	Criteria for Inclusion
Natural Colors	• Any color considered an "earth tone" • Any color reminiscent of the muted shades typically found in nature.
Water	• Any use of water (a surface of water, moving water, etc.)
Fresh Air	• Natural ventilation over stagnant air • High quality air with no smell and color
Sunlight	• The use of natural light over artificial light
Plants	• Any shapes, forms, and patterns of plants and other vegetative matter
Animals	• Alive animals • Any simulation of animal life
Natural Materials	• Whatever can be found in nature (feathers, crab shells, sea shells, stones, pine cones, dried fruits, etc.)
Views of Natural Features	• Natural features (water, trees, etc.) • Natural vistas (lakes, ponds, forests, etc.) • Natural vegetation (living plants, shrubs and trees)
Habitats	• Simulations of local habitats and ecosystems, such as wetlands, forest, grasslands, and watersheds.
Fire	• Any use of fire (heater, decorative, etc.)

Note: Table informed by Kellert, Heerwagen & Mador (2011)

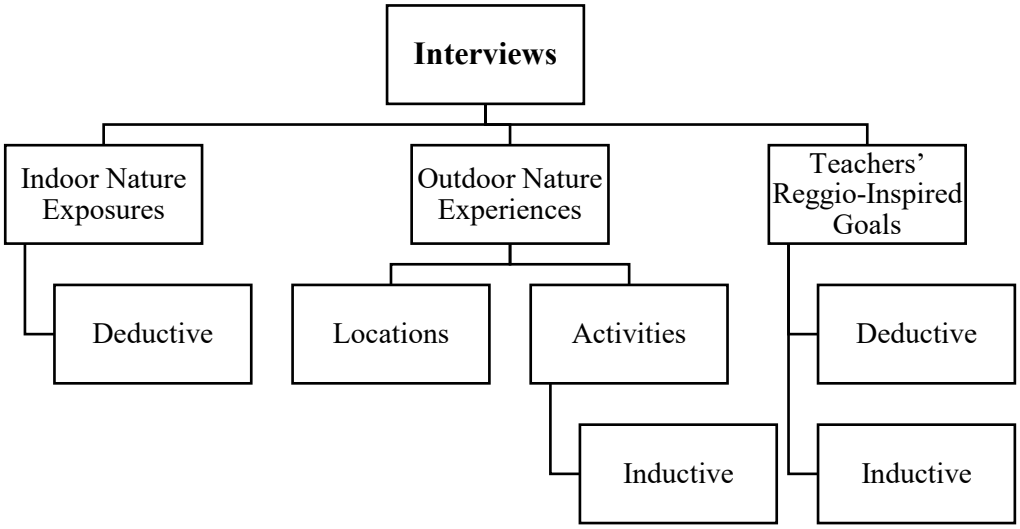

Figure 1: Mixed-method used for analyzing the interviews

2.4.2 Study Two

The data gathered in Games Testing were analyzed using measures of central tendency and dispersion. Descriptive statistics were used to illustrate the results of each test. To understand the open-ended verbal responses associated with Phase 3 of the Games Testing, the children's transcripts that provided explanations for the open-ended questions from Game 5 and Game 6 were analyzed in NVivo software. An inductive approach was used, developing *a posteriori* codes to find emerging themes. To keep children's identity confidential, each child was assigned a participant code (C1 through to C20).

2.5 Limitations

As with any study, the methods used to answer the proposed research questions come with their own limitations. It is the responsibility of researchers to identify the

limitations of their chosen methodologies, and endeavor to minimize the impacts of these limitations on the derived results (Connell, 2006). By making clear the limitations of their findings, researchers help stakeholders in related fields have clear understandings of the results, and show the necessary future steps to the other researchers (Meyers, 2006). This section describes the limitations that have affected the results of the current study.

The first limitation of this study is related to the size of the dataset of child participants (N = 20), which restricts the ability to draw universal conclusions. Due to time and resource constraints, the non-probabilistic purposive sample of this study was selected from 2 Reggio-Emilia preschools in Halifax (Peter Green Hall Children's Center, and Beech Street Preschool), and the results cannot be generalized to other Reggio-Emilio education centers. Increasing the number of respondents by including other Halifax Reggio-Emilia preschools, such as A Tiny Lab for Early Learning, Jubilee Preschool, Halifax Grammar School, and Prospect Bay Children's Centre, could in the future ensure the statistical power of the results and increase the generalizability of the conclusions. However, given that this study was non-probabilistic and exploratory in nature, the results are considered valid even though not generalizable.

Second, it is known that uncontrollable weather conditions (e.g. rain, thunderstorms, high winds, etc.) as well as the presence of insects during children's outdoor activities can negatively influence their emotions towards nature (Kals & Ittner, 2003). The children's interviews were conducted in December 2016, a cold, raining/snowing and windy month in Halifax. Thus, the timing of this study may have impacted the results.

Finally, due to the preschools' restrictions, the lead researcher could not attend any of the preschoolers' outdoor nature experiences to observe their activities. Thus, the only source for collecting data about preschoolers' outdoor routines was the interviews with teachers, which increases the probability of receiving biased responses.

Chapter 3: Examining children's indoor and outdoor nature exposures, and nature-related pedagogical approaches of teachers at 2 Reggio-Emilia preschools in Halifax, Canada

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3.1 Introduction

The importance of spending time in nature is undeniable for child development (Torquati, Gabriel, Jones-Branch & Miller, 2010; Rice & Torquati, 2013; Louv, 2005; Clements, 2004). There is a strong positive link between spending time in natural environments and children's self-esteem, self-concept and their total well-being (Fjortoft, 2004). Exposure to natural outdoor spaces not only enhances a child's physical and mental well-being (Maynard, Waters & Clements, 2011), but encourages children's imaginary play, independence, creativity and problem-solving skills, as well as engendering a deeper appreciation for nature, empathy and positive perspectives toward the environment (Wilson, 2012; Lester & Maudsley, 2006; Kellert, 2005). Natural spaces affect a child's knowledge transfer and attention functions (Bengtsson and Grahn, 2014; Taylor and Kuo, 2006), as explained by the Attention Restoration Theory (ART; Kaplan and Kaplan, 1989). According to the ART, 2 types of human attention – directed attention and soft fascination – interact with each other. Directed attention "requires

effort to sustain a specific focus and related activity as well as to inhibit attention toward potential distractions" (Schette, Torquati & Beattie, 2017, p. 5). Because of its required mental effort, directed attention overuse, which is more likely to happen during learning in formal indoor settings devoid of natural elements (Martensson et al., 2009), may result in directed attention fatigue that reduces children's concentration, inhibitory control, and learning gratification (Schette, Torquati & Beattie, 2017). Alternatively, soft fascination, which can be reinforced by engaging more with nature (e.g., natural parks, forest, the wilderness), is another attentional system "owing to the inherently compelling nature of activities and environments that elicit this less effortful form of attention" (Schette, Torquati & Beattie, 2017, p. 5). It may facilitate restoration and recovery from directed attention fatigue without overwhelming the attentional system (Bengtson and Grahn, 2014). Further, research has shown that outdoor education programs that encourage soft fascination in natural settings result in children who are able to more accurately interpret educational messages received from their educators and the environment, and who have higher academic achievement and grades than those exposed to indoor classroom curricula merely (Taylor and Kuo, 2006; Basile, 2000).

Since the industrial revolution, urban systems have been increasingly separated from their surrounding natural environments (Giusti, Barthel & Marcus, 2014) making it difficult for many children to engage with nature. With 54.5% of the global population and 82% of North Americans residing in cities (Nations, 2014), only a minority of children are being exposed regularly to natural green spaces (Thompson, Aspinall & Montarzino, 2008). During the last part of the twentieth century, the 'culture of fear' regarding the environment has spread among parents, and parents are more likely to tell

their children about frightening issues (e.g., climate change, ocean pollution) associated with the natural environment (White, 2004). Moreover, trends show that parents are choosing for their children to interact with more urbanized and less natural environments, and reducing their children's direct experiences with nature (Francis & Devereaux, 1991; Miller, 2012), which can have an impact on their familiarity and therefore their affinity with nature.

The separation of children from the natural environment, what Louv (2005) describes as 'nature deficit disorder', can be considered an obstacle in moving toward a more sustainable future. Specifically, a sustainable future cannot be achieved unless there is a generation who advocates for the environment (Folk et al., 2011; Davis & Elliott, 2009). Scholars have demonstrated that alienation from nature can affect children's affinity with nature, which can decrease the probability of adult conservation behaviors and attitudes later in life (Giusti et al., 2014; Torquati et al., 2010; Wells and Lekies, 2006). Further, the literature demonstrates that natural experiences in childhood influence adolescents' environmental preferences in terms of education, recreation and work (Bixler, Floyd & Hammitt, 2002), environmental knowledge (Chipeniuk, 1995) and environmental attitudes (Ewert, Place & Sibthorp, 2005). As stated by Pipher (2008, p.), "children cannot love what they do not know. They cannot miss what they have not experienced." To strive toward a sustainable future, humanity must address the issue of declining nature exposure for children and find ways to engage children with the natural environment.

Researchers have found that positive cognitive connections and affections toward nature are formed in early childhood (Giusti et al., 2014; Stern, 2000; Schultz, 2000;

Dunlap et al., 2000). Because 60% of children in early childhood (between birth and 5 years old) spend almost 7 hours of their waking time each day in preschools (Aud et al., 2013), it can be concluded that preschools may have a significant role to play in providing opportunities for nature exposure (Giusti et al., 2014). Yet there is little documentation as to how much of this preschool time is spent in nature and how the time spent in nature affects children. Further, there is little systematic research in the realm of early childhood environmental education. A review of 14 prominent journals in environmental education demonstrated that fewer than 5% of articles published between 1996 and 2007 focused on early childhood education (Davis, 2009).

This paper adds to the evolving body of literature on nature exposure and young children by examining 2 preschools to better understand: the frequency and variety of indoor and outdoor nature experiences for children; and, the preschool teachers' educational approaches and goals for children's development in nature. By doing this, we investigate the degree to which specific curriculum and frequency of nature exposure can impact biophilia. Each of these 2 schools follow the Reggio-Emilia-pedagogical approach to education, which emphasizes the importance of nature interaction (Cadwell, 1997; Vandermaas, McClain & Fair, 2017). Through our investigations, we have gained insights about the quantity of preschoolers' nature exposure and the quality and characteristics of the nature experiences of these children.

3.1.1 Nature Experiences and Biophilia

Scholars suggest that nature exposures may have a positive impact on a human's psychological, physical, and social health (Bratmana, Dailyb, Levyc & Grossd, 2015). Several studies that have shown relationships between experiencing daily views of nature

(e.g., a tree outside the apartment) and higher degrees of general well-being and satisfaction (Taylor, Kuo & Sullivan, 2002). Indoor plants in classrooms can decrease sick-leave absences, reduce physical discomfort, and improve children's grades and behaviors as well as teachers' job satisfaction (Daly, Burchett & Torpy, 2010).

The literature also demonstrates that the variety of benefits from nature can be different based on types of nature contacts (e.g., real interactions with natural environments, window views, photographs) and duration of exposures (e.g., hour-long, multi-day or life-long intimacy with nature; Keniger, Gaston, Irvine & Fuller, 2013). The more-direct and longer-duration interactions with nature, the more affective and cognitive benefits individuals receive (Bratmana et al., 2015). Furthermore, by benefiting from biophilic design and embedding nature-related elements into interior design, individuals can benefit from healing characteristics of nature through indoor environmental exposures (McSweeney et al., 2014). Biophilic design has "established a new framework for the satisfying experience of nature in the built environment and creating good habitat for people as a biological organism in the modern built environment that advances people's health, fitness and wellbeing" (Kellert & Calabrese, 2015, p. 6). By replicating nature with "natural light, plant-based features and organic textures, sounds and aromas," one can create a restorative and health-promoting indoor space that decreases levels of physiological stress, anger, and frustration, and also increases comfort, health, pain tolerance, relaxation, and happiness in individuals (McSweeney et al., 2014, p. 127).

Nature exposures during childhood can increase children's enjoyment of nature, environmental sensitivity, and psychological well-being (Collado, Staats & Corraliza, 2013). A wide variety of research findings suggest that positive and frequent nature

experiences during childhood result in a life-long commitment to protect the environment (Chawla, 1999; Collado, Staats & Corraliza, 2013), and can improve children's environmental attitudes, environmental knowledge and beliefs (Rickinson, 2001). Evans *et al.* (2007) found that attending a single, one-week, outdoor nature-related workshop strengthened children's ecological world views.

Kellert (1996) classified children's experiences of nature into 3 categories: direct, indirect, and vicarious. Direct experiences are "actual physical contact with natural settings and nonhuman species" such as children's play or activity in a backyard or a nearby forest or park, which is mostly unplanned and informal (Kahn & Kellert, 2002, p. 118). Indirect experiences include actual physical contact with nature, but in a more restricted and programmed way. Examples include children encountering plants, animals and habitats in various settings such as zoos, aquariums or botanical gardens, or contact with flowers, vegetable gardens and domesticated farm animals as an integrated part of a home or preschool. Finally, vicarious experiences do not involve actual physical contact with nature, but rather experiences gained through depicted scenes of nature, which could be realistic or symbolic and metaphorical (Kahn & Kellert, 2002). Examples of these would include nature stories (e.g., "The Very Hungry Caterpillar" by Eric Carle or "The Lorax" by Dr. Seus) and film (e.g., Disney's "Finding Nemo"). Giusti *et al*. (2014) consider the definition of "nature experience" within urban settings: drawing from the work of Finch (2008), Miller (2005), Pyle (1993) and Samways (2007), they define nature experience as any human interaction with non-human species and natural environments (Giusti's et al., 2014). Having the opportunity of interacting with a tangible aspect of nature (e.g., animals, plants, rocks, sticks, etc.), whether it is happening in a

human-made natural area (e.g., zoo or botanical gardens) or in a more natural area (e.g., forest or natural shore line), is considered an experience with nature. In this study, which is in an urban setting, we used the same definition for nature experiences.

Past studies have demonstrated the lack of a clear and direct relationship between environmental knowledge and behavior (Nisbet, Zelenski & Murphy, 2009). A person may have great knowledge of the environment and environmental issues but not necessarily translate that knowledge into pro-environmental actions in their own life. To address the gap between knowledge and behavior, some scholars have explored the concepts of environmental attitudes, environmental affinity and biophilia, which are believed to pre-dispose a person towards engaging in pro-environmental behaviors throughout their life. Based on evolutionary history, E. O. Wilson (1984) defined "biophilia" as a person's inherent affiliation to the natural environment (Rice & Torquati, 2013; Hinds & Sparks, 2008; Nisbet et al., 2008). Children's biophilia and environmental identity ("the meanings that one attributes to the self as they relate to the environment"; Stets & Biga, 2003, p. 406) have been shown to be impacted as a result of early significant experiences with natural areas, resulting in constructing more positive attitudes and behaviors in adolescence (Tani, 2016; Rice & Torquati, 2013; Clayton & Opotow, 2003).

According to Bragg et al. (2012), the influential factors that impact children's affinity to nature include: (1) engaging in nature activities; (2) having positive experiences in natural environments; (3) having the positive influence towards nature of family members or other significant role models; and/or (4) having positive memories in natural areas. This is supported by neurological research, which reveals that persistent

access to nature is “related to the development of a mindset more neurologically familiar and accustomed with the biosphere" (Giusti et al., 2014, p. 18). The possibility of interacting with nature over a long period of time and increasing the level of an individual’s environmental identity and relatedness embedded in their mind set, facilitates pro-environmental cognitive decision making (Giusti et al., 2014; Hinds & Sparks, 2008).

Due to the amount of time preschoolers spend in preschools, involving in a wide range of nature experiences and exposures which are restricted by preschools’ locations, facilities and pedagogical approaches, it can be hypothesized that children’s environmental affinity can be strongly affected by the quality of their preschool life provided by the preschool (Gandini, 1993; Giusti et al., 2014).

3.1.2 Environmental Education and the Importance of The Role of the Educator

Environmental education aims to improve public environmental literacy by raising environmental knowledge, attitudes, behaviors, and skills, developing concerns for discovering the consequences and real causes of environmental problems, and motivating people to take actions towards solving local, national and international environmental issues (Spence, 2011; UNESCO-UNEP, 1976). Environmental education programs can be delivered by formal (e.g., grade school, secondary and post-secondary education), non-formal (e.g., non-governmental organizations, not-for-profit organization, museums), and informal organizations (e.g., family members, mentors, peers, multimedia; Spence, 2011).

According to Palmer (2002), since the 1970s, environmental education programs have consisted of 3 main cores: education ‘about’, ‘in’, and ‘for’ the environment. To

realize the earth functions and identify the impacts of human beings on nature, environmental education must provide learners with a basic understanding of theories of ecology, chemistry, and biology, including discussions on the carbon cycle, population theory, the water table, the laws of thermodynamics, the concept of biodiversity, and so on (Wright, 2006). Also, environmentally literate individuals must demonstrate knowledge and understanding of the philosophical, political, economic, and socio-cultural factors influencing the environment (UNESCO, 1990). Education 'about' the environment encourages learners to understand their relationship with nature and potential positive and negative impact they may have on it (Wright, 2006). While education 'about' the environment focuses on discovering the scientific facts behind different components of nature, education 'in' the environment is utilizing nature as a medium for encouraging enquiry and discovery as well as a resource of materials for practical activities such as language, science, and mathematics (Palmer, 2002). First-hand experiences with fully natural and/or human-made nature-related environments support individuals to develop environmental connectedness and concerns, and gain more skills in observation, recognition, and affiliation (Wright, 2006). Finally, education 'for' the environment tends to "go beyond the acquisition of skills and knowledge", results in enhanced environmental values and behaviours, and increases individuals' involvement in environmental movements (Palmer, 2002, p. 137). Scholars believe that learning 'for' the environment should teach people how to change the world, motivate and empower them "to participate in ethical practices, in environmental improvement and in the protection of the earth" (White, 2006, p. 73). Education 'for' the environment helps individuals to translate their knowledge and concern into behaviour for nature.

Based on the 1975 Belgrade Charter: A Global Framework for Environmental Education, environmental education should be an interdisciplinary, life-long process that comprises all aspects of the environment ("natural and man-made, ecological, political, economic, technological, social, legislative, cultural and esthetic"; Spence, 2011, p.25), and promotes an active public participation in preventing and solving current and future environmental problems (UNESCO-UNEP, 1976). The Tbilisi Report, emerged from the Tbilisi International Conference on Environmental Education (1977), went further by emphasizing the necessity of integrating environmental education into the whole system of formal education at all levels (UNESCO-UNEP, 1977). According to the Tbilisi Report, environmental education learners should participate in planning their own learning experiences, and be exposed to diverse learning approaches and practical and first-hand nature-related activities (UNESCO-UNEP, 1977). Moreover, the Tbilisi Report puts special emphasis on the importance of developing environmental sensitivity in learners from the early years of childhood (Spence, 2011).

Studies on children's intellectual, cognitive, and emotional growth have shown that early childhood is the most important phase of an individual's learning process (Meiboudi, 2013; Nutbrown, 2006). A review of the literature on children's education reveals that human basic values, skills, attitudes, habits, and behaviors are determined by early childhood experiences of life (Samuelsson & Kaga, 2008). Accordingly, children's environmental education programs endeavour to achieve a sustainable and life-long improvement in children's environmental knowledge, attitudes, and behaviors (Liefländer & Bogner, 2014).

> If we desire that adults, in the next generation, respect nature and care for the planet, it is important to include now, in the early childhood education curriculum or programme, the study of nature, and the interdependence between human beings and the environment. Everything deeply lived, practised and felt in the early years of human development remains for the rest of one's life (Paris UNESCO, 2008, p. 26).

After the Tbilisi Report (1977), nature education and providing young children with indoor and outdoor nature exposures have been increasingly valued in early education (Edwards et al., 2016). According to Sauve (2005), the role of childhood environmental education is to develop critical thinking skills about the world surrounding children, and engage children in understanding of their interconnected relationship with nature. Young (2013) believes that a nature study for preschoolers is a combination of explorations and questioning that gradually becomes more and more focused and systematic, resulting in expanding children's comfort zones and familiarity with the wilderness (Meier & Sisk-Hilton, 2013). An active environmental education encourages children to observe, use their multiple senses, challenge themselves physically, and develop a sense of wonder, joy, belonging, and respect for nature (Meier & Sisk-Hilton, 2013). Moreover, by emphasizing discovery-oriented approaches to learning, preschool children are encouraged to document their experiences through representation and making crafts (Worth & Grollman, 2003).

According to previous studies, educators play a significant role in the success of environmental education programs (Stevenson, 2007a). Studies have revealed that educators' personal, educational and professional backgrounds, beliefs, and values highly

influence the success of bringing environmental education into their indoor and/or outdoor classes (Ernst, 2009). Further, environmental educators serve as role models and mentors who determine the scope of nature exposures based on developmental stage of the children, and create opportunities for children to explore nature, set goals, test their own environmental action skills, and participate in decision-making in the classroom (Chawla & Cushing, 2007). It is therefore postulated that effective environmental educators should create clear rules, encourage children to express their thoughts and feelings in a democratic environment, and reflect children's voices in their curriculum (Flekkøy & Kaufman, 1997). Children need to see that their ideas are taken seriously and realized (Chawla & Cushing, 2007). As such, an environmental educator should cognitively and affectively engage with students on environmental concepts (Stevenson, 2007b), and develop a student-teacher interaction that reinforces children's "motivation, self-esteem, interest in learning, and engagement" (Spence, 2011, p. 37).

3.1.3 Reggio-Emilia Pedagogical Approach – An Approach to Nature Exposure and Environmental Education

Reggio-Emilia is a city in Northern Italy (Hewett, 2001). After the end of World War II, this city, guided by Loris Malaguzz and with collaborative input from parents, teachers and the general community, developed a novel educational system and curriculum (Hewett, 2001). In this innovative early childhood pedagogical approach, which is supported by an eclectic blend of theories, children have more rights than needs; their thoughts and desires are listened to and valued in a democratic way; and they play an active role in constructing the body of their own knowledge (Hewett, 2001; Shelley & Flessner, 2013). This approach is consistent with Piaget's (1973) theory, which

emphasizes active education and suggests the role of the child as a researcher. In the context of this approach, children are considered researchers, forming their own questions, hypothesising the solutions and discovering the outcomes (Hewett, 2001). The literature has shown the effectiveness of the Reggio-Emilia-pedagogical approach in practicing the skills of communication and research development (Katz, 1998). In Reggio-Emilia educational environments, children feel safe to express themselves, reflect on themselves and others, formulate their own questions, and communicate as speakers and listeners (Rinaldi, 2006). Moreover, children learn how to present their ideas in multiple ways such as verbal language, drawing and making crafts (Katz, 1998). This can develop a basis for "modifying, developing, and deepening understanding" (Katz, 1998, p. 34), which can lead to further observations, discussions, and representations.

Another theoretical basis of the Reggio-Emilia approach is Vygotsky's social-constructivist theory, which emphasizes "children's learning in terms of the relationship between language and cognitive development" (Inan, Trundle & Kantor, 2010, p. 1189). Vygotsky believed that children, as social beings, expand their knowledge by collaborating, making dialogue, negotiating and interacting with teachers and peers; which is one of the fundamental Reggio teachers' beliefs (Inan et al., 2010; Hewett, 2001). This approach established a new 'image of the child' as intelligent, competent and strong (Malaguzzi, 1994), a new role of the teacher as an observer, listener, co-learner and facilitator (Rinaldi, 1993; Hewett, 2001) and a new view of the importance of a well-planned environment and materials (Inan et al., 2010).

The importance of children's leadership has been emphasized by Reggio-Emilia philosophers, as well. Reggio-Emilia-inspired teachers believe in children as powerful,

intelligent and curious creatures who are able to generate changes in environments they are involved in (Edwards, 2002). From Reggio-Emilia-inspired educators' points of view, children can become "producer(s) of culture, values, and right" (Rinaldi, 2011, p. 51). Therefore, in this environment, teachers intend to follow children's interests, and do not provide a pre-prepared and structured curriculum (Edwards, 2002). In Reggio-Emilia preschools, the process of teaching and learning is negotiable, emerging from the adult teachers and children's communications (New, 2007).

One of the remarkable traits of Reggio-Emilia-inspired educators is their respect for the natural world, which provides children with an integration of self and nature (Cadwell, 1997). Reggio-Emilia-inspired teachers believe that children's engagement in nature-related activities not only promotes preschoolers' feelings of being at home, but also enhances their sense of belonging to local, national, and global communities, which promotes pleasant relationships between children, their society and other living creatures (Vandermaas, McClain & Fair, 2017).

3.2 Methods

Considering the significant impact of nature experiences during childhood on children's nature connectedness (Rickinson, 2001), this study aimed to examine the indoor and outdoor nature exposures of children at 2 preschools (Peter Green Hall and Beech Street preschools) in Halifax, Nova Scotia and to better understand the pedagogical approaches to nature exposure taken by the teachers. This paper is part of a larger study that assesses the impact of nature-related experiences on children's bio-affinity. We purposefully chose to sample from Reggio-Emilia preschools, which afford

children the opportunity of being exposed to nature (indoor and outdoor) in their daily lives.

To make an assessment of indoor nature exposure for the children in each centre, the Primary Investigator observed and inventoried recognized features of the natural world in the built environment as established by Kellert, Heerwagen & Mador (2011), which include: natural colors, water, fresh air, sunlight, plants, animals, natural materials, views of nature, habitats and fire (for definitions see Table 1). To assess indoor and outdoor nature exposures and to gain insights into the teachers' approaches to nature exposure we engaged 3 head teachers (all female) from Peter Green Hall (PGH) and 2 head teachers (one male and one female) from Beech Street Preschool (BSP) in face-to-face and semi-structured interviews (for a list of questions see Appendix A). The interviews took place in a quiet classroom within the preschools' settings in November 2016, and the time needed to conduct a complete interview was ~45 minutes. All interviews were audio recorded for data accuracy purposes. We did not directly ask the teachers about the Reggio-Emilia-inspired goals; however, the semi-structured approach enabled teachers to mention any relevant matter they wanted to share. Transcriptions of the interviews were thematically coded using NVivo qualitative software, and analyzed using a mix of *a priori* deductive and *a posteriori* inductive approaches (see Table 2 for all codes). Three themes found in the Reggio literature were used as *a priori* deductive themes: children having a respectful relationship with nature; children's feeling of being at home in wild places; and a child's reported feeling of empowerment through knowledge about ways to protect the natural world (based on Vandermass-Peeler *et al*., 2017). Furthermore, by applying thematic analysis, *a posteriori* themes emerged:

children's leadership during nature-related experiences; improving children's communication and social skills; and, the role of children as researchers. All nature-related indoor and outdoor exposures and Reggio-Emilia goals mentioned by teachers during the interviews were coded and analyzed. To keep teachers' identity and information confidential, they were assigned participant codes (T1 – T5).

Table 2: Teachers' Reggio-Emilia goal

	Reggio-Emilia goal
Inductive	children's leadership during nature-related experiences
Inductive	improving children's communication and social skills
Inductive	role of children as researchers
Deductive	a respectful relationship with nature
Deductive	a feeling of empowerment through knowledge about ways to protect the natural world
Deductive	a feeling of being at home in wild places

3.3 Results and Discussion

The results show that the children within the 2 Reggio-Emilia preschools were provided with multiple opportunities for education 'in', 'about', and 'for' the environment through direct and indirect experiences with nature. The interior of the schools offered a multitude of indirect and vicarious indoor nature exposures. Children were exposed to a wide range of outdoor nature-related activities in their daily curriculum. Analyses of the interview transcripts reveal a number of major themes related to teachers' conceptualizations regarding teachers' role in the facilitation of nature

experiences including: developing a respectful relationship between children and nature; encouraging children to feel safe and comfortable in natural places; and empowering children through knowledge about ways to protect the natural world. Moreover, the teachers reveal significant goals to attain during nature-related experiences including: developing children's leadership abilities; improving children's communication and social skills; and, reinforcing the role of children as researchers.

3.3.1 Location and frequency of Outdoor nature-related experiences

Data analyses reveal that this cohort of preschoolers in both preschools have outdoor nature-related experiences in a variety of settings and locations on a daily basis (Table 3 and Figure 2). As demonstrated in Table 3, 11 out of 26 outdoor locations include open fields covered with grass and street trees, 2 locations are full-canopy remnant forest patches, and 10 locations are covered with mixed-vegetation. 15 locations comprise some type of built environment (e.g. building, playground), and 8 of the 26 locations have access to a body of water. It should be noted that not all the children have necessarily visited all the 26 outdoor locations because of when they joined the pre-school or because of various absences due to holidays, illness, etc. However, based on what the teachers reported, all of children in this cohort have visited at least three quarters (n=~20) of these 26 outdoor locations.

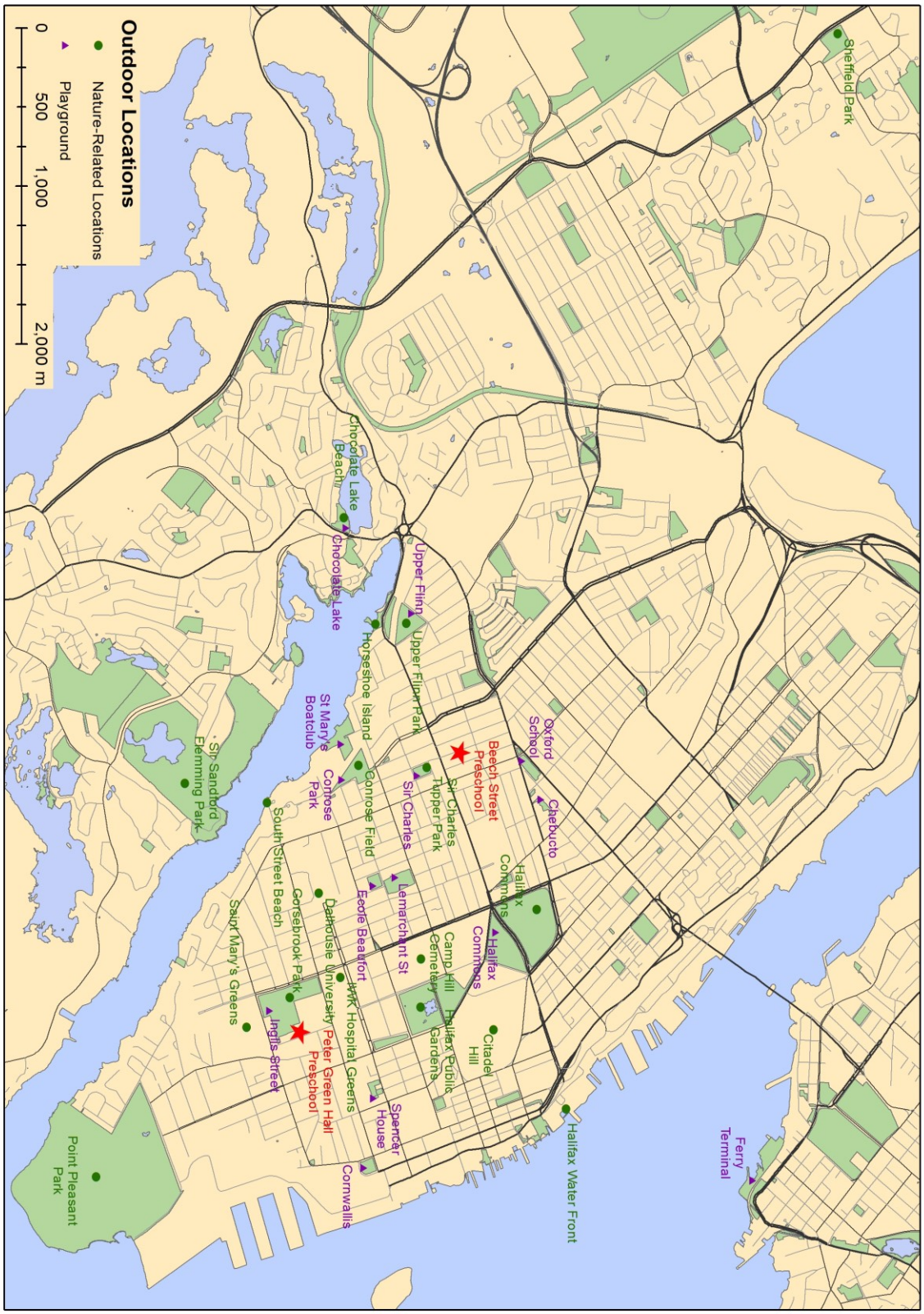

Figure 2: Outdoor locations children have visited

Table 3: Location of nature exposures for preschool children

Location	Open fields	Full-canopy remnant forest patch	Partial-canopy covered area (mixed-vegetation)	Urban built environment (e.g. playground)	Access to a body of water
Camp Hill Cemetery			*		
Chebucto Playground	*		*	*	
Chocolate Lake Beach			*	*	*
Citadel Hill	*				
Conrose Field	*			*	
Cornwallis Playground			*	*	
Dalhousie Greens	*				
Ecole Beaufort Playground			*	*	
Gorsebrook Park	*			*	
Halifax Commons	*			*	
Halifax Public Gardens			*		
Halifax Waterfront				*	*
Horseshoe Island	*				*
IWK Hospital Greens			*		
Lemarchant St Playground				*	
Oxford School Playground			*	*	
Point Pleasant Park		*			*
Preschool's backyard				*	
Sheffield Park	*				
Sir Charles Tupper Park	*			*	
Sir Sandford Flemming Park		*			*
South Street Beach					*
Spencer Playground			*	*	
St Mary's Boat Club			*	*	*
St. Mary's University Greens	*				
Upper Flinn Park	*			*	*
TOTAL (/26)	11	2	10	15	8

Activities that the children engaged in within these locations included unstructured playing in nature, observing and studying natural creatures, collecting and making a display of ecological elements (e.g., flowers, acorns, sticks, stones, salamanders), and small-scale cultivation.

In terms of the frequency of nature exposure, all teachers reported taking the children outside twice a day as a part of their daily curriculum for a total of approximately 3 hours per day. Teachers indicated that the proximity of the location was a significant factor influencing the frequency of visits and the time allocated to each visit. As one of the teachers explained: "we go to Conrose and Sir Charles Tupper park multiple times per week. But the ones that are a little bit farther, I would say, we go probably couple of times a month… Each month we probably do a big walk, just because it does take a long time to get there, and it's more important for us to be at the location for a longer period of time and not just traveling the whole time. Although the traveling is fun, too, being there is a more important" (T2).

Our assessment cannot evaluate the effectiveness of the children's education 'about' and 'for' nature. However, it strongly shows that this cohort of children is spending daily time 'in' nature, which can develop the foundation of environmental attitudes and encourage critical observation, enquiry, and discovery (Palmer, 2002). This result is consistent with previous research revealing that in Reggio-Emilia preschools, children spend substantial amounts of time outside and learn in the environment through playing, gardening, observing, and exploration (Vandermaas, McClain & Fair, 2017). Similar studies, using different methods, have also reported that Reggio-Emilia preschoolers have the opportunity of exploring the world at first hand, experiencing natural phenomena such as the weather, the changing seasons and life cycles, and moving around freely (Maynard, Waters & Clements, 2011).

3.3.2 Variety of Indoor nature-related exposures

Our findings identified various nature-related elements also provided within the preschools. As Table 4 demonstrates, these features include natural colors, water, fresh air, sunlight, plants, animals, natural materials, views of nature, habitats and are important as they have been shown to facilitate first-hand and/or vicarious exposures to nature which can create awareness, concerns, and environmental-friendly behaviors in children (Kellert, 2005; Maynard, Waters & Clements, 2011).

For some of the students, indoor nature exposure involved a view of the outdoors. One of the classrooms at PGH has a window with a view of outdoor nature. In addition, the classrooms at both PGH and BSP contained several nature books and posters depicting animals' habitats, sea-life and sea shores, life in the arctic and farms, which provide vicarious nature experiences for children and may partially compensate for the lack of real natural views. These exposures are important, as Kellert (2002) has demonstrated. Vicarious experiences of nature involving different media about the natural world can positively impact children's intellectual, affective, and assessment skills (Duerden & Witt, 2010).

The classrooms themselves are full of natural materials, and the color pallets are natural with pinewood, green, blue and yellow shades (Figure 3). As T4 pointed out, instead of using unnatural (i.e. neon) colors, they prefer to bring the colors of nature (e.g. colors reminiscent of the muted shades typically found in nature) into the classrooms by collecting flower petals, rocks, seashells, chestnuts and sticks, bringing them inside, and decorating the classroom's environment.

Figure 3: PHG Classrooms (Omidvar, 2017)

Children are also exposed to animal life inside the preschool (Figure 4). BSP has a cat that is allowed to stroll around the preschool and the neighbourhood all day, and the children may feed or pet her whenever they want. The teacher explained: “She brings dead animals in all the time. That’s a learning experience, too. I consider that a teachable moment. Children are just like “Oh! It’s a dead mouse! Let’s clean it up!” (T5). Further, there are fish tanks in all of the PGH and BSP classrooms, and the tanks are decorated with rocks, sea shells, plastic plants, colorful sand, gravel, and driftwood. In one of the PGH classrooms, there is a European Fire Salamander in an aquarium with moss, rocks, a

pool of water and a grassy area, resembling the natural habitat of the animal. Interestingly, since the European Fire Salamander eats live crickets, children need to take care of crickets and feed the salamander with them, which helps children to learn about the food cycle. Moreover, PGH junior preschoolers take care of several black salamanders in a wooden box filled with soil. There is a similar box in PGH and BSP seniors' classroom, which is full of earthworms and/or caterpillars depending on the season. Children have the chance to watch and study these animals' behaviours, as well as practice how to take care of them. As T2 explained, "Being invasive toward a living creature is hard balanced, because we want to watch and study them, but at the same time, we need to be respectful. We bring them to the classroom for a short period of time, but the children have to be very involved in proper care. What does this creature need or what do they want? What makes them feel comfortable? Do they like to be held? Probably not!". As previously mentioned, interacting and creating relationships with animals can support children's learning, develop their empathy and emotions, add a playful exercise to their curriculum, and improve their verbal and non-verbal skills (Svensson, 2014).

Figure 4: Live animals (Omidvar, 2017)

In both preschools, there are several shelves containing various natural materials such as feathers, crab shells, sea shells, stones, pine cones, dried fruits, seeds, chestnuts, and sticks (Figure 5). Also, there are sensory tables in all classes filled with water, sand, grain, etc. Children may play with their toy sea animals in the water, sea shells in the sand, or any other creative sensory game. Not only are children free to play with the natural materials, but sometimes teachers set a nature-related scene by using different natural materials for children to play with and explore (Figure 6). As T1 described, "we would cover a big table with [a] green blanket, which is supposed to be grass, and put logs there, a little pool full of water, and little toy frogs, to see what the children would do with them. They would just act like what frogs do in nature. They would jump on the

logs and then they will take a little bath. We always set a little nature table, and let them play. We got to the point where the children will choose the natural materials just as easily as they choose the toys, because we keep them out all the time. We keep them as part of our environment".

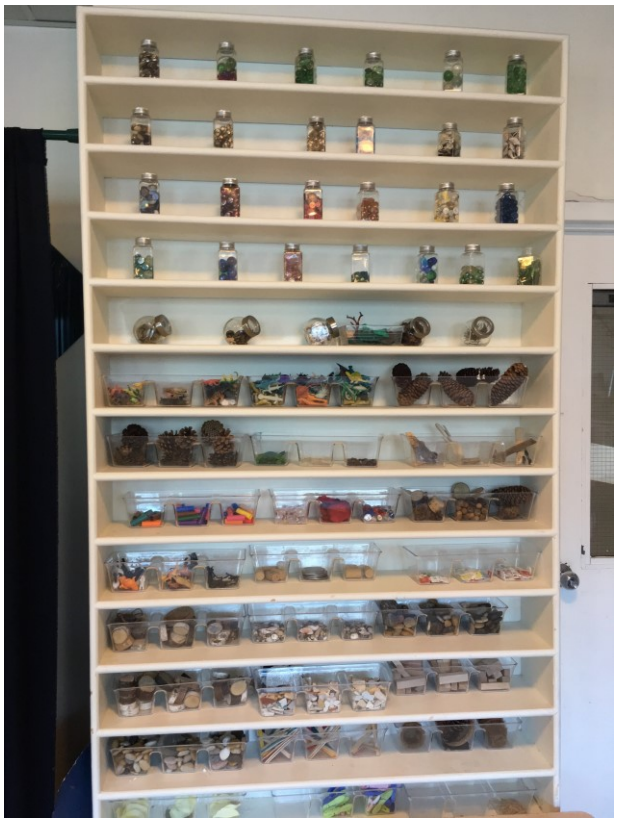

Figure 5: Natural materials (Omidvar, 2017)

Figure 6: Natural materials (Omidvar, 2017)

In terms of biophilic interior design (Kellert, 2011), each classroom in the preschools had between 4 and 10 different kinds of plants. In addition, some classrooms had a 'tree table,' which is a wooden table with a hole in the center with a deceased tree looking like it is growing out of the hole. When the tree died outside in their yard, the preschoolers suggested keeping the tree in their classroom. Following brainstorming about how to include the tree in the environment of the classroom, the children and teachers came up with the idea of making the tree table (Figure 7). Now, the tree table is a place for children to exhibit their art works, decorate it with their paper leaf and flower creations, make spider webs with yarns, or bird nests with sticks, and put these handmade nature-related elements on the tree.

Figure 7: Tree table (Omidvar, 2017)

Table 4: Indoor nature-related features

	PGH Juniors	PGH Seniors	PGH 4 yrs. +	Beech Juniors	Beech Seniors
Natural Colors	*	*	*	*	*
Fresh Air	*	*	*	*	*
Animals	*	*	*	*	*
Fire					
Habitats	*	*	*	*	*
Natural Materials	*	*	*	*	*
Plants	*	*	*	*	*
Sunlight	*	*	*	*	*
Views of Nature		*			
Water	*	*	*	*	*
Total (/10)	**8**	**9**	**8**	**8**	**8**

3.3.3 Preschoolers' Nature-Related Experiences and Activities

We asked teachers about the activities children have been interested and engaged in during their nature experiences over the last year. Our analysis revealed 4 major categories: nature recreation (playing in nature); observing and studying natural creatures; collecting and making a display of ecological elements (e.g., flowers, acorns, sticks, stones, salamanders); and, small-scale cultivation.

Playing in Nature: Playing in nature was the most frequent theme that emerged in teachers' responses. The teachers unanimously believed that recreational activities in nature offer more diversity to preschoolers' physical activities, and help them to develop social skills and explore creative learning. The teachers were of the opinion that nature-related activities can strengthen children's connectedness to the earth. All the teachers indicated that playing outdoors for long periods of time is essential for children to freely develop more adventurous and creative skills. This is in line with the work of Li, Hestenes & Wang (2014) who demonstrate that playing in nature offers children a wide range of pretend play scenarios. Shim et al. (2001) found that in comparison with indoor classrooms, children are more likely to join in pretend play in outdoor environments, which can enhance children's creativity and coping strategies. Finally, some teachers also mentioned the health benefits provided by outdoor play. As T2 described: "[Outdoor play] makes children's immune system[s] stronger, and from nature, they learn a lot about how to regulate themselves and how to take care of the environment. That's what my philosophy is…. My kids spend more than 3 hours a day outside, not in an industrial-structured playground, but in the woods. They have teepees, and hammocks, and very

natural places they can sit down. From that environment, I think, we reduced bad behaviors. Children naturally learn how to protect themselves, and how to walk properly. I believe in learning from nature and learning with nature". This understanding of the health benefits of children's play in nature is well documented in the literature (Herrington & Brussoni, 2015; Li, L.Hestenes & C.Wang, 2014). Outdoor play activities positively affect children's general health by preventing obesity, hypertension and dyslipidemia, increasing blood flow to the brain, and psychologically helping them to learn how to self-control and collaboratively play (Herrington & Brussoni, 2015; Frost, 1992; Strong et al., 2005; Thomas & Harding, 2011).

Observing and studying natural creatures: According to teachers, nature is the best place for studying animals and plants. When they go outside with kids in a natural park or the preschools' backyards, they find different bugs, snakes, worms, salamanders, slugs, dogs, squirrels or deer, as well as various types of plants. Interested children are allowed to bring inoffensive animals to the preschools carefully, study them and then take them back to nature. This relationship with animals is a valuable experience which can benefit children in various ways. Interacting with animals can positively alter children's viewpoint on life and its meaning (Svensson, 2014). Moreover, scholars have found that children who have been involved with animals show an enhancement of social behaviours, communication skills and physical and emotional well-being (Tissen, Hergovich & Spiel, 2007; Svensson, 2014). Developing relationships with animals in daily life provides a significant chance for children to practice their cognitive and empathic abilities as well as enhancing their concepts of morality (Svensson, 2014).

Figure 8: Nature collections (Omidvar, 2017)

Collecting and making a display of ecological elements: The teachers indicated that the preschoolers are encouraged to collect the loose parts of the plants which are not still alive, and make creatively different displays with them (Figure 8 & 9). These whole-body multisensory experiences can provide several opportunities for children to use their imagination and creativity (McClintic & Petty, 2015). T3 explained about an unoccupied birds' nest they found on the ground. After making sure that it is not used by birds, children brought it to the classroom, which was a trigger for learning more about birds and the structure of their nests. One of the 4-years plus preschoolers decided to create his

own nest by using natural materials he had collected from the woods. When it was all done, he invited lots of children from the seniors' classroom to visit it, asked the teacher to write a note on a piece of paper and attached it to the nest, which said "one 4 plus created, and lots of seniors helped", a very heart warming description!

Figure 9: Nature displays (Omidvar, 2017)

Small-scale cultivation and gardening: Both preschools have small gardens in their backyards (Figure 10). However, only 2 of the 5 teachers indicated that gardening was part of their daily curriculum. They both stated that their personal enthusiasm about farming and growing local food has resulted in promoting gardening experiences and enjoyment in their classrooms. By having seasonal considerations in mind, they plant

carrots, beans, cucumbers, lettuce, tomatoes and strawberries. During gardening time, children help with digging, planting, watering and weeding. Essentially, harvesting and eating their own grown food is the most exciting part of the cultivation for children. According to a study done in Montreal in 2012, cultivation and gardening can develop affective and caring child-nature interactions, which positively influence children's environmental identity, "an identity that manifests through the conservation and preservation of nature" (Hordyk, Dulude & Shem, 2015, p. 577). Additionally, benefiting from instructional gardens in preschools can change children's food intake patterns (Davis & Brann, 2017). Exposure to gardening and cultivation can change children's eating behaviours by increasing children's willingness to try fruits and vegetables, expanding children's knowledge about food origins and encouraging independence in eating (Gibbs et al., 2013; Heim, Stang & Ireland, 2009).

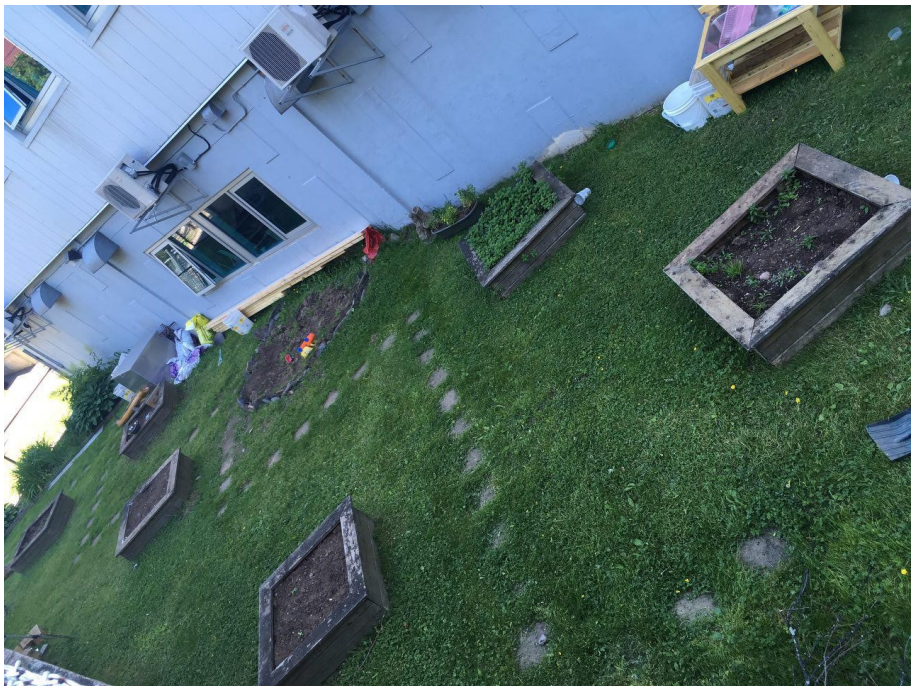

Figure 10: Gardens (Omidvar, 2017)

In summary, students in both preschools are exposed daily to a wide variety of outdoor nature for approximately 3 hours per day. There is a plethora of indoor nature exposures for students inside the built environments of the preschools including live animals, plants, natural play materials (e.g., shells and sticks), and representations of nature (e.g., books, posters, etc.). These intensive outdoor and indoor nature experiences afford children a unique opportunity to observe and explore 'in' the environment, as well as gain skills and knowledge 'about' different ecological and biological elements of the natural world. Furthermore, by developing a constructive relationship with nature, the children at these schools have the potential to develop values, caring feelings, and positive attitudes towards nature, which can lead to "opportunities in which students can actively participate in the resolution of environmental problems" (White, 2006, p. 78). This is aligned with the objectives of education 'for' the environment. As a result, it can be concluded that these 2 preschools integrated all 3 cores of environmental education in their curriculum.

3.3.4 Pedagogical and philosophical approaches of teachers to nature exposure

Our analysis not only revealed the types of nature experiences that preschoolers were exposed to, but the pedagogical philosophies of the teachers in creating nature-related experiences for the students. As a part of Reggio-Emilia goals, all teachers put an emphasis on the importance of children's leadership when they get outside. All teachers mentioned that the children show an interest in nature, which leads them to plan very open-ended daily outside activities. Thus, in lieu of preparing a pre-designed curriculum for their classes, the teachers tend to find more meaningful teaching moments from spontaneous activities resulting from the preschoolers' interests and curiosity. They

reported being quite conscientious about creating “teachable moments” out of nature-related explorations which harness the children’s excitement.

> “We teach them how to observe. We are not just saying ‘Look! This is this bug and this is how this bug works!’ We get them to look at the different body parts and think critically why it has so many legs. Is it slimy? Is it smooth? They make their own guesses about how the world works. I’m always desperate just to say ‘Oh! I know what that bug is’ and tell them the answer, but our philosophy is not to give them the answer, let them guess for themselves and build their own knowledge about the world around them. Nature is a perfect time to do that, because there is so much unknown out there. It’s not created by men. So, it’s interesting and exotic to them. This is also in line with my personal philosophy and the philosophy of our centre” (T4).

This is a good example of environmental education about nature, in nature and potentially for nature.

As T1 described, for her, the process of organizing these nature-related activities is a combination of stimulations and invitations.

> “For me, the best experience is when the children have a sense of not being controlled and not knowing what is heading them on the path, like the adventure part of it. Because they don’t know what they are going to see, they are not going to know what kind of materials they are going to want to pick up. Every stick is new; a new interesting branch or new interesting rock. And when we get to go on those adventures, those are far more positive experiences than if we are just sort of in a playground that looks the same all the time”.

This view is supported by previous studies which found that, from children's perspectives, fun, pleasure, choice, and freedom are the most significant elements of play (Glenn, Knight, Holt & Spence, 2013). Scholars suggest that, by providing the mentioned features, natural play spaces can encourage children to engage more in play and direct experience with nature, and improve their innate sense of connectedness to the earth (Refshauge, Stigsdotter, Lamm, Thorleifsdottir, 2015; Rice & Torquati, 2013).

The analysis of the interviews using the *a priori* and *a posteriori* themes developed shows some interesting results (Table 5). The most frequent theme that was found (11 separate references) was 'children's leadership during nature-related experiences'. Teachers emphasized the importance of listening to children's needs, desires and curiosity while planning on nature-related activities, and letting children's interests lead them. As T5 mentioned, for deciding on each part of the daily curriculum, they just need a reason from the children. "When we go outside, we have the idea in our head that we are there to explore and let the children lead. For this purpose, we don't tend to create a designed curriculum. We do not do that at all. We don't go with the previous set of ideas of things we need to do, or things we need to happen for the outing to be successful. It's very relaxed and natural. In this way, we find that the children feel confident enough to be able to express their ideas and their desires at that time."

The next most recurrent themes were 'improving children's communication and social skills' and the 'role of children as researchers'. Teachers supposed that exposure to various environments on a daily basis could bring up lots of conversation topics, which not only improve children's verbal and non-verbal communication skills, but also encourage them to ask questions, hypothesize, and find the answers in a relaxed and

organic way. “When we had the salamanders, that was really big with the kids, they asked where would they live? Where they come from? What they do? Do they have families? Do they….? So, we focus on one thing and then they bring up all the questions” (T3). Teachers believe that all their activities in nature such as collecting, playing, observing natural creatures, and gardening can have some triggers for their new group conversations started with “what is that?”, which could lead them to a new research question. As specified by the literature, sensory experiences of interacting with nature are associated with making more active observations, explorations, and hypotheses which promote cognitive learning (McClintic & Petty, 2015; Thomas & Harding, 2011).

One of the interesting stories about conversation and critical thinking opportunities provided by nature is ‘the story of bumblebee’ that T2 shared. She explained:

> “In the spring, we were playing outside. One of the children who is quite nervous while getting too close to wildlife but is really fascinated by it, comes running over to me and explains that he found a bug. So, we go over, sit down, and I recognize right away, it’s a bee! I ask children what they think it is. They have a discussion about what they feel the animal could be. Finally, they conclude that it is a bumblebee. But we notice that it is not flying anymore; it was sitting on the pavement out back. Since lots of kids were riding bikes or running around, children get concerned that something bad can happen to the bumblebee. We also talk about why the bumblebee is not flying anymore? They were trying to figure out, maybe it’s not feeling good, maybe it’s sick. Somebody said maybe it’s sleeping. The discussion went on for a little bit and more and more children were

coming over and gathering until we had a quite large circle. Then another child said she had heard that sometimes the bumblebees are getting tired and if we give them a little bit of sugar with water, it can help them get the energy to fly. So, children mix some sugar and water, we put a couple of drops there, and the bumblebee drinks it up. Then, we help the bumblebee on to a mitten, carry it over a grassy area that the kids think would be appropriate. Once we put it down, the kids noticed that the bumblebee was cleaning itself, dancing a little bit, and the wings are again strong. After few minutes, all out of the sudden it takes off and flies away. All the kids cheer. Everyone was so excited. They felt very good about themselves. They recognized that this thing couldn't talk to us, needed something, and they had to try to investigate what they could do to help."

The next theme that emerged was 'a respectful relationship with nature'. Teachers indicated a belief that taking care of plants and animals keep children in tune with nature in a respectful manner. As T4 mentioned, for her, being respectful of nature is the only prerequisite of planning outside and inside activities: "We try to encourage the kids not to pick anything that is alive still, outside. We try to encourage them to have respect for nature, things that are on the ground, different rocks, everything like that. If they find it and nature is no longer using it at that moment, then they can bring it in and study it". Furthermore, one teacher indicated that empathy is another important ability developed by nature-related experiences: "We teach children that thinking about a greater world around them is as important as thinking about their own selves. So, I think that empathy has a huge part of the program and the huge part of what we have been doing outside.

The trees are something you shouldn't hurt as own yourself. And this is translated to be nice to each other, and be nice to your parents, and be nice to animals and plants. This idea that we are all one big community is a huge part of what we talk about here" (T5).

While not mentioned by all teachers, a 'feeling of empowerment through knowledge about ways to protect the natural world' was an interesting theme that emerged. The best example of what teachers shared in this regard was participating in the Clean-Up Canada campaign.

> "After Clean-Up Canada, children start to feel passionate about littering. Like cigarette butts is a huge offence to my children. So, we participated in that and they absolutely loved that. They filled tons of garbage bags. We did all around our neighborhood, our community. So, they were very excited and enthusiastic and motivated to help clean up our earth. They suggested that Halifax municipality should put [out] more garbage cans, because they felt that people just couldn't find the garbage can and that's why they were doing that. So, they're already coming up with the ideas for the city of Halifax to be able to try to minimize the pollution in our areas" (T1).

Finally, while only mentioned by one of the teachers, 'a feeling of being at home in wild places' was very important to that particular teacher. The teacher explained that after intense exposures to natural environments, children feel more comfortable while exploring the woods, which may include sitting on the ground, making their hands and cloths earthy, and walking with wet shoes. "A lot of children that we have, have been here since they were babies, they are all used to going for walks, playing in nature and things. They do not even complain about cold weather or rain. Because it's fun! I don't

believe in bad weather. If children are not prepared for the weather, that's the only reason that children cannot enjoy outdoors" (T3).

Our results support previous research, which indicates that for Reggio-Emilia-inspired preschool teachers, children's leadership and developing critical and creative thinking skills are significant factors in designing the curriculum (Gencer & Gonen, 2015; Herrington & Brussoni, 2015; Li, L.Hestenes & C.Wang, 2014). Further, teachers' emphasis on improving children's communication skills is consistent with Hong, Shaffer & Han's (2017) conclusion that shows the positive influence of Reggio-Emilia pedagogical approach on children's listening, commenting, enquiring, and engaging in interactive conversations. Similar to our findings, other studies indicate that developing a peaceful, respectful, and positive relationship with the environment is one of the goals of Reggio-Emilia-inspired teachers (McClintic & Petty, 2015). However, by looking at the proportion of teachers' emphasis on anthropocentric (mentioned 27 times) vs nature-related educational goals (mentioned 9 times), it can be concluded that for this cohort of teachers, environmental education and developing children's nature connectedness is not the focal point of their curriculum.

As it is proven that teachers' perceptions and beliefs determine their actions and decisions in the outdoor and indoor educational environments (Spodek, 1988), our research adds to the body of the literature by representing teachers' voices and understanding of their experiences during nature-related educational moments.

Table 5: Teachers' Reggio-Emilia nature-related goals

	Reggio-Emilia goal	References
Inductive	children's leadership during nature-related experiences	11
Inductive	improving children's communication and social skills	9
Inductive	role of children as researchers	7
Deductive	a respectful relationship with nature	5
Deductive	a feeling of empowerment through knowledge about ways to protect the natural world	3
Deductive	a feeling of being at home in wild places	1

3.4 Conclusion

As a part of a larger study, this research has assessed the frequency, variety and quality of preschoolers' indoor and outdoor nature experiences in Peter Green Hall and Beech Street preschools located in Halifax. Results reveal that the daily outdoor activities facilitated by Reggio-Emilia-inspired teachers include playing in nature, observing and studying natural creatures, collecting and making a display of ecological elements, and small-scale cultivation. This cohort of preschoolers spends almost 3 hours per day participating in these nature experiences and has visited many of the 26 different outdoor locations many times during the past year. Moreover, based on biophilic interior design principals, the indoor environment of the preschools provides accessible nature-related experiences throughout the day, including interacting with live animals, plants, natural play materials (e.g., shells and sticks), and representations of nature (e.g., books, posters, etc.).

This study also examined the preschool teacher's educational philosophies and goals for children's development in nature. The teachers participating in this study put emphasis on the importance of children's leadership during nature-related experiences, improving children's communication and social skills, and reinforcing the role of children as researchers. Developing a respectful relationship between children and nature, encouraging children to feel safe and comfortable in wild places, and empowering children through knowledge about ways to protect the natural world were other Reggio-Emilia goals mentioned by teachers.

This study contributes to the small, but growing body of knowledge regarding environmental education and nature experiences with young children in preschools. The results show that children within these preschools are exposed to indoor and outdoor nature experiences constantly throughout their days, which is a useful when looking at the bio-affinity of the children (see Chapter 4). Further, while the study focused on 2 Reggio-Emilia preschools and therefore cannot be generalized to all Reggio-Emilio education centers, it does demonstrate the importance of nature exposure and education 'in, for and about' the environment to the teachers at these 2 Reggio-Emilio preschools. Future studies could look at multiple Reggio-Emilio schools throughout Canada and internationally to determine whether the themes revealed in this study are unique or common within all Reggio-Emilia preschools.

Chapter 4: Investigating the Effect of Nature-related Routines on Preschool Children's Affinity to Nature at Halifax Children's Centers, Canada

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4.1 Introduction

Scholars have shown that with trends toward the excessive utilization of electronic media and growing parental restrictions, children are spending more time engaging in indoor sedentary activities rather than in outdoor play (Mainella, Agate & Clark, 2011). This can have a major impact on both a child's physical and mental health and development, as well as their affinity for nature (also known as "biophilia"). 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 (Chawla, 1999; Collado, Staats & Corraliza, 2013). Previous studies have also demonstrated that positive and frequent nature experiences during childhood improve children's environmental attitudes, environmental knowledge and beliefs (Rickinson, 2001), increase the probability of conservation

behaviors and attitudes later in life (Zhang, Goodale & Chen, 2014), and form their positive pro-environmental cognitive connections and affections (Giusti *et al.*, 2014; Stern, 2000). Further, spending time in nature during early childhood positively impacts children's physical, mental and emotional development (Barton & Pretty, 2010; Bratman, Dailyb, Levyc & Grossd, 2015). Nature exposure provides children with a variety of physical activities that can boost a child's motor development, and positively influence their muscle growth, heart and lung development (Maynard, Waters & Clements, 2011; Richardson, Pearce, Mitchell & Kingham, 2013). Based on evidence presented by the stress reduction theory (SRT), the restorative impact of nature exposure leads to declining levels of stress, where interacting with nature can relax individual's autonomic nervous system, reduce their skin conductance and heart rate, and activate an innate sense of connectedness with nature (Bratman, Dailyb, Levyc & Grossd, 2015; Gladwell *et al*., 2012).

The research has now firmly established the positive benefits of nature exposure for the individual as well as for the environment. However, it is also clear that many children are not getting enough nature exposure. One solution to mitigate children's deprivation of nature exposures is environmental education (EE), which can improve children's environmental knowledge, concerns, skills, and behaviours (Bonnett & Williams, 1998). Environmental education programs, which can be delivered by formal (e.g., schools), non-formal (e.g., not-for-profit organization), and informal organizations (e.g., family members) (Spence, 2011), 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).

It is well established that 3 main tenants of EE must be present in any EE program in order for participants to adopt pro-environmental behaviors: education 'about', 'in', and 'for' the environment (Farmer, Knapp & Benton, 2007; Palmer, 2002). Education about the environment involves teaching learners about the principals of natural cycles and the theories of ecology, chemistry, and biology which help them to gain a better understanding about their connection to nature (Wright, 2006). Next, the foundation of environmental attitudes is developed by using nature as a third educator and a medium for encouraging critical observation, enquiry, and discovery (Palmer, 2002). Education "in" the environment allows nature to provide the educational materials and first-hand exposures to natural and/or human-made nature-related environments and lets learners experience their relatedness to, and their roles within the environment (Farmer, Knapp & Benton, 2007). Finally, education "for" the environment helps students to learn how they can change their surrounding world by improving and protecting the earth. By relying on their "ecological knowledge and awareness of problems and solutions", learners gain motivation for participating in pro-environmental behavior and movements (Farmer, Knapp & Benton, 2007, p. 34).

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 of life have a significant impact on an individuals' perception of their relation to themselves, to others, and to nature (Samuelsson & Kaga, 2008), and can result in the formation of life-long environmental awareness, attitudes, values, and behaviors (Liefländer & Bogner, 2014). This need for early childhood EE has been

recognized by some preschools who have modified their pedagogical approaches in the direction of a more purposeful and intensive integration of environmental education into their curriculum (Ärlemalm-Hagsér & Sandberg, 2017, p. 214). One example are Reggio-Emilia preschools, which are internationally considered high-quality, integrated, and productive educational centres (Chartier & Geneix, 2007; Vandermaas, McClain & Fair, 2017). The Reggio-Emilia approach, developed by Italian educationist Loris Malaguzzi, is a new belief system that has changed the image of the child, the teacher, and the environment in the realm of early childhood education (Vandermaas, McClain & Fair, 2017). According to this approach, preschoolers become active agents and researchers who observe, form their own enquires, and hypothesize potential solutions, test their hypotheses and make conclusions (Hewett, 2001). In this environment, children's needs and opinions are listened to and valued, and they are encouraged "to express themselves through multiple 'languages', including expressive, communicative, symbolic, cognitive, ethical, metaphorical, logical, imaginative, and relational" (Vandermaas, McClain & Fair, 2017, p. 197). Reggio-Emilia-inspired teachers believe in the importance of children's leadership since they see the child as a powerful, intelligent, and capable individual who can make differences in environments they are involved in (Edwards, 2002). 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, McClain & Fair, 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 during preschool life not only enhance their empathic connectedness to their surroundings, but also

improve their intellectual, communication, and social skills, as well as empowering them to protect the natural world (Hewett, 2001).

While there is a growing recognition of the need for EE curriculum to start at the preschool level, and the emergence of some pedagogical philosophies like the Reggio-Emilia approach that incorporates nature as a major component of their curriculum, there are few research studies that evaluate the influence of preschools that have nature-focus components in their curriculums on preschoolers' environmental cognitive, emotional, and attitudinal affinity. Further, a review of the literature demonstrates few studies that assess the possible methodological instruments that can be used to assess different aspects of young children's relationships with nature (with the exception of Giusti et. al., 2014).

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 school for at least one 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. Gisuti *et. al.* (2014) used this instrument in a study with preschoolers in Sweden. 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.

4.1.1 Nature Experiences and Bio-affinity

As stated earlier, nature-related experiences during early childhood is a determinative factor that can result in adult pro-environmental attitudes and behaviours (Giusti *et al.*, 2014; Torquati *et al.*, 2010; Wells and Lekies, 2006). 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, Goodale & Chen, 2014). Moreover, research has demonstrated that positive and long-term experiences with natural environments increase children's physical and mental health (Miller, 2007), as well as their enjoyment of nature, environmental sensitivity, and general well-being (Collado, Staats & Corraliza, 2013). As an example, Cheeseman (2016) found that children's participation in earth education summer camps contributes to their cognitive, affective, and behavioral development towards nature, and may result in a life-long connection to nature and environmentally responsible behaviors.

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; Samways, 2007). Thus, interacting with a tangible aspect of nature (e.g., animals, plants, rocks, sticks, 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 to understand nature experiences.

Kellert (1996) categorized the experiences of the natural environment for children into 3 classifications: direct, indirect, and vicarious. Direct nature experiences are gained by actual physical interactions with nature including natural settings and nonhuman

species (Kahn & Kellert, 2002). Direct nature exposures are unplanned experiences 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 or meadow). Children's indirect experiences of nature are actual physical encounters with nature that are restricted and pre-planned (Kahn & Kellert, 2002). Indirect nature experiences, which can be indoor or outdoor, are provided by zoos, aquariums, botanical gardens, and other nature centers, which facilitate individuals' encounters with plants, animals, and habitats in a human-made and manipulated area (Kahn & Kellert, 2002). Taking care and having an interaction with domesticated animals, plants, and habitats as a part of a child's family life are considered as indirect experiences with nature (Kahn & Kellert, 2002). Finally, symbolic or vicarious experiences are not physical or actual encounters with nature, but occur through representations and depicted scenes of nature, such as watching movies or television programs about nature, or reading nature-oriented books and magazines (Kahn & Kellert, 2002). These experiences can be realistic, or immensely symbolic and metaphorical. The range of benefits can vary based on types of nature experiences (e.g., first-hand and real exposures to nature, visiting a zoo, photographs) and duration of experiences (e.g., hour-long, multi-day or life-long intimacy with nature; Keniger, Gaston, Irvine & Fuller, 2013). More direct and long duration interactions with nature can lead to more affective and cognitive benefits (Bratmana *et al.*, 2015).

Interestingly, several studies have found that strong cognitive considerations may not always bring about pro-environmental behaviors (Zhang, Goodale & Chen, 2014). As Martín-López, Montes & Benayas (2007) found, there is a weak correlation between being a scientifically knowledgeable person and supporting pro-environmental actions

and behaviours. To fill this gap between cognitive considerations and behaviors, some scholars have introduced the concept of environmental attitudes and biophilia as significant factors influencing the development of individuals' environmental-friendly behaviors (Ajzen, 1991; Martín-López, Montes & Benayas, 2007; Serpell, 2004). The concept of biophilia, developed by Wilson in 1984, is defined as a person's instinctive and innate affinity to the natural environment (Rice & Torquati, 2013; Hinds & Sparks, 2008; Nisbet *et al.*, 2008). Moreover, some scholars have discussed that although biophila is an inherent and innate psychological affection, it can be learned, enhanced and developed by observing and interacting with natural elements specifically during early childhood (Ballouard, Provost, Barre & Bonnet, 2012). Thereby, children's positive experiences of nature can result in constructing more environmental attitudes and behaviors in adulthood (Tani, 2016; Rice & Torquati, 2013; Clayton & Opotow, 2003). According to neurological science research, children's frequent nature experiences can develop their mindset in a direction which is more intimate with the biosphere (Giusti *et al.*, 2014).

Considering the amount of time children spent in preschools (7 hours of their waking time, per day), preschools and childcare centers, by facilitating 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 other components of the natural world (Gandini, 1993; Giusti *et al.*, 2014).

4.1.2 Children's Cognitive and Emotional Development

According to contemporary early childhood psychologists, children's cognitive and emotional development is the consequence of a complex, intertwined and dynamic interaction of nature and nurture (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 or her development, but put different amount of emphasis on the influence of biology and/or experience on children's development. Each model can be placed on a diagram which starts with nativism, "a belief that all intellectual abilities are innate" (Bjorklund & Causey, 2017, p. 20), and ends with empiricism, "a belief that all intellectual abilities are a result of experiences" (Bjorklund & Causey, 2017, p. 20).

In recent decades, the number of advocates of the sociocultural perspective of development has grown (Jaramillo, 1996; John-Steiner & Mahn, 1996; Marginson &Dang, 2017). They are of the opinion that cognitive development cannot be investigated without considering an individuals' cultural context (Cole, 2006; John-Steiner & Mahn, 1996). As Vygotsky (1978), the founder of this sociocultural theory believed, learning and development have evolved in a social and cultural context, and social interactions are what construct meanings in a human's mind (Mahn, 1999; John-Steiner & Mahn, 1996). 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 (Gauvain, 2001; 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 environmental and social 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 deeper and more comprehensive experience of the environment, and they show considerable gain in emotional understanding, empathy and altruism (Hestenes *et al.*, 2015). At this age, children are able to consider the meaning of symbols and to use more comprehensive language to describe their emotions (Hestenes *et al.*, 2015; Wilson & Wilson, 2015). Moreover, it is known that preschool children's 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, according to the literature, 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, Elliott (2014) argued that simply

providing children with natural outdoor play spaces is not sufficient for nurturing individuals with pro-environmental attitudes and behaviors. She concluded that "a dynamic relationship between the physical context and early childhood pedagogies and philosophies" and early childhood educators' conceptualization of environmental education are significant factors as well (Vandermaas, McClain & Fair, 2017, p. 196). In the first part of this research project (Chapter 3), we evaluated the preschoolers' outdoor and indoor routines, as well as the preschool teacher's educational approaches and goals for children's development in nature. In this chapter, we report the results of interviews with children, which intend to reveal the impact of children's preschool life on their cognitive, emotional, and attitudinal affinity with nature.

4.1.3 Connection to Nature Measures

To date, different types of scales have been developed to measure various aspects of the human-nature relationship. Bragg *et al*. (2013) conducted a meta-analysis of the literature and found that the key measures include: Connection to Nature Scale (CNS; Mayer & Frantz, 2004); Nature-relatedness Scale (NRS; Nisbet *et al.*, 2008); Inclusion of Nature with Self (INS; Schultz, 2002); Environmental Identity Scale (EIS; Clayton, 2003); and, Emotional Affinity to Nature (EAN; Kals, Schumacher & Montada, 1999). In addition, there are scales that have been developed exclusively for use with young children such as the Connection to Nature Index (CNI; Cheng & Monroe, 2012) and Nature Connectedness Inventory (NCI, Ernst & Theimer, 2011).

Nonetheless, none of the aforementioned imperial studies are adjusted to the mental and verbal abilities of preschool children. To fill this gap, Giusti *et al.* (2014) adopted developmental methods in harmony with children's conception of the world

(Piaget, 1960). Since preschool children are not able to verbalize their sense of connectedness with nature and have very limited capacity to express complex emotions and beliefs, the researchers avoided the use of self-reporting questionnaires (Giusti *et al.*, 2014). As the result, image-based techniques are employed in the 'Games Testing' (Giusti *et al.*, 2014).

To the best of our knowledge, there is not any published research examining preschooler's affinity to nature by using the Games Testing with the exception of 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), there are no studies within the Canadian context that have used the Gamest Testing to evaluate preschool children's bio-affinity. As such, this study is the first within a Canadian context to use Games Testing to attempt to assess bio-affinity. Results from this study assist in the creation of a better understanding of the impact of nature experiences during preschool life on children's emotional, cognitive and attitudinal affinity, as well as a better insight into the applicability of this research instrument for Reggio-Emilia preschoolers, living in Halifax, NS, Canada. This research provides precise results for the use of not only formal and non-formal educational planners, but also researchers interested in the realm of early childhood environmental education and innovative research methodologies.

Table 4: 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	14	Adults	Likert-type	Emotional
NRS	Nature-relatedness Scale	21	Adults	Likert-type	Affective, Cognitive and Experimental
INS	Inclusion of Nature with Self	-	Adults and children	Schematic-type	Affective, Cognitive and Experimental
EIS	Environmental Identity Scale	14	Adults	Likert-type	Affective, Cognitive and Experimental
EAN	Emotional Affinity to Nature	16	Adults	Likert-type	Emotional
CNI	Connection to Nature Index	15	Children	Likert-type	Affective, Cognitive and Experimental
NCI	Nature Connectedness Inventory	16	Children	Likert-type	Affective, Cognitive and Experimental

4.2 Methods

This study examines children's emotional, cognitive and attitudinal affinity with nature after attending a Reggio-Emilia school, located in Halifax, for at least one year. To do so, the Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere instrument was employed. This paper is a part of a larger study that evaluates the indoor and outdoor nature exposures of children at the aforementioned preschools as well as the pedagogical approaches to nature exposure taken by the teachers. The larger study also involved interviews with teachers (see Chapter 3) that focused their interactions with nature. Some of the insights from those interviews are mentioned in the discussion section of this paper. We purposefully chose to sample from Reggio-Emilia

preschools, as the nature-related philosophy affords children the opportunity of being exposed to nature (indoor and outdoor) in their daily lives.

To make an assessment of children's emotional, cognitive and attitudinal bio-affinity, we recruited children from 2 schools in Halifax, Nova Scotia that follow the Reggio-Emilia Approach (Peter Green Hall and Beech Street preschools). 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 began with a warm-up question about children's favourite food, game, color, etc. Games testing was conducted in a quiet space within the preschools, during school time, lasting between 30 and 40 minutes per child. At the end of the interview, each child received a certificate of participation in the study.

4.2.1 Games Testing

The Game Testing process is divided into 3 phases. In the first phase, children's Emotional Affinity with nature was evaluated using 2 games. The purpose of the first game is to understand children's level of empathy for other ecological living elements. Children were shown ten images of different animals, plants, vehicles and tools sequentially and asked, "Does this [image] have feelings. Answering negatively to images of vehicles and tools and answering positively to images of animals and plants are considered to represent affinity to nature (Giusti *et al*., 2014). For Game 2, children are shown 8 images of positive and negative environmental behaviors and then asked to

express their reactions to the behaviors by using the image of a smiling or sad face (e.g., a picture of ground pollution as a negative behavior or a picture of watering a flower as a positive one). Choosing the sad face as a response to negative environmental behaviors and the smiling face as a reaction to positive environmental behaviors is considered to represent affinity with nature (Giusti *et al.*, 2014).

The second phase is designed to measure children's environmental awareness, which has both a cognitive, knowledge-based component and an affective, 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 the environment using 2 games. In Game 3, preschoolers were asked to match the images of 10 products (e.g., milk, wooden table, paper) to some associated natural resources (e.g., cow, forest, and tree) or some associated human-made resources (e.g., factory, money, etc.). Coupling the products with the correct resources (natural and human-made) is considered as representing affinity with nature (Giusti *et al.*, 2014). In Game 4, children were asked about the harmful impacts of environmental pollution on people, animals, plants and vehicles. Negative answers about vehicles and positive answers about people, animals, plants were considered as representing affinity with nature (Giusti *et al.*, 2014).

The Third phase of the Games testing focuses on children's attitudinal affinity with the biosphere by asking 2 sets of questions. The first set, Game 5, asks: "Where do you usually play the most?", "Where do you like to play?" and "Why?", "Where do you feel the most free to play?" and "Why?", "Where do you feel the most safe to play?" and "Why?". Game 6 asks "Where do you not usually play?", "Where do you not like to play?" and "Why?", "Where do you not feel free to play?" and "Why?", "Where do you

not feel safe to play?" and "Why?" Children answered these questions by selecting among the images of various environments (e.g., park, indoor videogames, farm, outdoor street, etc., Giusti *et al.*, 2014)) Then, during the second set, a short interview, they rationalized their choices using their own words. All answers were audio-recorded and transcribed for further analysis.

Considering the small sample size (n = 20), statistical tests were not applicable. Thus, the first 2 sections of the Games Testing 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 the Games Testing's open-ended questions and children's verbal explanations were analyzed using an inductive approach in NVivo software (Bazeley & Jackson, 2013). To keep children's identity confidential, participant codes were assigned (C1 through to C20).

4.3 Results and Discussion

In the following sections, we summarize the Games Testing results, and the researchers' thoughts on the applicability of this instrument for preschool students in the Canadian context.

4.3.1 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) were not able to demonstrates an acceptable evidence of understanding this question: 8 of these 11

children answered ‘yes’ or ‘no’ to all pictures, no matter what they were shown, and 3 children did not respond to these questions at all. As a result, only 9 children out of 20 preschoolers answered this question. It is interesting to note that a difficulty with answering these particular 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.

As demonstrated in Figure 11, many of the children identified animals as having feelings. 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. With the exception of birds (9/9), trees were the only item that received unanimous votes for having feelings. In fact, C17 believed that trees feel good because of all the water and sunshine they receive. It’s interesting to point out that, 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 as a whole 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 could 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 shows that the cohort as a whole does not have emotional affinity with nature.

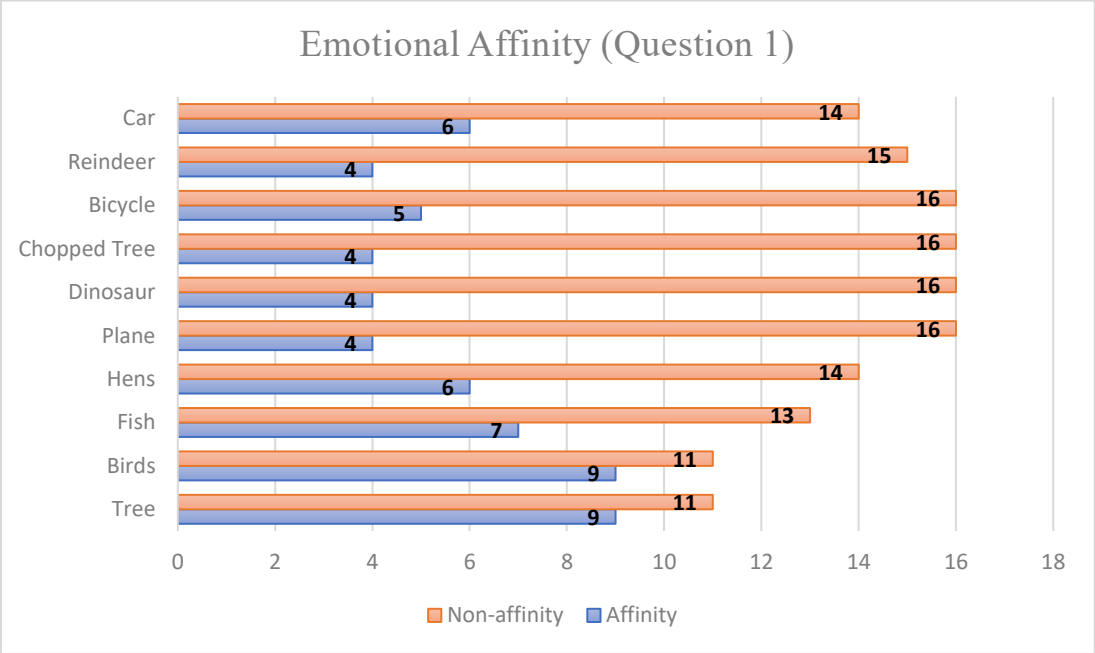

Figure 11: Emotional affinity with the biosphere (question 1)

For Game 2 in Phase 1, children were shown what are considered 3 pro-environmental activity images (watering plants, planting trees, and cleaning the streets) and 5 negative environmental issues and/or behavior images (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 12 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 image 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 have spent almost 3 hours per day in outdoor nature-related environments and are provided with rich indoor nature exposures (see Chapter 3), this cohort of children were not emotionally affiliated with nature. 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 they 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, McClain & Fair's (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 can be due to the deficiencies of the pedagogical approach itself, its implementation in the 2 preschools tested, the research instrument in testing the bio-affinity amongst this particular 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 approches to see if there is any significant difference in their emotional affinity with nature.

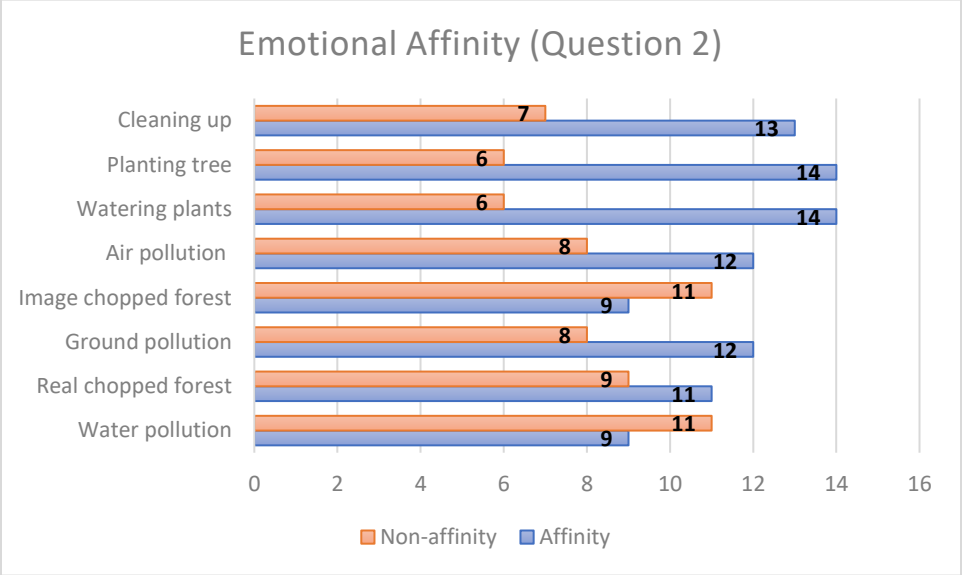

Figure 12: Emotional affinity with the biosphere (question 2)

4.3.2 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 (e.g., milk, wooden table, paper) to associated natural resources (e.g., cow, forest, and tree) and some associated human-made objects (e.g., factory, money, etc.) (Question 3). According to Giusti *et al.* (2014), the responses that match the right combinations of natural sources and human-made objects are considered correct answers. Table 6 demonstrates how the responses are categorized in analysis. For example, a child with less than 2 correct answers is considered to be environmentally unaware, and a child with 6 correct answers is strongly environmentally aware.

Table 6: 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

As Table 5 demonstrates, 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, pigs and/or horses. Thus, the majority of the preschoolers who participated in this study lack the knowledge related to interconnections between human needs and nature. 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 13, 14 & 15). For example, 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 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, 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 which considers every unfamiliar condition as a high-risk and harmful situation, without having a 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 Number 3 explained: "We have noticed that children don't tend to necessarily notice the garbage being around as being a bad thing, because it has been a part of their development the whole time. Once the kids start to realize that it's not for the use of trees or for the animals, they start to feel passionate about it as something that is wrong and not ok… 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, 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 or geared to a European audience.

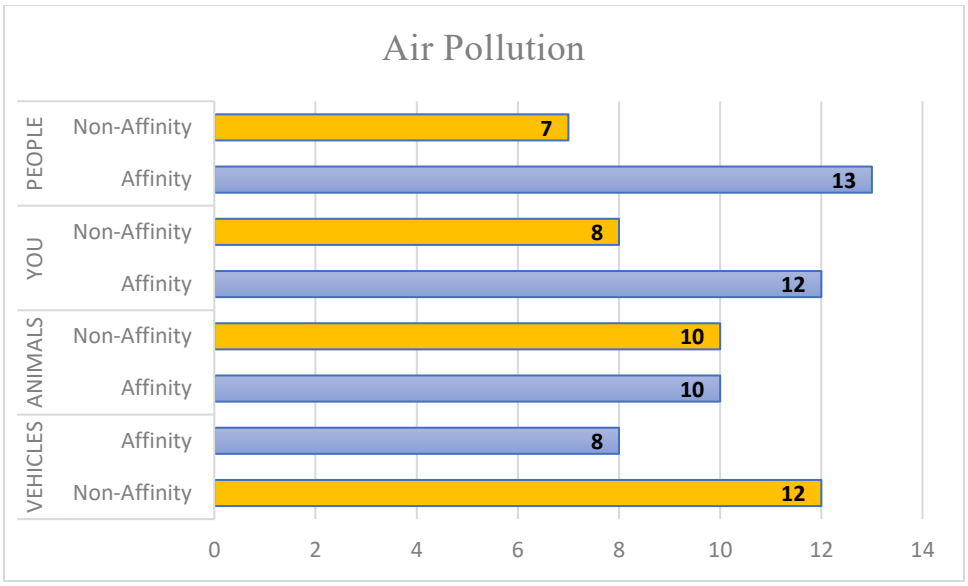

Figure 13: Responses to the question of who/what is harmed by Air Pollution

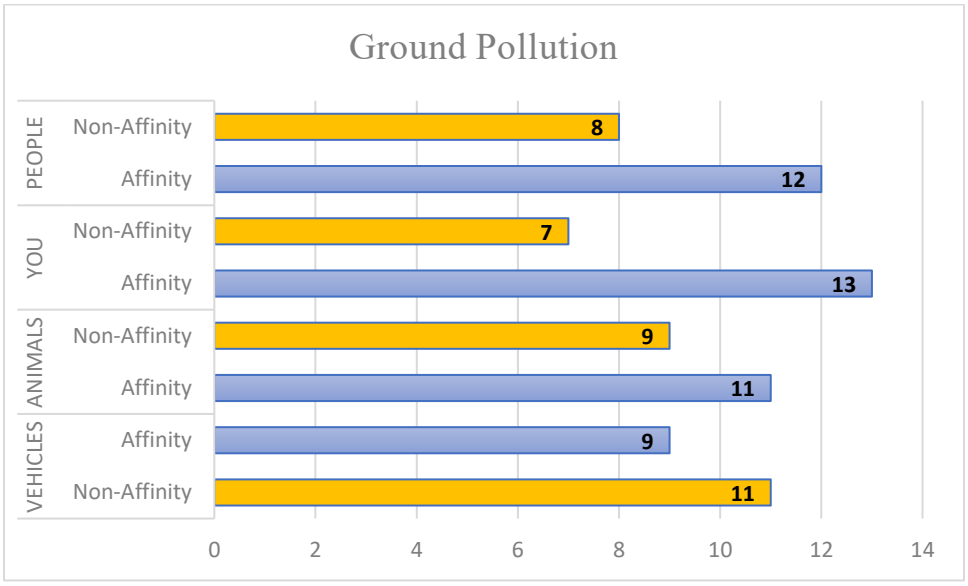

Figure 14: Responses to the question of who/what is harmed by Ground Pollution

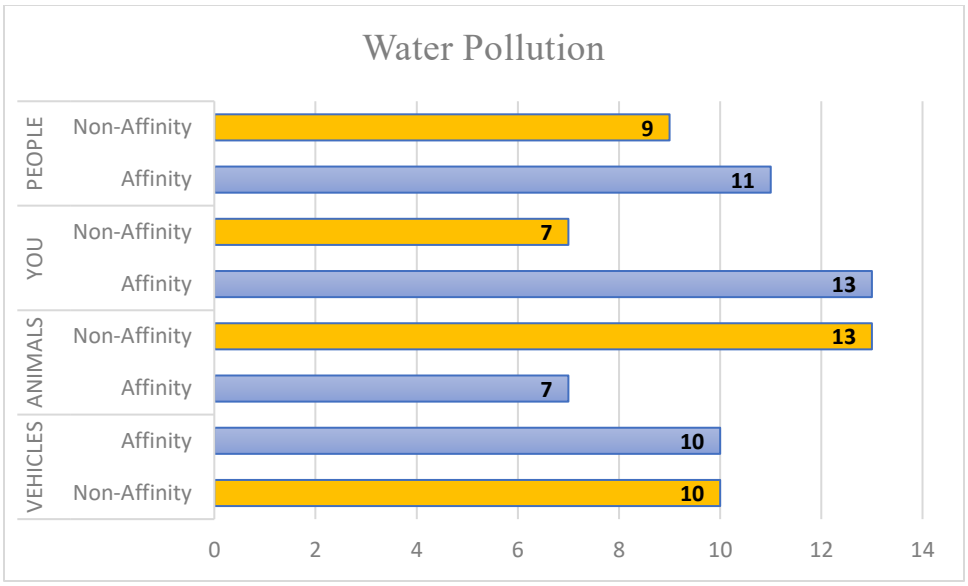

Figure 15: Responses to the question of who/what is harmed by Water Pollution

4.3.3 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 one 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:

"I like to stay in the playground forever. I love it!" (C1);

"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" (C2);

"I like the playgrounds, because I can slide and there are lots of toys" (C5);

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

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 one 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 have a preference for non-nature exposure related activities:

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

"Inside! Because I like to draw pictures for my mommy and my grandma and there are lots of books and toys here. I do not like if my pants get wet" (C18).

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: "I am safe in the daycare! All my friends are here!" (C9); "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).

Furthermore, a number of the children reported that they do not feel free and safe to on farms. They explained:

> "Farms are not safe, because if the horses are out of their cage, they might kick us or something!" (C12);
>
> "Because if I stay in the farm by myself, I would never see my mom and dad and I never find them" (C10);
>
> Sometimes grass can hurt, you know. The farm is the only picture that I don't feel really safe there. I just don't like all that animals gather around me. That makes me a little nervous or scared" (C17).

The results of Games 5 and 6 offer mixed results for bio-affinity. While they show that children prefer to play in outdoor settings, they also report that they feel the most safe indoors. These results are similar to what Giusti *et al.* (2014) reported in his article. According to Giusti *et al.* (2014), 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, Agate & Clark, 2011), and are having less experiences with nature. These results may lend credence to

the argument that 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 7: 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

4.4 Conclusion

This paper is part of a larger study that examines the frequency and variety of indoor and outdoor nature experiences for children at PGH and BSP childcare centers

(see Omidvar, Wright, Beazley and Seguin, 2018). The results from the first paper showed that the aforementioned 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 (e.g., flowers, acorns, sticks, stones, salamanders), 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 a Games Testing 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 8 shows, the results are mixed.

Table 8: The Results of the Games Testing

Game	Strong Bio-Affinity	Moderate Bio-Affinity	Low Bio-Affinity
1			*
2		*	
3			*
4	*		
5			*
6			*

The results indicate that this cohort of preschoolers is not emotionally affiliated with nature. Although children showed moderate concern for negative environmental

behaviours, 11 children had difficulties with answering the questions related to non-humans' 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].

Regarding children's cognitive affinity with the biosphere, this cohort of children was not able to successfully recognize the role of ecological 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 revealed that children's negative attitudes towards natural environments, which can be the result of fear of both wild and domesticated animals and of getting lost or injured, have resulted in feeling more safe and free in indoor environments and playgrounds, and being reluctant to spend time in green and natural environments.

This paper contributes to the evolving body of the literature on early childhood environmental education by examining bio-affinity of children in schools who have nature as a part of their curriculum. The results show that the Reggio-Emilia pedagogical approach implemented in these particular preschools has not resulted in developing strong emotional, cognitive and attitudinal 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 particular age group in Canada, or its implementation in this study. Future studies should continue to explore young

[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.

children's environmental affinity throughout the country and globally, with particular emphasis on determining whether an increased sample size might change the results. Further, the tests should be conducted in different seasons, cultures, and languages, and programs. Given the mixed results from our games testing, but the relatively high degree of nature exposure that this cohort experiences relative to the fact that Canadian youth spent averagely one hour or less per day outdoors (David Suzuki Foundation, 2012; see Chapter 3), it is highly recommended that the Guisti et al (2014) instrument be further tested for its' appropriateness for various settings, ages, and cultures.

Chapter 5: Conclusions

While the importance of evaluating nature exposures and environmental education during early childhood has been emphasized by many scholars (Bragg et al., 2012; Gandini, 1993; Nutbrown, 2006; Rice & Torquati, 2013), studies focusing on children's various nature experiences and their impacts on children's cognitive, emotional, and attitudinal bio-affinity are lacking. Given the need for this research, this thesis sought to answer the following research questions:

(1) What kind of indoor and outdoor nature experiences are provided by 2 Reggio-Emilia preschools located in Halifax? How often are children exposed to these nature experiences?

(2) What are the Reggio-Emilia preschool teacher's educational approaches and goals for children's development in nature?

(3) What is this cohort of children's level of cognitive, emotional, and attitudinal affinity to nature after attending a Reggio-Emilia preschool for at least one year?

5.1 Main Findings

When looking at the study as a whole, there are 4 main findings. First, the Reggio-Emilia curriculum followed at the 2 preschools provided various opportunities for children to be exposed to nature during preschool life. The cohort of children that we studied spent almost 3 hours per day on outdoor nature-oriented activities facilitated by Reggio-Emilia-inspired teachers over the past year. This time outdoors is significantly more than the Canadian average of one hour or less per day (David Suzuki Foundation 2012). Activities that the children engaged in included playing in nature, observing and studying natural creatures, collecting and making a display of ecological elements, and

small-scale cultivation. Moreover, it was indicated that this cohort of children had the opportunity to visit many of the 26 different outdoor locations identified in this research, many times during the past year. Regarding preschools' indoor biophilic design, the indoor environment of the preschools provides accessible nature-related experiences throughout the day including interacting with live animals, plants, natural play materials (e.g., shells and sticks), and representations of nature (e.g., books, posters, etc.).

A second finding of this research is related to teacher's philosophies and goals for children's development in nature. For the teachers in our cohort, the importance of children's leadership during nature-related experiences, improving children's communication and social skills, and reinforcing the role of children as researchers were significant factors in developing and facilitating the curriculum at the preschools. Also, developing a respectful relationship between children and nature, encouraging children to feel safe and comfortable in wild places, and empowering children through knowledge about ways to protect the natural world were other Reggio-Emilia goals mentioned by teachers, but less so than the foregoing aims. The proportion of teachers' focus on anthropocentric skills versus environmental educational goals indicates that for this cohort of teachers, increasing children's affinity with nature is not the focal point of their curriculum.

A third finding from this research is that regardless of the more than average time the children in this study spent daily on outdoor and nature-related activities, their cognitive affinity with nature, as tested using the Giusti et al. (2014) Games Testing instrument, was weak. Moreover, we found that some of the children demonstrated negative attitudes towards natural environments. This cohort of children reported to feel

more safe and free in indoor environments and playgrounds, and were reluctant to spend time in more-natural environments due to their fear of both wild and domesticated animals and of getting lost or injured.

Fourth, this study demonstrated that this cohort of preschoolers is not emotionally affiliated with nature. Most of children were unable to distinguish living from non-living things, could not answer questions related to non-humans feelings, and did not show empathy for other ecological living elements. Although some of the children showed to be moderately concerned for negative environmental behaviours, these were primarily in anthropocentric terms, and in total the responses reflected a non-affinity with nature.

As a whole, this study shows a significant gap between the level of children's environmental affinity and the preschools' Reggio-Emilia nature-oriented educational goals. In this case, having the opportunity of experiencing different aspects of nature did not lead children to attitudinally develop rapport with nature, cognitively gain knowledge about ecological and biological elements of the natural world, and emotionally feel more empathic and concerned about other living creatures. The Reggio-Emilia pedagogical approach implemented in these particular preschools has not resulted in developing strong emotional, cognitive and attitudinal bio-affinity among the children regardless of numerous outdoor activities embedded in the Reggio-Emilia curriculum, well-designed and enriched indoor environment in terms of the accessibility of various nature experiences, and the high flexibility of the curriculum. While it is beyond the scope of this thesis to determine the reasons for this low bio-affinity amongst the children at these preschools, there are potential reasons that we speculate on below.

First, it is possible that while the Reggio-Emilia philosophy embraces environmental education, the teachers themselves may not have the appropriate training to realize those pedagogical goals. As one of teachers explained, attending a Reggio-Emilia teacher education program is not an essential requirement to being employed as a permanent or substitute teacher in their preschool. As such, teachers at these schools (some of which confirmed that they did not have Reggio training) may not have the knowledge and/or skills to effectively deliver the environmentally-focused curriculum. A lack of effective and transformative pre-service and in-service environmental education training programs of preschool teachers, which Tilbury (1992) calls 'the priority of priorities', may therefore be one of the reasons that explains why the children in our study had higher than average amounts of time engaged in outdoor and environment/nature play, but had low bio-affinity according to the Games Testing procedure.

Second, 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:

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.

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 particularly audience to gain optimum results.

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.

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's 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 have 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.

5.2 Limitations

Similar to all research, this study includes a number of limitations. First, due to time and resource limitations, this study focused on a small sample size (N=20) from 2 Reggio-Emilia preschool located in Halifax, and the results cannot be generalizable for Reggio-Emilio education centers. Future studies are needed throughout the country and globally to determine if increasing the sample size might change the results and increase the generalizability of the conclusions.

Second, the research timeline did not allow for using the Games Testing in different seasons with the children, which may influence the results of this study. Literature demonstrates that uncontrollable weather conditions (e.g. rain, thunderstorms, high winds, etc.) as well as the presence of insects during children's outdoor activities may negatively influence their emotions towards nature (Kals & Ittner, 2003). The children's interviews were conducted in December 2016, well into a cold, raining/snowing and windy fall season in Halifax, which may have affected children's attitudes towards nature.

Another limitation, which is caused by preschools' restrictions, is related to the evaluation of children's outdoor nature experiences. As preschools' restrictions did not allow the researcher to accompany and observe children during their outdoor activities, conducting an interview with teachers was the only source of data about preschoolers' outdoor routines, which increases the probability of receiving biased responses. Qualitative researchers believe that using multiple independent methodologies to assess a concept, which is called triangulation (Denzin, 1978), can minimize the impact of personal biases and strengthen a study's validity (Jonsen & Jehn, 2009). Thus, for future studies, using first-hand observations along with conducting interviews is recommended.

The final limitation is related to the weaknesses of the Games Testing that are mentioned above. Moreover, as the Games Testing has not been used in Canada, we are not able to compare our results with other relevant studies with the same cultural, demographical, and geological context.

5.3 Implications

This study supports the notion that "interviews with preschool children can yield invaluable information regarding children's thinking and knowledge" (Doverborg & Pramling, 1993, p. 1). This research has demonstrated the importance of involving children as informants and participants while examining children's experiences and beliefs. Underestimating children's conceptual and narrative competences results in "adult-centrism", which prevents qualitative researchers from being open to learn from children's perspectives and value children's voices and viewpoints (Curtin, 2000). Moreover, although the application of image-based techniques in evaluating children's

attitudes and empathy have been tested before (Bryant 1982; Feshbach, 1975; Pell & Jarvis 2001; Borke, 1973), the necessity of modifying the Games Testing's questions and pictures for target audiences is undeniable.

This research is valuable as it focuses on providing a clear insight into the Reggio-Emilia preschools' indoor and outdoor curriculums and the outcomes of their environmental education programs. However, it has also revealed a gap between Reggio-Emilia early childhood instructors' nature-related educational philosophy and the real outcomes of these 2 Reggio-Emilia programs, reflected on children's emotions, knowledge, and attitudes towards nature. This is a significant conclusion, which should be considered by both researchers and the early childhood organizers and policy makers.

5.4 Recommendations for future research

There are a number of future research studies that can be recommended as a result of this study. First, future studies should investigate the quality of integration of Reggio-Emilia pedagogical approaches into preschools' educational settings in Canada. A particular challenge is identifying appropriate methods of implementing Reggio-Emilia nature-related objectives in Canadian preschools with regards to climate conditions, culture, and socio-economic status of the population.

Second, future research should evaluate Reggio-Emilia preschool teachers' knowledge and capability of facilitating outdoor and indoor nature-related routines, their motivations, and their attitude towards integrating environmental education into their curriculum.

Third, more studies are needed to examine the challenges and barriers to implementing Reggio-Emilia curriculum due to the physical design of the Reggio-Emilia preschools' indoor and outdoor environments, as well as the limitations that the city's urban design may impose on planning, preparing, and implementing environmental education programs.

Fourth, as preschool educators' environmental beliefs, values, and behaviors play a significant role in the success of environmental education programs (Stevenson, 2007a), it is recommended that future research studies investigate the impact of preschool teacher training and career education programs on preschool teachers' environmental literacy.

Fifth, it is suggested that future research include an observation component to measuring the quality and quantity of outdoor and nature-related experiences of children. Observation could help to better understand and evaluate preschoolers' nature experiences, and long-term observation could provide a richer dataset and useful contextual information needed to make valid conclusions.

Sixth, as children learn behavior by direct experiences and modeling the behaviors they observe (Bandura, 1974, Hammond, McFarland, Zajicek & Waliczek, 2011), and considering the proven effect of family members' environmental value system and their engagement in conservation behaviors on children's environmental attitude development (Rice & Torquati, 2013), efforts should be taken to engage parents in future studies similar to this. Assessing the impact of different family activities (e.g. playing in a park, playing video games, visiting a farm, playing with indoor toys, hiking in a forest, etc.), parents' demographic background, such as age, education, income etc., and their environmental values and parental restrictions on children's bio-affinity can contribute to

the evolving body of literature in this field. Moreover, demographic factors of the children, such as age, gender and birth order, and the physical and social environment of their neighborhood are other significant factors that should be investigated.

Finally, more research is needed to evaluate the applicability of the Games Testing tool (Giusi et al 2014) for measuring the cognitive, emotional, and attitudinal bio-affinity of 3 to 5-year-old children in different socio-cultural settings. Future studies could explore the impact of using different sets of pictures and questions that are more in harmony with 3 to five-year-old children's biological and cognitive development. It may be appropriate to modify the Giusi et. al (2014) tool, as informed by interdisciplinary research linking children's biological and psychological development and early childhood environmental education.

5.5 Summary

While many researchers have focused on the outcomes of environmental education programs, little research has assessed the impact of the Reggio-Emilia early childhood pedagogical approach on preschool children's bio-affinity. As a result, this study attempts to evaluate the indoor and outdoor nature experiences facilitated by two Reggio-Emilia preschools located in Halifax and the influence of these exposures on preschoolers' cognitive, emotional, and attitudinal affinity for nature. Results indicate that in spite of the excessive time the children in this study spent daily on outdoor and indoor nature-related activities, their cognitive, emotional, and attitudinal affinity with nature, as tested using the Giusti et al. (2014) Games Testing instrument, was weak. The reasons of children's weak bio-affinity, even after being enrolled in a Reggio-Emilia

preschool for at least one year, can be traced to the implementation of Reggio-Emilia principals in the participated preschools, teachers' environmental literacy, parents' environmental values and parental restrictions, children's socio-economic and cultural background, geological and climate conditions, etc.

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Appendices

Appendix A: Teachers' interview Questions

INTERVIEW QUESTIONS

Interview ID code: _____
Location of Interview: _____
Date/Time: _____ : am / pm

Script: Thank you for participating in this study. This interview is important for this study, as it will provide a unique insight into preschoolers' nature-related experiences during preschool life.

Please do not feel pressured to answer any of the following questions. If at any point you become uncomfortable or wish to stop the interview please let me know, as there will be no consequences as a result.

If you would like a question repeated or asked in a different way to better understand please feel free to let me know. Additionally, if you have any other relevant experiences you would like to share with the interviewer that may not be directly connect to the question being asked, please do not hesitate to discuss it.

Finally, this interview will be audio recorded for data analysis purposes. If you are not comfortable with this interview being audio recorded please let me know immediately.

<u>Outdoor Nature Experiences:</u>

a) Could you tell me about some of the outdoor places to which you have taken the children in your care during this past year?
b) For each of these outdoor places, how often would you say you have visited the spot?
c) Please look at this air photo of the Halifax peninsula. Can you show the locations that you just mentioned?
d) Now that you see the photo, do you notice other places that you have taken the kids? If so, how often would you say you visit this/these spots?

<u>Indoor Nature Exposures:</u>

a) In this part, I would like to gain a better understanding about the indoor built environment and different nature exposures kids have inside at this preschool. These features may include: color, water, air, sunlight, plants, animals, natural materials, views, habitats and fire. Could you list all the different indoor nature experiences facilitated in this preschool, and explain about it?
b) For each of these features, how often would you say kids interact with it?

Appendix B: Research Instrument (Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere, Giusti et al., 2014)

1a. Emphatic behavior instructions

Show one picture after the other, in the table below, to the child. For every picture ask him/her:
"Does (this picture) feel pain?"
Example: "Does a tree feel pain?"
The child answer has to be a simple yes or no. Therefore, the game result will be a simple list of "yes" and "no" matching each picture in the table below.

Tree 	Chopped tree 	Hens 	Bicycle 	Birds 
Reindeer 	Car 	Fish 	Plane 	Dinosaur 

1b. Concern & sensitivity instructions

Give to the child both images with smiles ("happy smile" and "sad smile"). Show him/her the images in the table below one after the other. Do NOT ask any question to the child and do NOT explain what the picture means. Ask the child to show to the teacher one of the smiles after he/she has shown the picture. Take annotation of the result and show the next picture of the table below.
"Happy smile" and "sad smile"

Table of images

Water pollution 	Real chopped forest 	Watering plants 	Ground pollution 
Image chopped	Planting tree	Cleaning up	Air pollution

forest 	**(Saying that is not taking the tree off!)** 		

2a. Provision of ecosystem services instructions

Place in front of the child all images in "List 2" of the table below. All pictures have to be fully visible to the child from his/her position. Show one picture of "List 1" to the child and ask him/her to find a picture, among the ones already placed in front of him/her ("List 2") and clearly ask him to answer:

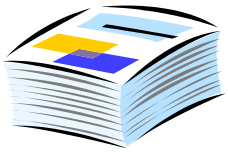
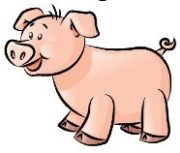
"What do you need to have (this picture)?"

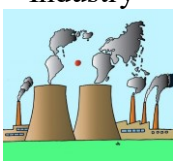
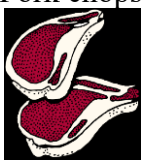
Example: "What do you need to have a wooden table? "Answer: child picks the image of "wood"

What the picture represents has to be clearly stated to make the child understand for example that the image is a WOODEN table or that the image represents BLUEBERRIES and not every kind of berry.

This process has to continue for every image in "List 1" without taking away the pictures of List 2 in front of him/her. There is more picture in "List 2" than in "List 1" for experimental purposes.

The game result will be a table were for each image in "List 1" there will be the picture that the child has selected from "List 2".

List 1			List 2	
Wooden table 	Eggs 		Wood 	Forest 
Tuna can 	Paper sheets 		Tuna 	Cow 
Carrot 	Glass of milk 		Hens 	Pig 

Tap water 	Blueberries 		Vegetable garden 	Industry 
Wool hat 	Pork chops 		River 	Transportation 
			Sheep 	Money 
				Tractor 

2b. Pollution awareness instructions

Show to the child one picture in "List 1" (representing different kinds of pollution) and place it visible in front of him/her. What this picture represent has NOT to be said to the child. Then, show to the child one after another all sets of images in "List 2" and ask him/her for every set of pictures (animals/vehicle/you/people):
"Is (the first picture) harmful to (the second picture)?"After have shown all sets of pictures in "List 2" for one picture in "List 1" show to the child the next picture in "List 1" and follow the same process described above.

Example: "Is this picture (without mentioning air pollution) harmful to animals?"; "Is this picture (without mentioning air pollution) harmful to vehicles?"; "Is this picture (without mentioning air pollution) harmful to you?"; "Is this picture (without mentioning air pollution) harmful to people?"; "Is this picture (without mentioning ground pollution) harmful to animals?", etc…
The game result will be a simple list of 4 "yes" and "no" for each picture in "List 1" corresponding to each set of pictures in "List 2".

List 1

Air pollution	Ground pollution	Water pollution
		

List 2

Animals	Vehicles	You	People
  	  		  

3a. Favorite environmental quality instruction

Place all the sets of picture below in front of the child and ask him/her to select ONE picture to answer the following questions. To the question "Why?" the child doesn't have to select any picture, but reply in words, this implies that teachers have to synthesize it and write down children's answers:

1. "Where do you usually play the most?"
2. "Where do you like to play?" and "Why?"
3. "Where do you feel the most free to play?" and "Why?"
4. "Where do you feel the most safe to play?" and "Why?"

Recreational	Indoor videogames	Playground	Farm
			

Indoor toys	Green area	Outdoor street	Forest
			

3b. Disfavored environmental quality instruction

Place all the sets of picture above in front of the child and ask him/her to select ONE picture to answer the following questions:

1. "Where DO NOT you usually play?"
2. "Where DO NOT you like to play?" and "Why?"
3. "Where DO NOT you feel free to play?" and "Why?"
4. "Where DO NOT you feel safe to play?" and "Why?"

Appendix C: Research Ethics Approval

Social Sciences & Humanities Research Ethics Board
Letter of Approval
July 12, 2016
Nazanin Omidvar
Management\Resource & Environmental Studies

Dear Nazanin,

REB #: 2016-3902
Project Title: Investigating the Effect of Nature-related Routines on Preschool Children's Affinity to Nature at Halifax Children's Centers

Effective Date: July 12, 2016
Expiry Date: July 12, 2017

The Social Sciences & Humanities Research Ethics Board has reviewed your application for research involving humans and found the proposed research to be in accordance with the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans. This approval will be in effect for 12 months as indicated above. This approval is subject to the conditions listed below which constitute your on-going responsibilities with respect to the ethical conduct of this research.

Sincerely,

Catherine Connors, Director
Post REB Approval: On-going Responsibilities of Researchers

After receiving ethical approval for the conduct of research involving humans, there are several ongoing responsibilities that researchers must meet to remain in compliance with University and Tri-Council policies.

1. Additional Research Ethics approval
Prior to conducting any research, researchers must ensure that all required research ethics approvals are secured (in addition to this one). This includes, but is not limited to, securing appropriate research ethics approvals from: other institutions with whom the PI is affiliated; the research institutions of research team members; the institution at which participants may be recruited or from which data may be collected; organizations or groups (e.g. school boards, Aboriginal communities, correctional services, long-term care facilities, service agencies and community groups) and from any other responsible review body or bodies at the research site

2. Reporting adverse events
Any significant adverse events experienced by research participants must be reported in writing to Research Ethics within 24 hours of their occurrence. Examples of what might

be considered “significant” include: an emotional breakdown of a participant during an interview, a negative physical reaction by a participant (e.g. fainting, nausea, unexpected pain, allergic reaction), report by a participant of some sort of negative repercussion from their participation (e.g. reaction of spouse or employer) or complaint by a participant with respect to their participation. The above list is indicative but not all-inclusive. The written report must include details of the adverse event and actions taken by the researcher in response to the incident.

3. Seeking approval for protocol / consent form changes
Prior to implementing any changes to your research plan, whether to the protocol or consent form, researchers must submit describe the proposed changes to the Research Ethics Board for review and approval. This is done by completing an Amendment Request (available on the Research Ethics website). Please note that no reviews are conducted in August.

4. Submitting annual reports
Ethics approvals are valid for up to 12 months. Prior to the end of the project’s approval deadline, the researcher must complete an Annual Report (available on the website) and return it to Research Ethics for review and approval before the approval end date in order to prevent a lapse of ethics approval for the research. Researchers should note that no research involving humans may be conducted in the absence of a valid ethical approval and that allowing REB approval to lapse is a violation of University policy, inconsistent with the TCPS (article 6.14) and may result in suspension of research and research funding, as required by the funding agency.

5. Submitting final reports
When the researcher is confident that no further data collection or participant contact will be required, a Final Report (available on the website) must be submitted to Research Ethics. After review and approval of the Final Report, the Research Ethics file will be closed.

6. Retaining records in a secure manner
Researchers must ensure that both during and after the research project, data is securely retained and/or disposed of in such a manner as to comply with confidentiality provisions specified in the protocol and consent forms. This may involve destruction of the data, or continued arrangements for secure storage. Casual storage of old data is not acceptable.

It is the Principal Investigator’s responsibility to keep a copy of the REB approval letters. This can be important to demonstrate that research was undertaken with Board approval, which can be a requirement to publish (and is required by the Faculty of Graduate Studies if you are using this research for your thesis).

Please note that the University will securely store your REB project file for 5 years after the study closure date at which point the file records may be permanently destroyed.

7. Current contact information and university affiliation

The Principal Investigator must inform the Research Ethics office of any changes to contact information for the PI (and supervisor, if appropriate), especially the electronic mail address, for the duration of the REB approval. The PI must inform Research Ethics if there is a termination or interruption of his or her affiliation with Dalhousie University.

8. Legal Counsel
The Principal Investigator agrees to comply with all legislative and regulatory requirements that apply to the project. The Principal Investigator agrees to notify the University Legal Counsel office in the event that he or she receives a notice of non-compliance, complaint or other proceeding relating to such requirements.

9. Supervision of students
Faculty must ensure that students conducting research under their supervision are aware of their responsibilities as described above, and have adequate support to conduct their research in a safe and ethical manner.

Appendix D: Information Bulletin

Hello,

My name is Nazanin Omidvar, and I am currently a student in the School for Resource and Environmental Studies at Dalhousie University pursuing my second Master's degree in Environmental Studies. My passion and research interests are in environmental education and encouraging people, especially children, to spend time outdoors and create a life-long connection with nature. Acting on this passion, I have conducted several research projects over the past 5 years regarding preschoolers' environmental attitudes, and the impacts of preschool life on their sense of nature-relatedness. I came to Dalhousie University in hopes of developing a research project that could allow us to better understand the benefits of nature exposures during early childhood. After consulting with some proficient professors at Dalhousie and Mount Saint Vincent Universities, the following research project has been created, and we hope that you are interested in taking part!

This study aims to examine the influence of different outdoor and indoor natural activities in a preschool's curriculum on children's affinity with the biosphere, by using a questionnaire which is called "Games Testing for Emotional, Cognitive and Attitudinal Affinity with the Biosphere" (Giusti et al., 2014). In the other words, this master's thesis focuses on assessing a group of preschooler's emotional, intellectual and attitudinal connection with nature and finding its potential correlation with the preschools' spatial accessibility to natural environments. By completing this study, we hope to identify where changes can be made to ensure that preschools provide positive and impactful nature experiences for children.

If you agree to allow your child to participate in the study, they will be asked to complete a set of games and then take part in a face-to-face interview. These games are comprised of picture matching, yes/no and short answer questions to which your child can respond by pointing to a picture of a happy or a sad face or other images that will be provided. The techniques used for developing the interview questions are consistent with children development norms, and have been tested in several studies examining children's environmental morality. These interviews will be conducted at Jubilee Road Children's Center (or Peter Green Hall Children's Center), with each game and interview taking no more than 15 minutes to complete.

Throughout the entire research process your child's name and any other information pertaining to their identity will be kept confidential. Please find attached consent form and contact the lead researcher should you have any questions. After signing the consent form you will have the opportunity to withdraw your child from the study at any point if their participation becomes uncomfortable. If you wish to withdraw your child, please contact the lead researcher and they will be removed from the research database. Please see the attached consent form for more details on the ethical considerations associated with this study.

If you have any questions or concerns regarding the research process and/or ethical issues, please contact Nazanin Omidvar (at 902-989-2494, nazanin.omidvar@dal.ca) or Dr. Tarah Wright (at 902 494-3683, tarah.wright@dal.ca) at any time. We will also tell you if any new information comes up that could affect your decision to participate.

Thank you for your interest,

Nazanin Omidvar