Authenticating Children's Interest in Nature

by

Jesse Jewell

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We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

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Dr. Jodi Streelasky, Supervisor
Department of Curriculum & Instruction

Dr. Todd Milford, Departmental Member
Department of Curriculum & Instruction

Abstract

In this study, I investigated seven and eight-year-old children's interest in the boreal forest in Yukon, Canada. This research attempts to provide insight on this topic by giving students autonomy over their movement in a diverse natural landscape, and by investigating where they go and what they do in a forest context. A mixed methodology approach was used to explore children's interest in the boreal forest, and data were analyzed from the geospatial technology that was affixed to each child, and by inquiring about what the children enjoyed doing in the forest. Key findings from the study included: the importance of play as a primary means of interacting socially with the environment, children's affiliation and fascination with living things as strong motivators for exploration, and the affordances the landscape offered the children, specifically loose parts (e.g., sticks, berries) and the diverse topography (e.g., hills for running, dense forest for hiding). Based on these findings, I contend that it is becoming increasingly important for educators, parents, and policy makers to understand the child-nature relationship and its relevance to young children.

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Dedication

This thesis is dedicated to my family. First, to my wife Janine who very patiently supported me through this academic journey of countless hours. Next, to my 3 children. The irony of being fixated on researching, reading and writing about a child's relationship with nature while not being able to help your own children do these things during these times was almost too much to bear! I'm now looking forward to spending more time in the woods and along the creek.

Chapter 1

Introduction

Children have a special relationship with the natural world that is unique from that of adults (Green, 2016; 2017; Hyun, 2005; Kahn, Severson, & Ruckert, 2009; Louv, 2005; Sebba, 1991; Wilson, 1984, 1995). Nature is an exceptional place for children where interaction is self-initiated, largely because nature is not organized by humans, it does not come with instructions for interaction, and it offers dynamic and diverse opportunities (Ghafouri, 2014; Tordsson, 2002). Children learn and explore in the natural world using primarily their senses, whereas adults tend to perceive nature based on previous experiences and existing knowledge (Boileau, 2011; Green, 2017; Hyun, 2005; Sebba, 1991; Wilson, 1995). Moreover, if children are given a degree of autonomy when immersed in nature, they become intrinsically motivated to engage in spontaneous play that is guided by their senses, which provides a more authentic glimpse of their interests (Ghafouri, 2014; Green, 2016, 2017; Skar, Gundersen, & O'Brian, 2016). Autonomy in learning refers to the desire to express your authentic self and to experience that self in action (Deci & Ryan, 2000).

The decreasing amount of direct nature contact for children in North America has attracted attention and concern from researchers and educators alike (Clements, 2004; Louv, 2005; Rosenow & Bailie, 2014; Tremblay et al., 2015). This has coincided with a period of continued urbanization and subsequent disconnection from nature (Louv, 2005). In relation to school contexts, there are also barriers to accessing off-site learning environments; however, research has revealed that teachers' perceived value of off-site learning is not considered a barrier (Ernst, 2012, 2014; Ernst & Tornabene, 2012; Rickinson et al. 2004). Instead, barriers for primary education center on access, such as walking distance, time, liability, and weather (Ernst

2012, 2014; Rickinson et al. 2004; Wyver et al., 2010). Relating this to the Yukon elementary school context, access in terms of walking distance, is not a barrier given the proximity of schools to the boreal forest. This knowledge provides greater rationale for focusing research attention on how teachers' practice, on how students learn in off-site environments, and how this environment can complement student learning.

Yukon Territory has implemented the redesigned British Columbia curriculum which focuses on instructional strategies that are authentic, student-centered, and acknowledge student interest (British Columbia Ministry of Education, 2016). In 2017, Yukon Education mandated this redesigned curriculum and began implementing the curriculum in kindergarten to Grade 12 classrooms. Specifically, *BC's Redesigned Curriculum: An Orientation Guide* states that the "redesigned curriculum provides teachers with great flexibility in creating learning environments that are relevant, engaging, and novel. Flexible learning environments give consideration to local contexts and place-based learning." (https://curriculum.gov.bc.ca/)

In this study, I investigated seven and eight-year-old children's interest in the boreal forest in Yukon. Specifically, I addressed the following research questions:

i) Where do young children choose to go when they are given autonomy in the boreal forest in Yukon?

ii) What do young children choose to do when they are in a boreal forest context?

These questions provided information on students' autonomy over their movement by paying close attention to where they went using geospatial technology tools. I also collected and analyzed children's oral narratives on what types of activities they enjoyed engaging in while in the boreal forest.

Rationale

All of Yukon's 23 elementary schools are within walking distance to the northern boreal forest, resulting in this environment becoming a natural extension of the physical school where students play and learn. Several Yukon elementary schools have developed outdoor learning spaces in recent years to bridge the gap between the school and the natural environment. These spaces typically consist of a fire pit with benches, and occasionally, a canvas wall tent and woodstove to facilitate winter use. The boreal forest has been an appreciated environment in primary education in Yukon; however, I argue that there is room for teaching and learning to grow and evolve in this environment. Based on my experiences, it appears that student voice and interest in the boreal forest remain overshadowed by teacher-led strategies and prescribed learning outcomes. I believe outdoor settings should be accessed by primary students in all seasons with an emphasis on nature play, which refers to unstructured play in natural settings (Ernst, 2012).

At the very least, I believe students should be given a chance to explore their natural environment with some degree of autonomy. Simultaneously, teachers should pay close attention to what draws their students' attention as this information has the potential to offer starting points for authentic inquiry with young children. I also believe that these learning experiences in the boreal forest should be routine rather than utilized as a rare and special event. I am motivated to see education in Yukon progress towards a more student-centered approach that values student interest and strives to draw on their interest to inform teaching practice.

In my current position as Experiential Education Curriculum Consultant at Yukon Education, I have a vested interest in learning more about student interest in nature. Questions that emerge for me include: What motivates young learners in the boreal forest? What do they

wonder about? How do they want to learn in this environment? And finally, what do teachers need to know and be able to do to facilitate this type of learning? These questions motivate me as both as a curriculum consultant and a researcher.

The primary education science curriculum in Yukon has explicit links to the natural environment (e.g., Grade 4 Science Big Idea - all living things sense and respond to their environment) (https://curriculum.gov.bc.ca/). Similarly, in the boreal forest the curriculum is written in the landscape. For example, the natural biotic and abiotic features of the landscape constitute the content of the learning standards. In addition, the new BC Kindergarten - Grade 3 Science Curriculum's Big Ideas focus on children making observations and connections related to living things (https://curriculum.gov.bc.ca/).

Exploration in the outdoor environment in the primary grades requires very little in the way of materials, much of which can be constructed by students with a teacher's guidance. This reality, in combination with students' natural affinity towards play-based exploration of the outdoors, has tremendous potential for student engagement and motivation when learning in an outdoor environment. This combination is not new; however, I see room to explore these concepts in a Yukon context with a focus on student interest. I also feel there is space to expand the body of knowledge on how educators can assist primary students in discovering or rediscovering their interest in nature, and more specifically, on how best to understand student interest in the boreal forest in Yukon.

Significance

Several recent studies have examined student-nature contact, children's nature-play, and the benefits of learning in nature for children (e.g., Beattie, 2015; Coe, 2016; Chawla, 2015; Chawla, Keenan, & Pevec, 2014; Ernst, 2014; Gill 2014; McCurdy, Winterbottom, Mehta, & Roberts, 2010; Roe & Aspinall, 2011; Sharma-Brymer & Bland, 2016).

Rickinson et al. (2006) highlighted gaps in nature-based education research in relation to the process of learning for students and the role of the learner. They added that nature-based education research needs to expand to include infancy and early childhood, not just formal school-aged youth. Boileau (2013) suggested that in Canada, children's voices have been marginalized in early childhood environmental education (ECEE) research; however, perceptions of the value of child voice are beginning to change. Beattie (2015) argued that most environmental education research has been done with middle to secondary school students and that the bulk of early childhood environmental education research is conducted without including the voice of children. My hope is that this study will contribute to the growing body of knowledge on early childhood environmental and nature-based education, specifically relating to the value of acknowledging student voice relating to interest in nature in an authentic way. Secondarily, this study is significant as it contributes to a better understanding of the relationship between student autonomy, voice, and interest when children engage with nature.

Theoretical Influences

My research is framed by the following theories: sociocultural theory (Rogoff, 2003; Vygotsky 1978); experiential education (Dewey, 1915, 1938; Kolb, 1984); and, place-based education (Sobel, 2005).

Sociocultural theory recognizes the development of knowledge as being a social process whereby the learner develops through interactions with others (Vygotsky, 1978). Vygotsky (1978) used the term more knowledgeable others (MKO) referring to a student's peers, teachers, parents, and community members – all of whom interact with a learner and provide guidance towards gaining new knowledge. These supporters play an important role in a child's development in all environments, including in nature.

Experiential education focuses on 'learning by doing,' although its modern structure is more complex (de Jong, Wierstra, & Hermanussen, 2006; Kolb, 1984; Kolb & Fry, 1974; Schenck & Cruickshank, 2015). Their understandings of experiential learning included the notion that learning is best realized as a holistic process, not an outcome, and that learning is also an iterative process based on first-hand personal experience. Kolb (1984) maintained that experiential learning theory is built on several propositions in relation to learning that are shared by historical scholars such as Dewey (1900). Kolb (1984) suggested that learning is a process of knowledge creation based on experiences and the resulting reflection and conceptualization of those experiences.

Place-based education (Sobel, 2005) also informs this study and is described as a process where learners develop more personal relationships with their natural environment or community as a foundation for learning. Place-based education is distinguished from other context-rich learning theories by its steadfast connection with, and reference to, the actual place of learning.

Emphasizing hands-on and relevant learning experiences, this theory of teaching and learning helps students develop stronger ties to their community, enhances students' understanding of the natural world, and creates a heightened commitment from students to serve as active, contributing citizens (Sobel, 2005). Although place-based education is viewed as a relatively modern theory, its roots are deep and its early foundation and defining features were contributed to by the likes of Friedrich Froebel and John Dewey (Elder, 2016). Also, very early aspects of place-based education are linked to Indigenous ways of knowing and doing, based on the unequivocal relationship Indigenous peoples have had and continue to have with place (Basso, 1996; Cajete, 1994, 2000; Deloria & Wildcat, 2001; Kawagley & Barnhardt, 1999).

Collectively, these theories will frame my study as the research participants will be constructing knowledge and having shared experiences with their peers in a natural environment within their community. The participants will also be provided with opportunities to reflect on their experience with nature, a process that links to experiential education. Finally, students will be immersed in the boreal forest, a place that is not foreign to them but distinct from their typical classroom environment, which will provide the students with an authentic and personal outdoor experience.

Summary

In this chapter, I addressed the significance of nature as an educational environment for young learners. According to Hyun (2005), Sebba (1991), and Wilson (1995), children's affiliation to nature appears to be innate and will further develop or diminish based on the social influences in their young lives. Additionally, these researchers contended that children's attraction to nature is distinct from that of adults, as children perceive nature through their senses while adults tend to base their perception on previous experiences and knowledge (Boileau,

2011; Green, 2017). Autonomy during learning experiences has also shown to have an effect on engagement; true student interest emerges when close attention is paid to this process (Ghafouri, 2014; Green, 2013). I also outlined the significance of valuing student voice and interest in learning and how this complements the current Yukon curriculum transformation towards student-centered education.

Finally, I shared the theories that are framing my research - sociocultural theory, experiential education, and placed-based education. In the following chapter, I elaborate on these theories and share the growing body of literature related to children's interest in nature, including research specifically relating to understanding student autonomy, voice, and interest in nature.

Chapter 2

Introduction

In the preceding chapter, I introduced my research questions that seek to uncover and authenticate student interest in nature. I also addressed how concepts and strategies such as learner autonomy and honouring student voice and interest interrelate in the context of nature-based learning.

In this chapter, I summarize three theories that will frame the literature related to my research: sociocultural theory (Rogoff, 1990, 2003; Vygotsky, 1978); experiential education (Dewey, 1915, 1938; Kolb & Fry 1974); and, place-based education (Gruenewald, 2008; Sobel, 1993, 2005). This is followed by a review of the literature which addresses two bodies of literature. Firstly, I reviewed studies that examined children's voices and autonomy in nature-based research. The second body of literature reviews research utilizing emerging technology to better understand children's interest in nature.

Sociocultural Theory

Sociocultural theory (Vygotsky, 1978) acknowledges the significant role that social interactions and cultural influences play in learning and the construction of knowledge. In his work, Vygotsky (1978) focused on the zone of proximal development (ZPD). The ZPD refers to the limits of cognitive development of an individual at any given time as learning progresses. Tasks should be arranged so they fall within this zone for each individual, so they are not over or underwhelmed, and construction of new knowledge can progress (Vygotsky, 1978). Progression in part is depended on interactions with more knowledgeable others (MKO). Vygotsky proposed that learning takes place on two distinct planes; firstly, on a social and interactive level where the

learner is experiencing their environment with others, known as interpersonal; secondly, learning takes place on a personal level where the experiences are internalized, referred to as intrapersonal (Vygotsky, 1986).

Rogoff (1990, 2003), who was influenced by Vygotsky, viewed learning and social development as a product of participation in a specific culture. Rogoff (1990, 2003) challenged the nature vs. nurture view of human development by proposing that people are biologically cultural. Rogoff's emphasis on culture as a driving force of knowledge construction supports sociocultural learning theory and moves it towards acknowledging the influence of specific cultural diversity on child development. Rogoff (1990, 2003) rejected the static or normative view of culture and argued that cultures shift and overlap, even for individuals within the same community. Rogoff described learning as occurring on three planes: within the individual child, among others within the child's community, and finally, the sociocultural context in which the learner and those around them interact (Edwards, 2005).

Experiential Education

Experiential education has historic roots that will be summarized before discussing its modern applications. Aristotle (trans, 1980) wrote, "for the things we have to learn before we can do them, we learn by doing them" (Hardie, 1980). In his work, Dewey (1915) developed school designs focused on learning by doing which had explicit connections to gardens, parks, and nature. Students were taught in an informal, apprentice-like model which was in contrast to the industrial model of the day (Benson, Harkavy, & Puckett, 2007). Dewey (1938) developed much of the foundation for experiential education theory in the early 20th century. His innovative school designs of the early 20th century focused on hands-on experiences.

Kolb (1984) further formalized these concepts into modern and accessible tools for educators. Kolb (1984) stated that experiential learning theory is built on six propositions that include: the notion that learning is best realized as a process not an outcome; learning is re-learning; learning requires a conflict between opposing views of the world; learning is a holistic process of adaptation to our environment; learning results from synergetic transactions between a person and their environment; and, learning is the process of creating and re-creating personal knowledge within the student.

Place-Based Education

Place-based education focuses on a learner's sense of place, beliefs, and special places within it (Kriesberg, 1999; Sobel, 1993). Place-based education draws explicit connections between schools, communities, and the environment by focusing learning on projects that traverse these environments and immersing students in real life problem solving (Greenwood & Smith 2008; Gruenewald, 2008; Sobel, 1993, 2005; Woodhouse & Knapp, 2000). The term place-based education was first introduced in its modern form by Lane-Zucker and Elder in 1992 as an instructional approach (Elder, 2011). Sobel (1993, 2005) posited that the local community and surrounding environment serve as the stimulus for curricula exploration and the active engagement of students. Despite the popularization of the current understanding of place-based education theory, its roots are ancient and have been part of Indigenous knowledge systems globally (Semken, Ward, Moosavi, & Chinn, 2017). Simply put, place-based education aspires to develop a deeper understanding of place for those who live and learn within that environment (Semken et al. 2017).

Sobel (2005) argued that if the local community and environment are used as a starting place for curriculum exploration the results would include strengthened community bonds,

greater appreciation for the environment, and increased engagement as citizens. Gruenewald (2008) explained that the education of citizens needs to be guided by place-based theory if we expect education to be capable of having a positive effect on society and the places we inhabit.

The connections between sociocultural theory, experiential education, and place-based education provide background knowledge and understanding pertinent to my research with children in nature. The next section provides a review of literature which also supports knowledge and understandings essential to my investigation. The review primarily focuses on studies involving young students in nature where they experience autonomy and their interest and voice is valued by the researchers.

Student Voice and Autonomy in Nature-Based Research

Honouring student voice is a growing trend in research with young children (Caiman & Lundegard, 2013; Green, 2016, 2017). Young children's learning outdoors occurs in a spontaneous way which necessitates giving them space, time, and autonomy in these environments to gain insight into their perspectives (Khu, Ponte, & Chau, 2013; Prince, Allin, Sandseter, & Arlemalm-Hagser, 2013; Skar, Gundersen, & O'Brian, 2016). In this section of the literature review, the studies highlight child autonomy in relation to children's freedom of movement in nature. These studies provide context and understanding for the research I have undertaken which will be described in greater detail in the following chapter.

Skar, Gundersen, and O'Brian (2016) explored how children's interest in nature was influenced by varying degrees of involvement by adults to identify which factors influenced their engagement in nature. Data were collected from 269 Norwegian children and their families at the Hama og Hedmak Trekking Association and the Lillehammer Trekking Association in Norway between August 2013 and January 2014. No specific data relating to the age of the children was

given. Families in the study were members of either trekking association and the sampling took place during events and activities hosted by these associations.

The methodology drew on a hermeneutic-phenomenological perspective to investigate children's nature contact with an adult's presence. Data collection methods included field notes, participant observations, and conversations with the children and adults. All field notes taken at both sites were then transformed into comprehensive reports following each data collection session. Data collection focused on four main areas in relation to the child participants: topics and activities; participation in activities; social interaction; and, nature contact.

Findings from this study revealed a distinct divide in child behaviour among the experiences offered by the trekking associations. Experiences that included more than 20 people (e.g., orienteering, canoeing, fishing, tobogganing) and were highly organized saw superficial child engagement with nature as captured by observations. Conversely, open-ended and smaller events revealed that children were intrinsically motivated to engage in nature and engage in more social interaction with peers (e.g., a small group hike to a mountain, campfire activity). Both this study and the next involved children and their caregivers.

Boileau (2011) investigated activities that young learners articulated as meaningful in the natural world. In this study, 32 children were involved, ranging in age from three to five years old. This study took place at Gray's Creek Conservation Area within the city of Cornwall, Ontario along the St. Lawrence River. The participants had similar socio-economic, ethnic, cultural, and linguistic backgrounds. This study focused on three questions: What formats, topics, and activities work best with young children for early years environmental education programs? What can educators learn from listening to children regarding their understanding of

the environment? And finally, how can the findings from the River Buddies pilot program inform the development of future early years programs?

The goals of the River Buddies program are to foster a sense of wonder and respect for the natural world, educate about natural history, and to give children access to environmental scientists. The River Buddies program was developed by the researcher. Data were collected over 4 weeks and consisted of nature workshops and outings for children and their caregivers. The one-hour workshops focused on plants, soil, animals, and water in the park. The outings, for children and their caregivers, were guided nature hikes in the Gray's Conservation Area.

Data were collected using the Mosaic Approach (Clark & Moss, 2001) which is a multi-method framework for gathering information on young children's perspectives on their experiences. Data were collected through audio recordings, auto-photography, and researcher observations. Findings from this study included: prolonged student fascination with live animals by most participants; children's strong desire to engage with a diversity of natural loose parts, such as sand, sticks, and rocks; students' finding enjoyment in the embodiment of animals; children exploring using their senses; and children sharing their learning with their peers and adults. The following study by Waters and Maynard (2010) examined children's autonomy as they explored their natural surroundings.

Waters and Maynard (2010) investigated what specific elements in the outdoor environment draw children's attention when given a chance to explore in the same park on several occasions. This study was conducted with three primary school classes in South Wales with student ages ranging from four to seven-year-olds. Each class participated in the study for an afternoon four times throughout the school year. The location was a local park with a diverse landscape that included steep terrain, wooded areas, open fields, dense vegetation, and wetlands.

Visual and audio data of all teacher-student interaction were collected during the sampling periods. Specifically, the researchers focused on examining the information students chose to share with the teachers during the outings.

The data were analyzed using a grounded theory approach that involved coding of what was shared. The data revealed that a third of all student-initiated interactions related to an element of the environment (e.g., a bird, a shell, berries). This was consistent across all three classes. Some of the elements of student-initiated interactions included fantasy such as elf holes and dragon homes. Another third of student-initiated interactions included elements such as natural loose parts (e.g., sticks, seeds, stones, leaves, mushrooms, hail, rocks). Another third of all initiations were indirectly related to the environment. These child-teacher interactions included discussions about being outside; however, these conversations did not focus on a specific element of the environment. Waters and Maynard (2010) concluded that it was the recurring aspects of the outdoor environment (e.g., trees, rocks, hills) that drew students' attention the most. Based on their findings, Water and Maynard recommended that unkept and natural spaces be made available for young students to explore on a repeated basis and that the richness of such environments should not be underestimated. In the next study Kalvaitis and Monhardt (2012) investigated student interest in nature by analyzing drawings created by students following their experiences outdoors.

Kalvaitis and Monhardt (2012) conducted a study on the relationships that 6 to 11-year-old students have with nature. In addition to providing more insight on student-nature relationships, they wanted to investigate if this relationship changed significantly between age groups. This study included 10 classrooms from the Rocky Mountain region of the United States.

A mixed-methods approach was used for data collection incorporating both drawing and writing activities.

Participating students were asked to draw a picture of themselves doing something in nature that they valued and then write about the picture and explain their relationship with nature. The methodological approach aimed to capture children's interactions *in* nature rather than *about* nature. The sessions were facilitated by the researchers and teachers during the art block at school which consisted of one 55-minute class for each participating class. Data were analyzed in three phases. Phase one was a statistical analysis of the contents of the children's drawings. Phase two involved statistical testing of the categories of the content in the drawings, and phase three focused on a content analysis of the written narratives. The elements of each drawing were inventoried and assessed for frequency. Seven categories were used to code the images: setting, people, non-human living and non-living elements, activity, time, style, and tone (Gamradt & Staples, 1994).

Statistical analysis of the coded images was done using a chi-square goodness-of-fit Mantel-Haenzel test in an attempt to identify trends between two or more groups. The writing element of the study was analyzed for word frequency using NVIVO 8 software. Findings from this analysis exposed the types of experiences students valued in nature including places, people, and specific activities. A form of play was evident in 89% of all images and showed no variation between grade. Students in the younger grades shared more about nearby nature (e.g., watching bugs, picking flowers), whereas older students in the study depicted themselves in more outdoor events such as hiking or more complex processes such as thinking or feeling.

Findings from the students writing revealed that students overwhelmingly wrote about themselves in reference to nature or outside. Followed in frequency by valuation words such as "like" or "love" which indicates the type of relationship they have with nature. Other high frequency words included tree, animal, fun, and play/playing. The data from the written responses correlated with the imagery data as students in higher grades made less reference to family or friends. Based on the findings, Kalvaitis and Monhardt recommended that curriculum designers and educators pay more attention to specific developmental aspects of student-nature relationships in order to benefit from student interest. In contrast to this study, Cheng and Monroe (2012) investigated student interest in nature among a very large sample size in this next study.

Cheng and Monroe (2012) explored how students perceived a nature-based program by focusing on student interest and whether a conservation ethic, which refers to pro-environmental attitudes and behaviours, was developed. This study was conducted in a school district in Florida with 5,500 fourth-grade students. Of the 5,500 students, a total of 1,432 responded to the survey. Prior to the nature-based program, a pilot group of students from the same school district interviewed in small groups to establish a connection to nature index based on their interests and attitudes in relation to time spent in a natural environment. Interview questions included: When was the last time you went to a natural place? Where did you go? What did you do there? How did you feel? And finally, what are you interested in learning about the environment? A correlation analysis was done to analyze the association between connection to nature and variables that could affect children's attitudes toward nature. These variables included: experience, nature near the home, and family values toward nature. Family values toward nature emerged as the greatest predictor.

In their discussion, Cheng and Monroe (2012) revealed students' perceptions of connection to nature consisted of enjoyment of nature, empathy for animals, and a sense of oneness and responsibility. This study revealed a significant correlation between students' connections to nature and nature near their homes. Additionally, their connections to nature were correlated to other variables such as previous experiences in nature, knowledge of the environment, and family values. Connection to nature emerged as the strongest independent variable that influenced a student's interest in participating in nature-based activities. The next study by Ghafouri (2014) builds on Cheng's and Monroe's work by examining student engagement with nature.

Ghafouri (2014) conducted a study in a metropolitan area in Southern Ontario with a kindergarten class that examined students' engagement with the natural environment. The research focused on how children's engagement with nature contributed to their overall learning experiences and how free-choice within learning experiences affected children's learning. Qualitative data were primarily collected in the form of participant observations. The observations took place four times a week over a five-month period. Observation tools included field notes, digital photography, digital video, and digital audio recording. The classroom teacher was also interviewed to acquire an understanding of her teaching philosophy with children in nature and to gauge the possible impact of the study on the children's experiences in nature. Data were also collected from parents/guardians using a questionnaire that inquired about their experiences with the natural world, time spent in nature, and the types of activities they involved their children in outdoors. Finally, samples of student drawings were collected.

Data were analyzed and synthesized through a grounded theory approach. These patterns were then categorized, sorted, and linked to each research question. Ghafouri contrasted two

distinctly different outdoor experiences with the participating class. The first experience was an open-ended exploration of nature close to the school. The other outdoor experience was a trip to a local farm. Student interest and excitement before and during both experiences was observed as high. However, a significant difference was observed pertaining to student derived questions during the two experiences. The open-ended experience close to the school inspired a considerable amount questions and authentic inquiry from the students. Students were also co-constructors of knowledge and directors of their own learning during and after the open-ended exploration experience. In contrast, although the students were observed enjoying the farm visit, student derived inquiry was absent. The approach of the farm visit was described as transfer of knowledge rather than co-constructing knowledge. Ghafouri concluded that when advocating for nature-based experiences with students that attention should be paid to student autonomy. In the next study by Green (2013), a similar conclusion is reached regarding student autonomy when learning in nature.

A study of 12 kindergarten students' connection to place, particularly nature, was conducted by Green (2013) in the Rocky Mountain region of the Unites States. The study honoured student perspectives by acknowledging the children as active agents of their own experiences. The participants were predominantly middle-class children. Green used an interpretive qualitative methodology to collect and analyze data. Specifically, interactive methods were utilized, including: student led tours of their special places at home, representational model building of these special places, guided classroom conversations, and informal conversations. Data analysis occurred in three cycles, including inter-rater reliability measures. Holistic coding, a method of coding broad themes in large quantities of data, was used to identify general themes in the data. The second cycle of analysis included taxonomic coding, a

categorization coding strategy, to categorize the types of special-place activities shared by the students. These included actions such as play, hiding, and exploration. The third cycle of analysis was axial coding which was used to break down themes and relate them to one another.

Green's findings revealed that students prefer to have several special places rather than just one. Different special places often had different uses, some for exploring, some for hiding, and so on. Most special places had a positive meaning in their lives, such as affording different types of play. Play was divided into three distinct categories: functional play (e.g., riding bikes), constructive play (e.g., building forts), and symbolic play (e.g., playing babies). Overall, students were attracted to environments that provided them with a sense of autonomy and control. They were particularly engaged in claiming and constructing, creating their own rules, being creative and imaginative, and exercising environmental competency. Green (2013) concluded that by listening to children identify and explain their special places we can gain valuable insight into their interest.

Technology, Autonomy, and Nature-Based Research

The literature reviewed in this section highlights studies involving young students in nature where data were collected using wearable technology. This wearable technology included cameras, video cameras, and tracking technology such as GPS devices (Caiman & Lundegard, 2013; Fjortoft, Kristoffersen, & Sageie 2009; Green, 2016, 2017; Loebach & Gilliland, 2010). In the majority of studies shared in this section the presence of the researcher during data collection was minimized to preserve children's autonomy.

Green (2016) conducted a study with 31 three to six-year-olds enrolled in a forest-based summer program in a central Alaskan city. Her study evaluated the advantages and challenges of wearable cameras when conducting research with children in nature. The same area of birch tree

forest close to a school was visited eleven times over a ten-week period for a duration of one hour each time. Additionally, seven classroom visits were arranged to engage students in analysis and interpretation of the photographs they took. Students were given autonomy to explore and experience free-play in the forest. Data were collected through sensory tours that were led by the students. Sensory tours enable researchers to collect data in an unobtrusive way, as participants are able to engage in authentic interactions with just their peers and the environment (Kindt, 2011). The participants were equipped with wearable cameras on their foreheads that captured a log of where they went and what they did. The cameras also captured the students' narratives during their exploration.

Analysis of the data revealed that student interaction with nature was imaginative and socially constructed with peers. All participants paid close attention to aspects of ecology, such as insects, and participated in gross motor activities, such as tree climbing. The video data revealed how student-student and student-nature interactions can be interrupted by the presence of an adult. An observable change in their narrative and behaviour was evident in the video data when this occurred. Since the cameras were worn by the students the video revealed how different the world appears from their perspective compared to an adult. Wild rose plants and their abundant thorns presented a navigational challenge for students and adults appeared enormous from the child's perspective.

During the classroom visits, students reviewed the video footage and were asked the following questions by the researcher: What were you thinking about when you watched the movie? What did you notice? What did you hear? What did you see? And lastly, what are you wondering about? The researcher also encouraged them to draw pictures to share their thinking. Students expressed great interest in their videos and were eager to share and answer the

questions, which reinforced the video data through video-stimulated recall. This process offered an insider's perspective into the experiences in nature, as children were able to articulate what their video meant to them rather than the videos solely being analyzed by the researcher.

In another study by Green (2017), the focus was on how rural Alaskan Native children make meaning of, and interact, with nature. The 60 participants in this phenomenological study were between the ages of five and seven-years-old and from the same small village in western Alaska. Data were primarily collected through sensory tours, which is a method used to gain insight into child-led exploration in their environment by giving them autonomy and minimal interference. During the sensory tours participants were equipped with wearable cameras when exploring in the outdoors. In addition to gathering data from the wearable cameras, the participants also produced drawings, photographs, writings, and nature prints. Field notes were taken during and after the sessions. The sensory tour videos were transcribed, interpreted, and analyzed using the Environmental Identity Development (EID) framework (Clayton & Opotow, 2003). The EID consists of four progressions: trust vs. mistrust in nature; spatial autonomy vs. environmental shame; environmental competency vs. environmental disdain; and environmental action vs. environmental harm.

In this study, most participants displayed a sense of trust in nature. This trust led to an increase in spatial autonomy as the children felt free to explore, taste, and touch. Spatial autonomy contributes to increased environmental competency (Green, Kalvaitis, & Worster, 2016). The data revealed that environmental action in the context of rural Alaska appeared distinct from urban concepts as actions like recycling or taking public transit would not necessarily exist here. In contrast, actions linked to sustainability, such as harvesting from the land vs. importing food, was evident in student actions and dialogue. Similar to this study, the

following study by Caiman and Lundegard (2013) also focused on child participant dialogue to gain understanding of their interest in nature.

Caiman and Lundegard (2013) conducted a study that investigated student agency in a garden setting in Sweden by listening to four to five-year old students' perspectives on their encounters in nature. The participating students attended a Green Flag School. Green Flag Schools share a focus on sustainability and environmental education by providing students with unique opportunities to have a positive impact in their communities and around the globe (https://www.eco-schools.org.uk/).

The researchers specifically focused on young children's development of agency as they encountered phenomena in nature. The data were analyzed using an epistemological analysis approach, which addresses how meaning is created in encounters between the environment and participants. Student interactions in the garden were recorded and their dialogue was analyzed. The researchers focused on two specific experiences; the first was the children's dialogue when exploring with seedling pea plants; the second was the children's interactions with a bird nest. Student dialogue focused on providing for the seedling pea plant and solving problems that they perceived the plant might have, in this case, a potentially damaging rainfall. Similarly, they perceived a problem with an uninhabited bird nest and collaborated to solve that problem. The students concluded that the nest appeared to be in too noisy of a location and decided that the nest needed to be moved to a quieter location. The teacher supported the students' concerns and solutions and was careful not to impose her own ideas. Comparably, the next study also examines a child's interaction with nearby nature.

Loebach and Gilliland (2010) explored children's perceptions and use of their local neighbourhood in London, Ontario. Sixteen students, aged seven to nine, participated in the

study. Participants were equipped with digital cameras and maps to record features of their neighbourhood. Adult facilitators accompanied the students and recorded the ongoing narrative among students. GPS technology was also utilized to track the routes taken by the students during the study. The walks throughout the community were all child-led and conducted with students in pairs. Students were encouraged to use routes that they would normally follow, including shortcuts and informal pathways. As the researchers followed the children, they engaged them in detailed discussions about what they do in their neighbourhood and their perceptions of their local environment. The researchers asked questions, such as: "What is it about this place that you like?", "What is it that you like to do here?", and "Can you tell me what you were taking a photo of?" to gain more insight into the places in which the students displayed interest.

Data were sorted to identify themes and each theme was attached to a representational photograph taken by participants. This enabled routes and places of interest to be geocoded using data from GPS and placed on a map permitting spatial relationships to be analyzed. Student narratives from the explorations were sorted into ten prominent themes. For example, the most prominent theme that emerged was that of belonging or sense of ownership in the community. Often these places included their own home or places very close to home. Students frequently shared information about scary places; however, these negative feelings were always associated with specific places and not representational of the whole community. Overall, the findings revealed that the students have a complex relationship with their community, which included both positive and negative perspectives. The researchers concluded that the child-led tours in conjunction with auto-photography appeared effective in eliciting important places in the neighbourhood. However, the use of GPS units to track routes resulted in some challenges

relating to accuracy. The researchers contended that accuracy may have been affected by cloud cover, tree canopies, and/or proximity to buildings. This next study by Fjortoft, Kristoffersen, and Sageie (2009), based in Norway, also utilized GPS technology to track child participant movement.

Fjortoft, Kristoffersen, and Sageie (2009) organized a study in southern Norway to learn more about student movement patterns and physical activity in schoolyards. The 70 participants in the study were six and seven-years old. Two distinct schools, one rural and one urban, were included in the study. The primary objective of the study was to describe children's movement patterns and physical activity levels, including how schoolyards were used by students. A comparative analysis of schoolyard use between the two schools was also conducted. Prior to the study, the two schoolyards were mapped and classified based on their respective features, including soccer fields, asphalt, play equipment, and forest. Movement data were collected using wearable GPS units and heart rate monitors.

Fjortoft et al. (2009) found that the two different school landscapes afforded diverse opportunities for students. In the urban school yard, which was comprised primarily of asphalt and a small soccer field, students were observed roaming - with little focus. The play structures located on the asphalt were not high interest areas. Student engagement was highest on the soccer field. In comparison, the rural school landscape was more diverse than the urban school, and this was reflected in the students' interests. The yard included a forested area that was extensively used by study participants. Despite the differences in landscape, physical activity levels were similar in both schoolyards.

Although the utilization of GPS technology seemed to be a successful method of collecting spatial data, a limitation of the study included difficulty delineating between playground equipment use when features were close together. This occurred because the GPS was not accurate enough for the researchers to tell exactly which piece of equipment was being used. Nonetheless, wearable technologies enabled the researchers to reduce the impact of an adult's presence on student behaviour and autonomy, which strengthened the authenticity of the data collected.

Summary

The collection of research shared in this chapter focused on student voice, autonomy, and the use of wearable technology during research with children in nature. The key findings in the reviewed studies revealed some consistent trends. For example, across several studies, children displayed a similar affiliation with nature that was led by sensory exploration and centered on play, including imaginative play and play that the landscaped afforded (e.g., trees afforded climbing, dense vegetation afforded hiding games). The data in the studies also revealed children's fascination with living and non-living aspects of nature, particularly animals or evidence of animals and loose parts (e.g., berries, sticks, rocks) (Boileau, 2011; Green, 2013, 2016, 2017; Kalvatis & Monhardt, 2012; Waters & Maynard, 2010). Additionally, children's engagement with the outdoors promoted collaboration among peers that emerged when participants were given autonomy (Caiman & Lundegard, 2013; Ghafouri, 2014; Green, 2016, 2017). The affordances of wearable technology in several of the studies (e.g., Fjortoft et al., 2009; Loebach & Gilliland, 2010; Caiman & Lundegard, 2013; Green, 2016, 2017), proved to reduce the disruption created by adults and allow a more authentic glimpse of genuine student interest in nature.

In the next chapter, I share the methodology that guided my study, the data collection methods, and analysis.

Chapter 3

The Mixed Methods Paradigm

The mixed methods approach I used in this study enabled me to capitalize on the benefits of both research traditions. The quantitative data enabled statistical precision to be added to the qualitative data, the children's narratives. In turn, the children's narratives added depth, richness, and affirmation to numbers and location data. These two approaches, while not being beneficial for every study, proved essential for this particular research.

Typically, one methodological approach remains the primary tool and the other is used as support and to add depth and insight into findings (Creswell, 2015; O'Leary, 2014). The emphasis given to either methodology is determined by the needs of the research question(s) and this is described as either a quantitative perspective with acceptance of qualitative data, or, a qualitative perspective with acceptance of quantitative data (O'Leary, 2014). This study's design enabled triangulation of data and painted a more accurate and holistic picture of a child's interest in nature (Bates & Stone, 2015; Greig, Taylor, & MacKay, 2007). This approach to data collection supports young students' participation in research and highlights the importance of giving children multiple pathways to express their voice (Clark & Moss, 2001). This is referred to as the Mosaic Approach (Clark, 2001), which creates a more composite picture of participants' experiences, and included the use of emerging technology in research with children (see Caiman & Lundegard, 2013; Fjortoft et al., 2009; Green, 2016, 2017; Loebach & Gilliland, 2010). I argue that the collection of qualitative and quantitative data collection methods addressed the complexity of children's interest in a diverse landscape over time (Bates & Stone, 2015).

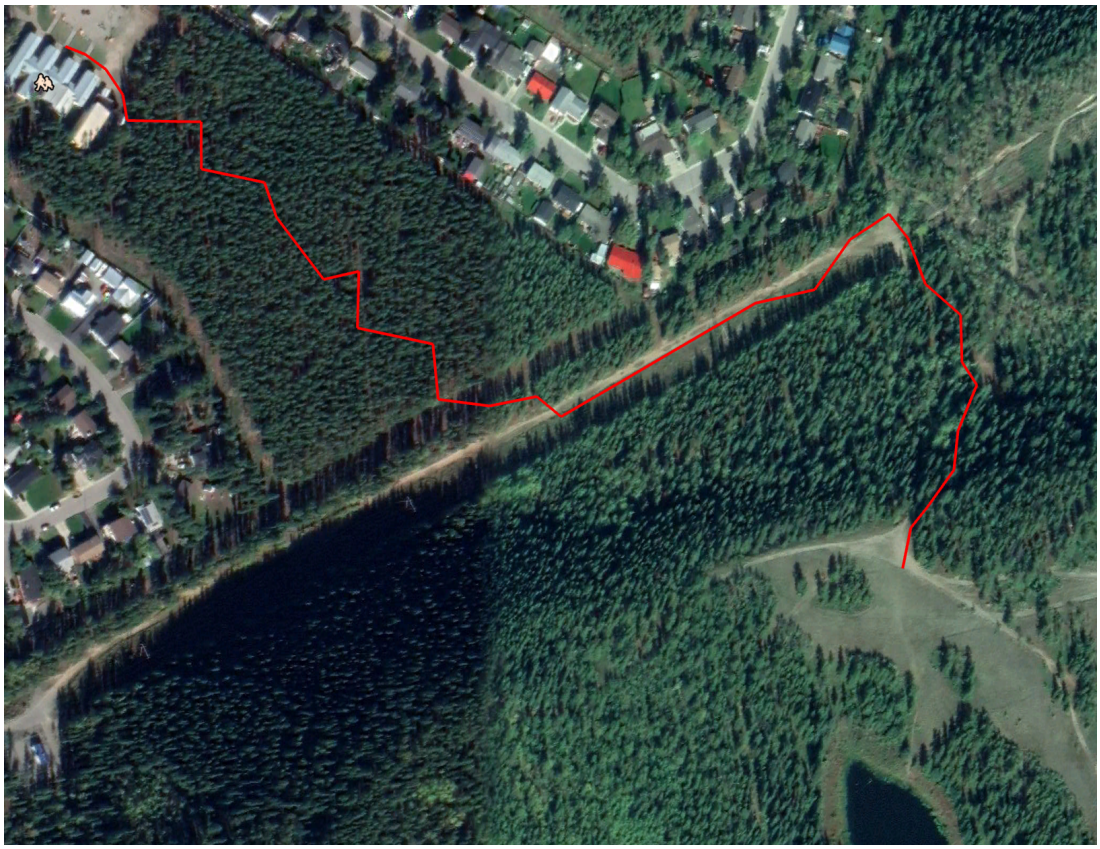
Participants

The participants in this study consisted of a grade two class of 7 and 8-year-old students at a primary school in Whitehorse, Yukon. This small primary school consist of kindergarten to grade three classes with a total enrolment of 70 students. The class involved in this study had 13 participating students. The school is located in a diverse socio-economic neighbourhood of Whitehorse. Three students are on individual education plans (IEP), two students have behaviour support plans (BSP), and one has a student learning plan (SLP). Four students are considered English as additional language speakers (EAL). There is also a set of triplets in the participant group.

Context

The outdoor setting was the boreal forest in the Yukon Territory. The chosen school's location was unique in that despite it being a small school, it sits on a 2.5-hectare wooded lot, which then backs on to Chadburn Lake Municipal Park that is over 7000 hectares. Chadburn Lake Municipal Park consists of several small lakes, untouched stretches of the boreal forest, hiking and mountain biking trails, and Grey Mountain (elevation 1494 meters above sea level). It was important that any aspects of the human-built environment were avoided to prevent students from becoming distracted and therefore reducing the quality of the study in relation to the research question. This meant ensuring structures such as manicured parks, playgrounds and buildings were not visible. Figure 3.1 shows the school and the path travelled to the study area.

Figure 3.1. The red path indicates the trail to the starting point for each sampling session. The distance from the school is approximately 850 meters.



The teacher of the students involved in this study played an invaluable role in this study. She was willing to participate in several outdoor sampling sessions over winter and spring in Yukon. This involved ensuring students were prepared to participate comfortably outdoors, managing risk and administering first aid, and making time in the daily school schedule to accommodate seven data collection sessions.

At the time of data collection, the participating teacher had twenty years of teaching experience, all in Yukon. She began her teaching career teaching home school students, followed by teaching in a small rural Yukon community before teaching in Whitehorse, Yukon. She shared that she is inspired by Waldorf and Montessori philosophies and has always been into immersing students in off-site environments. Her early experiences exploring in nature with her

grandmother on Vancouver Island had an influence on her teaching strategies along with her experience at Malaspina University-College. She continues to teach at a primary school in Whitehorse, Yukon and actively participates in professional development.

Procedures

Before I engaged in data collection with the children, approval was granted from the University of Victoria Human Research Ethics Board (see Appendix #4). The participating class was then selected by first approaching the school's Superintendent at Yukon Education in Whitehorse, Yukon. This was done by arranging a meeting with the Superintendent to explain the proposed study and acquire permission to recruit a class in a Yukon school. Once permission was granted, I applied the geographic criteria of a readily accessible wilderness area to Whitehorse elementary schools. The next step was to approach the school that best met this geographic criterion and meet with the principal to determine if a classroom teacher was willing to participate. During the meeting with the principal, I explained the study in detail. The principal consented to the study taking place at the school. The principal recommended the grade two teacher who she believed would be willing to participate in several sampling sessions outdoors in all seasons. The strenuous nature of this type of study necessitated seeking this recommendation which may have had an effect on external validity, or transferability of the results (O'Leary, 2014). The size of the effect may be buffered by the diverse socioeconomic status of the sample and the findings in this study will offer some indication of this if they are consistent with the findings of similar studies with children in nature.

Following this initial meeting, a meeting was scheduled with the participating classroom teacher to explain the study and to share the invitation letter to participate in the research. The teacher consented to participate in the study and consent was then sought from the

parents/guardians of all the students in the class. Following this, I arranged an initial meeting with the students to explain the study, my role as a researcher, and to get their verbal consent. I used student-friendly language to explain what research is and then explained my research and my role as a researcher. I explained what their role would be like as potential participants in this study and how they would be making valuable contributions to research. I also explained the importance of student voice in research involving students. They were informed that where they chose to explore during sampling sessions is a way of them expressing their interests. I also showed them a GPS unit and modelled how to wear it. I followed this by an explanation of how they work using orbiting satellites and I shared how it collects information important to my research.

I met with the teacher and educational assistants prior to the first session and discussed how we would be careful to not use language that would influence participant movement or decision making when moving on the landscape unless the participant was in immediate danger. An acknowledgement of the traditional territory of the Kwanlin Dun First Nation and Ta'an Kwachan Council was facilitated and then we began. Participants were placed into conditions where they could be observed naturalistically. Since I was striving to get to the core of what matters most to students when immersed in nature, students were given autonomy over movement. The same starting point for the seven sampling sessions was used each time. The students then had the GPS units affixed using a Velcro strap to their upper arm. Following this, participants were facilitated through a sensory wake up circle (Staniforth, 2010). This exercise facilitated participants through their five senses; smell, taste, hearing, touch, and sight. Participants were encouraged to explore the forest using senses as their guides. The teacher and I

explained that the verbal command *all in!* would be used when it was time to come back to the starting point. Students were then free to explore in the landscape.

Field notes were taken by myself during each of the seven data collection sessions in nature. I typically centered myself in the area where students were exploring. My aim was to be a non-participant and interact with students as little as possible although I was not attempting to be covert in this process as that would have been potentially more distracting (O'Leary, 2014). This was effective and participant-researcher interactions were limited to a few adjustments of the GPS unit's Velcro strap. Notes were taken using an unstructured format, in that observations were recorded without using predetermined criteria. This is part of the grounded theory process that begins with data collection in this manner and then searches for emergent patterns after the fact.

Instruments

In this research, the quantitative data gathering tools used were Garmin eTrex GPS units. These units are relatively small, lightweight, and affixed easily to the upper arm of participants (Garmin ETREX 10, 2019). Garmin Basecamp, which is a map viewing/geographic information system (GIS) software package primarily intended for use with Garmin GPS navigation devices, was used for uploading and storing the data prior to analysis. Garmin Basecamp enables individual or all-participant track data to be viewed. Satellite imagery was used to overlay participant tracks over an image of the landscape. This enabled a clear view of the forest type and topography of where participants travelled.

Quantitative Data Collection

As addressed in the previous section, quantitative data were collected using global positioning system (GPS) technology. This data captured geospatial data in the form of tracks on a map of participant movement during the sampling period. Quantitative data were organized on digital maps using Garmin Basecamp software and satellite imagery. Maps were generated for each sampling period and also for individual participants to enable analysis of group and individual movement in the form of tracks. Finally, participant tracks were overlaid on the satellite imagery to enable analysis of participant movement in relation to the landscape features. Patterns and trends in student movement included: where students chose to spend their time, what they avoided, and whether they chose to explore together or alone.

Qualitative Data Collection

Qualitative data collected included seven participant interviews following each of the sampling periods, seven separate field notes, and one teacher interview. These data were sorted and analyzed using key word searches of student responses to the debrief question. Following this, qualitative data were used to cross-reference findings from the quantitative map data using an infographic. The infographic is a satellite map with tracks and students' data overlayed. After searching for meaning and interpretation of this data, conclusions were drawn in accordance with the following research questions: where did students go and what did they do when given autonomy in nature?

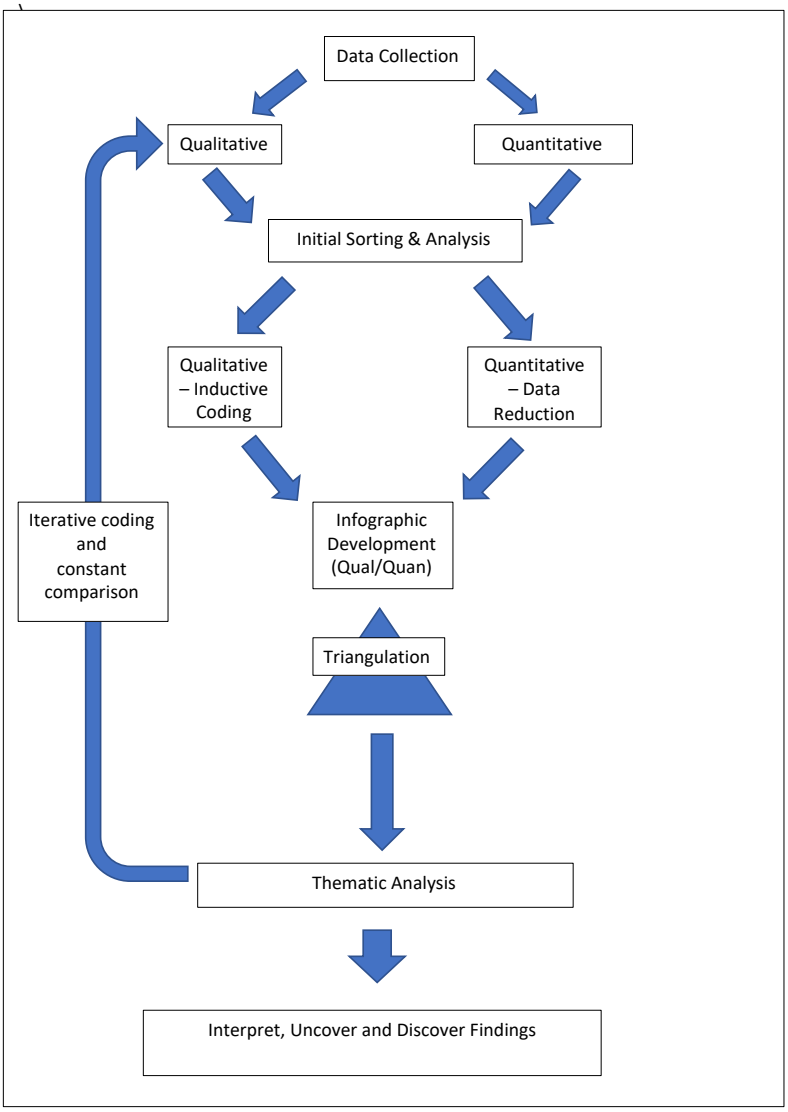
Mixed

I initiated analysis by reviewing all field notes immediately following each session, reviewing children's tracks on a map, and transcribing post-session debrief interviews. After several reviews of this data, patterns started to emerge. These patterns evolved into categories and categories further evolved into themes. I also engaged in data reduction due to the large amount of data that were collected, and then reviewed and re-organized the data again to enable quantitative and qualitative analysis simultaneously. After I identified the themes, I aligned the findings to the research questions.

Plan for Data Analysis

A grounded theory approach was chosen for this study to support the emergence of authentic themes from both quantitative and qualitative data that are unique to the children's experience in nature. This process of data analysis is iterative and builds upon itself as findings emerge (Ghafouri, 2014). This process is also referred to as reflective analysis which cycles through data collection, sorting, analysis, a search for meaning, interpretation, and drawing conclusions, all the while keeping a sense of the research questions, objectives, guiding theories, and methodology (Glaser & Strauss, 1967; O'Leary, 2014). Through this process key concepts emerge which are then grouped into themes until theoretical saturation has been reached (Charmaz, 2014). The following is a diagram of my data analysis process:

Figure 3.2. Data Analysis Diagram



In Figure 3.2, I illustrate my data analysis sequence. It is important to understand that grounded theory analysis is an iterative process. Themes that emerged during inductive coding of qualitative data were triangulated once mixed with quantitative data in the infographic. This allowed for the emergence of more trustworthy themes which could then be compared once more to the larger data set.

Trustworthiness and Credibility

The premise of this study was to enable the voice and interest of the child to emerge with as much clarity as possible, while minimizing the influence of adults on their interactions with nature. I used a mixed-method methodology in an attempt to do this and answer the research questions as clearly and with as much credibility as possible. Apart from introducing myself to the class and positioning myself as a researcher and a learner too, I was diligent in crafting these experiences to enable student autonomy, and not as an adult-led or facilitated experience. I put care and thought into locating a suitable study area and was fortunate to have found a very diverse and relatively untouched landscape. Through an iterative process data were analyzed and triangulated with as much rigor as possible. The findings in this study were consistent with similar studies involving children's interest in nature suggesting my data collection and analysis process was successful.

Ethical Considerations

This study was conducted with the approval of the Human Research Ethics Board of the Office of Research Services at the University of Victoria and the Yukon Department of Education. Consent to participate was given by the school principal, teacher, parents/guardians and from the participating students. Students participating in the study were given an opportunity to decline to participate at any point during any of the sampling sessions. Student and school identifiers have been removed and student names have been replaced with a number such as participant #10. The sampling sessions were carried out in accordance with Yukon's Off-Site Experiential Learning Policy and risks associated with the sessions were mitigated.

Chapter 4

Findings

In this chapter, both qualitative and quantitative data collected during the sampling period will be shared and analyzed. First, qualitative data will be shared that addresses the research question focused on what students were most interested in during their time spent on the landscape. Second, quantitative data will be shared which displays data related to each participant's movement within the landscape during the sampling sessions which is also a reflection of the participant's interest. Finally, both qualitative and quantitative data will be displayed together on an infographic.

Initial Sampling Trial

Data from the first two sampling sessions has intentionally been omitted to account for extinction time (Bouton, 2004). Evidence of the shear novelty of wearing a GPS unit was present in both participant reflections and the researcher field notes. In my field notes from the initial sessions, students displayed a noticeable degree of fascination with the GPS units that were attached to their arms. During the post-session participant interviews, students were asked to reflect on their time on the landscape. Four of the 12 participants in attendance explicitly mentioned the GPS after session #1. By session #2 the novelty of the GPS seemed to wane, and by session #3, the fascination appeared to be gone and students did not make reference to the device. Therefore, data from sessions #3 through #7 will be the focus of analysis.

Qualitative Data

Table 4.1 displays participant responses from each sampling session and for each participant. In total, 61 participant interviews are shown in Table 4.1.

Table 4.2. Qualitative data from post-session participant debrief interviews #3-7.

Parti-cipant	Session #3	Session #4	Session #5	Session #6	Session #7
1	• Playing with friends • The explosion (an electrical transformer on a nearby street exploded)	• Running and… just running around • Playing a game (zombies) • Playing Dinosaur Island	• Playing dinosaur island with friends • Exploring the forest	• Seeing the bear • Playing zombie elimination	• Seeing the beaver • Watching friends jump and fall in
2	• Playing with my friends • Participant X trying to get 'souls' with a rock	• Playing Jurassic Park • Playing zombie tag	• Playing Dinosaur Island	• Pass	• Playing parkour • Jumping around the mud • Seeing the beaver
3	• Being chased • Seeing a stick that a beaver ate	• Seeing the crocus flowers	• Playing Dinosaur Island • Finding crocus flowers • Putting sticks in the pond	• Falling into the water • Slipping on the ground	• Seeing participant #8 falling into the pond • Jumping
4	• Getting things like moss • I saw beaver tracks	• Finding things like berries. Juniper berries • Finding kinnikinnick	• Looking at the loon • Playing zombies • Going on the other side of the pond • Playing tag	• Surprised that participant # 3 got wet • Running down the hill • Playing a game	• Seeing the beaver, it came close • The mud • Seeing bird poop, it was red

			• Playing with my friends • Trying to get the bird • Running down the hill	• Seeing a bear in the forest	
5	• Playing games like chase the zombie game	• Playing zombie tag • Playing with sticks • Using our imagination	• Playing a bunch of different games • Zombies • 5 Knights have hoodies game	• Playing titanic with sticks in the pond • Playing at the pond • The bear	• Jumping in the water
6	• Being chased by participant 5	• Running away from a zombie (participant 5)	• Playing with friends • Climbing hills	• Throwing sticks in the water • Watching the bear	• Absent
7	• Consent not given.				
8	• Walking with Mr. Mitchell • Being chased by participant 5	• Zombie tag • Running through puddles	• Running around all over the place • Playing dinosaurs • Found three ants	• Spying on the girls • Looking at the black bear • Running around	• Falling in the lake • Playing with friends • Parkour game
9	• She said "Same things as participant 11" • Running down the hill • Sliding down • Playing games	• Walking back because I felt sick	• Trying to get the bird to come over • Moving the ice	• Everything • Seeing the bear poop	• Absent

	• Going in trees and hiding • Running in the trees with participant 9				
10	• Collecting stuff • Running • Seeing lots of spring stuff • Berries	• Climbing a big mountain • Some people helped • The zombie game	• Seeing lots of animals (ducks) • Being quiet to see if the bird would come to us	• Seeing a bear • Felt happy • Seeing bear poop • Playing in the woods • Seeing participant 3 fall into the water	• Watching will jump and fall in • Jump challenge • Finding beavers
11	• Running down the hill • Sliding down • Playing games • Going in trees and hiding • Running in the trees with participant 9	• Playing the zombie game • Running down the icy hill • Running to a path	• Looking at the duck • Holding an ant • Running down the hill • Sliding down the steep hill • Walking with participant 9 • Looking at four squirrels • Looking at the feathers I think a cougar ate a bird	• Looking at the bear • Seeing the bear poop • Running • Saw a butter cup • Ate a honey suckle • Crocus flowers and a daisy • Walking	• Looking at the beaver; the beaver slapped its tail • Running and walking • Hiding • Going to the beaver house
12	• Playing • Hiding • Exercise • Running • Walking	• Playing running and tag	• Playing with friends • Playing with pond • The forest	• The bear • Ate sap; so sticky • Playing in the forest	• Falling in the water • Seeing the beaver

			• Looking for birds (blue jay) • Found five squirrels	• Looking for beavers • Playing with participant 8	• Getting sticks from the beaver house
13	• Consent not given.				
14	• Playing with friends • The explosion	• Getting my socks wet • Playing zombies	• Playing with friends • Running • Going around the pond	• Seeing the bear • Fun playing with friends • Playing infecting zombie	• Absent

This data provides an individual account of what each participant chose to share regarding what they enjoyed the most from their experiences in nature. Displaying individual accounts in such a table enables initial coding and analysis of this data. The information in this table reveals that the participants had a shared experience in nature and that their interaction with the environment was socially constructed (Vygotsky, 1978). Participants used a common language to describe their experiences, which enabled a keyword search and coding in the ensuing table. The keywords chosen for the search resulted from a scan of the participants' common language used in the debrief interview.

Table 4.2. Keyword search of qualitative data from post-session participant interviews.

Keyword search of participant responses	Frequency
Play/playing	46
Animal (bear, beaver, bird, duck, squirrel)	33 (11,10,7,3,2)
Running	24
Game	16
Zombie	13
Friends	12
Hill	12
Pond/Water	12 (6,6)
Forest/tree	10
Hiding	9
Snow/ice	8 (7,1)
Falling	7
Boy/Girl	7 (1,6)
Chasing	5
Tag	5
Jump/Jumping	5
Climbing	4
Chose to pass	4
GPS	4
Flower (crocus)	3
Sliding	3
Throw/Throwing	2
Competitive speech (win, lose, lost, against, vs., fight)	1

The keyword search of participant comments revealed that play/playing was the most common category to emerge with 46 references from 61 participant interviews. Second to play/playing, animals, specifically a bear, beaver, bird, duck and squirrel, were the next most frequent category to emerge with 33 references from 61 interviews. Of the animals, bear was the most frequent animal mentioned by participants. Third, the act of running was mentioned 24 times by participants, followed by games (16), zombies (13), friends (12), hills (12), as shown in Table 4.2.

Play or playing (n = 46) was the most common category to emerge from the post-session participant interviews. Examples of play that were captured in my field notes and from the post-experience interviews included: imitating animals, hide and seek, play involving their imagination (e.g., zombie game, Dinosaur Island, patient and doctor game, Titanic game). This is consistent with findings in other studies involving children and nature and the significant role of peers in play (Boileau, 2011; Green, 2013, 2016; Kalvatis & Monhardt, 2012; Waters & Maynard, 2010; Vygotsky, 1978). From Vygotsky's perspective, play was a primary medium for child development. Children used role-playing as they imitated adults doing more difficult tasks as a means of informal development and learning. Nature also affords children with an environment that they appear to use intuitively and find favourable for play (Fjortoft et al., 2009; Green, 2013, 2016; Waters & Maynard, 2010).

Animals (n = 33) were the next most frequently referenced category by the participants. The animal category included references to bears, beavers, birds, ducks, and squirrels. The emergence of this category for participants is consistent with other recent studies involving children and nature (Boileau, 2010; Green, 2016; Kalvatis & Monhardt, 2012; Waters & Maynard, 2010). The apparent fascination with animals suggested by this data combined with the lack of biophobic comments captured in the field notes suggests that students have a positive relationship with nature (Wilson, 1984). This finding is further supported by the lack of negative or fearful comments observed and captured in the field notes even after the interaction with a black bear.

The third most frequently used term was running (n = 24). The diverse physical landscape of the study area, which included treeless hillsides, afforded participants with opportunities to run; this was reflected in their post-experience debriefs. Children's engagement

in outdoor physical activity in diverse landscapes was also evident in other studies (e.g., Fjortoft et al., 2009; Green, 2013, 2016). The hill (n = 7), was the most common physical feature mentioned by participants; this reinforces the affordances of landscape for running as observed in Participant #9's comment, "running down the hill".

Games (n = 16) and zombies (n = 13) were the fourth and fifth most frequently mentioned terms. These terms were often used in conjunction, such as "playing the zombie game" as mentioned by Participant #11. A case could be made for including these terms in a broader category with play/playing, further supporting play/playing as the most frequently referenced category from the post-experience participant debrief. This type of game involves children utilising their imagination. Imaginative and fantasy play were also commonly found in other studies with children in nature (Boileau, 2011; Green, 2013, 2016; Waters & Maynard, 2010).

The primary goal of the qualitative data in this mixed methods study was to help triangulate the findings from the quantitative data. In summary, the themes which emerged in the post-experience trip debrief proved to be rich and consistent with several other studies despite only consisting of a single question being asked following each of the sampling sessions.

Quantitative Data

Quantitative data were collected from each individual participant using GPS units. The data collected offers insight into geo-spatial movement across the landscape during each sampling session. This data is presented in a series of satellite maps revealing the path each participant travelled and directly addresses the research question that focused on where participants chose to go when given autonomy in nature. The maps include quantitative data relating to each participant's travel speed (km/h) and distance travelled (m) as well as % of time

spent in forests vs barren ground. These data can also be seen in Appendix 3. Qualitative data from each participant's post-session debrief is also shown on the map for ease of triangulation. The maps reveal which terrain features students travelled to (e.g., hill, pond, forest).

In this chapter, four of the participants' data are highlighted. These participants' data were highlighted as they offer a representative sample of the overall group. These participants were also present during most data collection sessions resulting in a more complete data set to analyze.

Mixed Analysis of Focus Participants

Participant #3

Over the course of five sampling sessions, participant #3 spent 63% of their time in the forest and 37% of their time on barren ground. To put this into context, the total study area where the participants explored was approximately 26, 931 square meters (sq/m) of which 16, 337 sq/m, or 60%, was forest and 10,594 sq/m, or 40%, was considered barren. This data supports findings in other studies with children in nature in relation to where they chose to locate themselves in forested areas (Fjortoft et al., 2009). Forests also afford children with loose parts such as sticks, leaves, moss and cones, which may have contributed to their significant preference for this type of landscape (see Boileau, 2011; Green, 2013; Waters & Maynard, 2010). This finding is supported by the participant's comments during the post-experience debrief, such as in session #3 where they talked about "finding the stick", and in session #5 "finding the crocus flower."

There was a high degree of variability between sessions in the total distance travelled by participant #3. For example, in session #4 they travelled 963 m (Figure 4.1); in session #5 they only travelled 336 m (Figure 4.2). Cross-referencing with qualitative data offers possible insight

into this variability. For example, in session #4 where the participant travelled a relatively far distance, they commented that they saw crocus flowers; their GPS track in Figure 4.1 reinforced this as it is clear that they spent time searching the hillside where crocus flowers typically grow. In session #5 where they travelled 336 m, their comments revealed that they again found a crocus flower but that they also played a game called Dinosaur Island and spent time putting sticks in the pond; this offers an explanation for the relatively short distance travelled. This again is confirmed by Figure 4.2. The co-constructed game Dinosaur Island, which the student participated in with their peers, was not facilitated by an adult. This is an example of the child developing knowledge socially as they interacted with their peers (Vygotsky, 1978).

Figure 4.1. Session #4, Participant #3 Infographic. The student's track on the hillside confirms their search for crocus flowers both at the beginning and end of the sampling session.

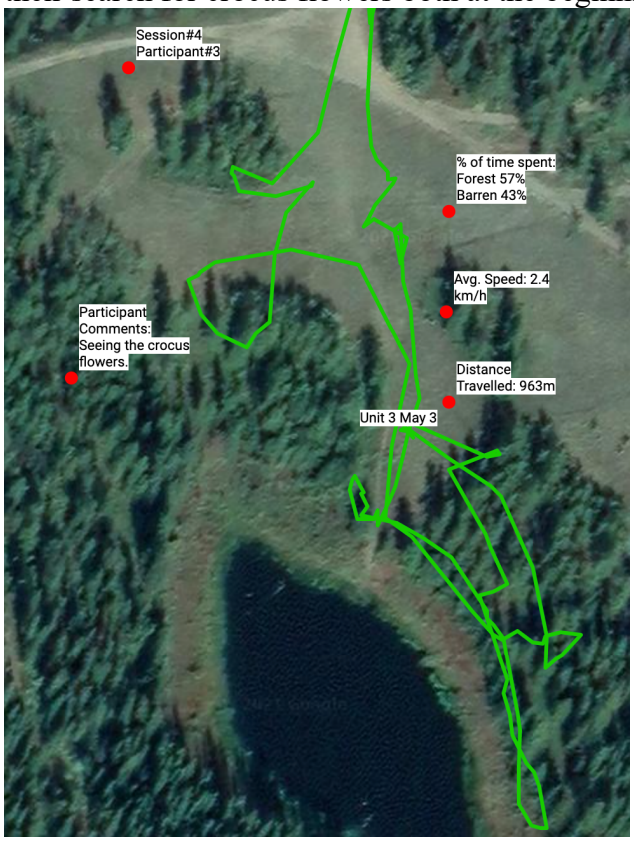
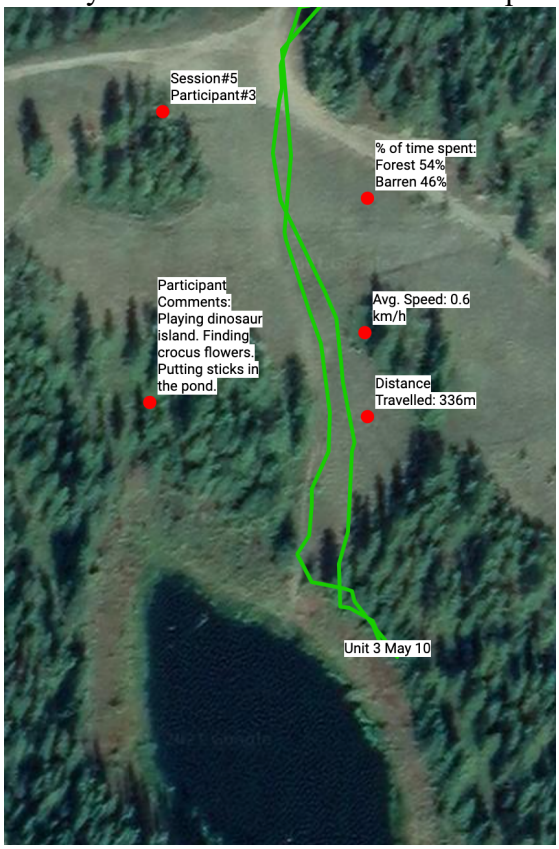


Figure 4.2. Session #5, Participant #3 Infographic. Notice that the participant travelled almost directly to the forested area next to the pond where they played Dinosaur Island.



Participant #4

Participant #4 spent 65.8% of their time in the forest and 34.2% on barren ground. This participant had a noticeable attraction to flora and fauna. In the post experience debrief, this participant mentioned at least one aspect of plant or animal life each time. For example: “I saw beaver tracks,” “Finding things like berries,” “Looking at the loon,” “Seeing a bear in the forest,” and “Seeing the beaver; it came close.” Like several of the other participants, Participant #4 had diverse routes of travel for each sampling session. A possible explanation for this could be the participant’s constant search for aspects of flora and fauna, which they seemed to find fascinating (Boileau, 2011; Kalvatis & Monhardt, 2012). Since the sampling sessions were spread over four months, including a change in seasons from winter to spring, students appeared

to be fascinated by the emergent aspects of nature. This search for interesting aspects of nature appears to contrast against playing games with some degree of imagination or role playing. For example, participant #4's comment of "playing zombies" and "playing with my friends," were made on the same day as their comments "looking at the loon" and "trying to get the bird." This switching back and forth between types of behaviour during a single sampling session was also observed in several other participants in the study. They appeared to be constantly on the lookout for interesting aspects of flora and fauna while playing games and interacting with each other.

Participant #4 had the highest average travel speed when compared to the other focus participants and consequently travelled the greatest distance. Figures 4.3 and 4.4 depict this movement well. A probable explanation for this could again be linked to their comments from the post-experience debrief. Participant #4 used verbs such as *getting, looking, finding, seeing,* and *playing* in all debriefs. Experiential and place-based learning theories offer at least a partial understanding of this type of behaviour. This participant's movement during their tireless search for artifacts of flora and fauna is an example of place-based education theory where the focus of attention and learning came from the landscape (Sobel, 2005).

Figure 4.3. Session #4, Participant #4. This infographic shows the vast distance travelled and the travel speed while looking for berries.

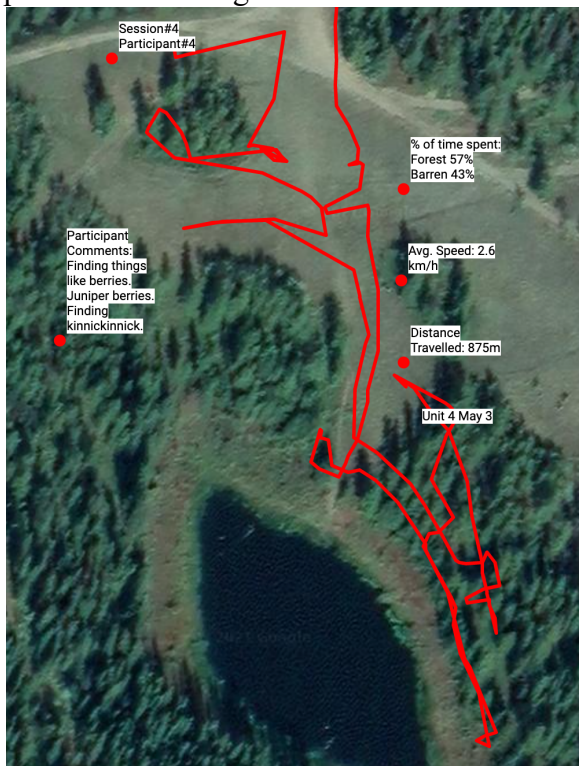
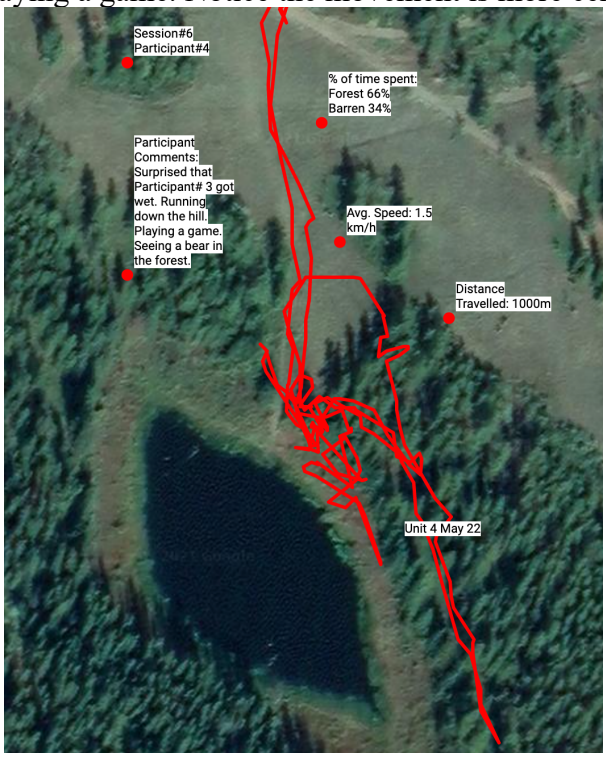


Figure 4.4. Session #6, Participant #4. Again, the participant travelled a great distance but this time playing a game. Notice the movement is more centrally focused.



Participant #5

Participant #5 spent the most amount of time in the forest when compared to other participants. Analysis of their GPS track revealed clear patterns where the participant would return to the dense area of forest next to the pond during each sampling session as seen in Figures 4.5 and 4.6. The participant's post-session debrief comments offer an explanation for why the student travelled where they did; in all but one debrief the participant mentioned playing some sort of game. This is consistent with other studies where children's activities were highly influenced by what nature afforded them (Fjortoft et al., 2009; Green, 2013; 2016). As evident in GPS data from other participants, Participant #5 was not playing alone. Other students also preferred to play games in this densely forested area that enabled the children to hide. This affordance is supported by Participant #11's comments from the same sampling session: "playing games", and "going in trees and hiding", and participant #12's comment: "hiding". The repeated reference to play or playing by Participant #5 is consistent with studies involving similar-aged children in nature (Boileau, 2011; Green, 2013; Kalvatis & Monhardt, 2012) and enabled the children to construct knowledge with their peers (Vygotsky, 1978).

Figure 4.5. Session #3, Participant #5. The participant repeatedly returned to this area near the pond to play.

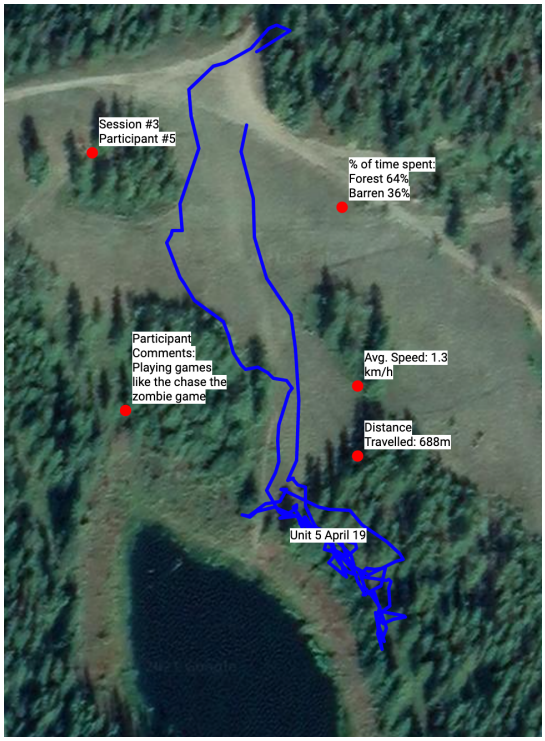
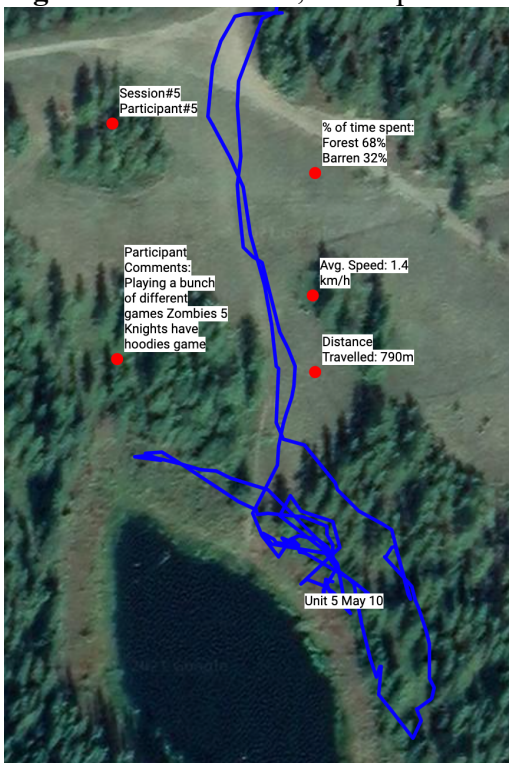


Figure 4.6. Session #5, Participant #5. In this figure the same area was used for play.



Participant #10

Participant #10 spent 61.4 % of their time in the forest and 39.6% on barren ground. This is the most amount of time spent on barren ground when compared to the other focus participants. Participant #10 was similarly fascinated with flora and fauna as was evident in their post-session comments: “collecting stuff,” “seeing lots of spring stuff,” “berries,” “seeing bear poop,” “seeing lots of animals,” and “finding beavers”. These comments were consistent with the GPS track data as you could see the participant zig-zagging across the landscape as they searched for artifacts of nature in Figure 4.7. This participant’s movement exhibited a degree of spatial autonomy in nature that can be linked to a child’s trust in nature (Green, 2017). Although not mentioned in their post-experience comments from session #4, Participant #10’s GPS track on the infographic and the data from the researcher field notes conclude that the student travelled to the location of the crocus flower patch.

Figure 4.7. Session #3, Participant #10. This participants’ search for artifacts of nature led them to spend more time on barren ground than other participants.

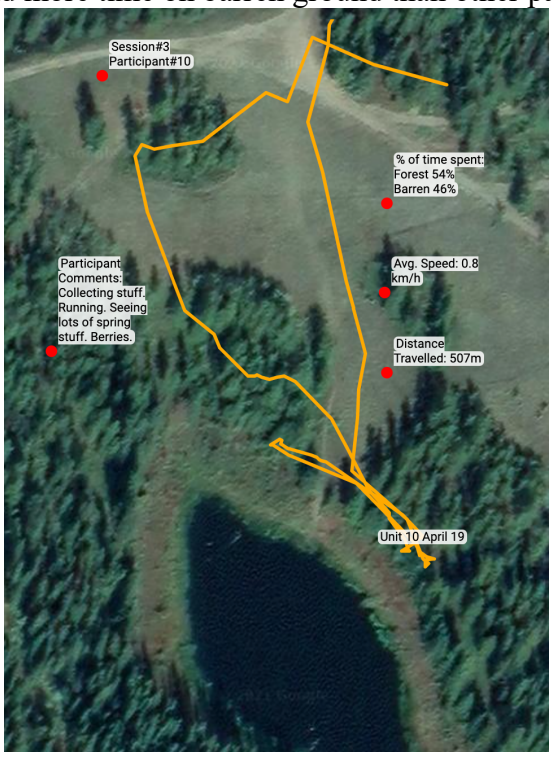
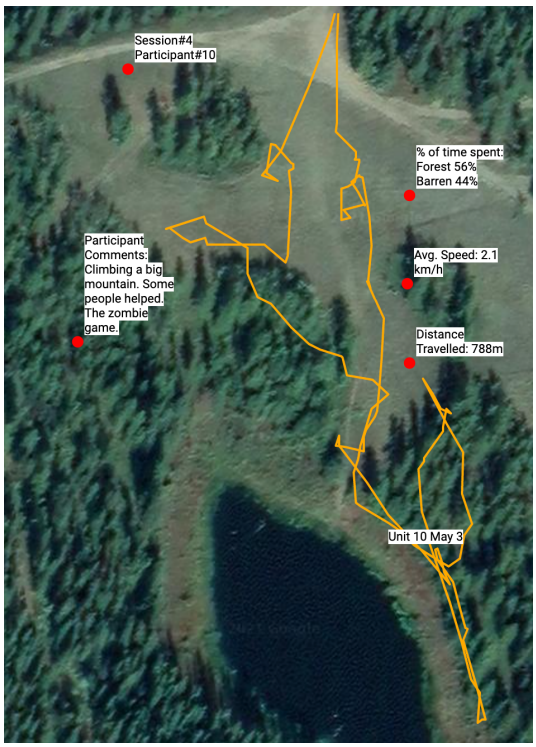


Figure 4.8. Session # 4, Participant #10. Again, they return to the barren ground to the location of the crocus.



Overall, these four participants, who represented the diversity of the overall participant group, have revealed through their movement data an unobstructed and authentic view of their interest in nature.

Summary

The quantitative data from participants #3, 4, 5, and 10 provided a rich and authentic understanding of their interest in nature by presenting a clear picture of where they travelled when given autonomy. This quantitative data was triangulated with the qualitative data from the post-experience interviews, adding to the validity of these findings. This could be clearly be observed on the infographic where post-experience interview data was overlayed on the map containing the participant movement on the landscape. Overall, these participants' experiences in nature were consistent with findings from other studies of similar-aged children in nature. These

children expressed a fascination with flora and fauna and artifacts of nature, also known as loose parts. They engaged in playing games that the landscape afforded, which included running, jumping, and hiding, and they played games that drew on their imagination and fantasy.

A consistent trend was the participants' preference of the forest as opposed to the barren ground; possible reasons for this were discussed and validated by the qualitative data. In the next chapter I discuss these findings in greater detail, including the contributions and implications of these findings, as well as limitations and possibilities for further research.

Chapter 5

Implications and Conclusions

In this study, I sought to uncover authentic interest in the boreal forest among a class of seven and eight-year-old children. Specifically, I wanted to know, when given autonomy, where did participants choose to go when offered diverse landscapes and what did they choose to do? Deepening our understanding of a child's interest in, and relationship with nature, is powerful information for early childhood educators, teachers, parents, and policy makers. This greater understanding of how children interact with nature could be used to inform everything from the construction of outdoor physical spaces to curriculum and teaching strategies and how parents engage with their children.

Based on the data, the participants in the study showed little hesitation in expressing their interest in, and perspective on, their engagement with nature; this was captured with both quantitative and qualitative methods. In this chapter the significant narratives that have emerged from the data will be discussed as they relate to the study's research questions. I will also discuss implications of the study's findings, contributions to the field of study, limitations, and possibilities for further research.

Quite possibly the most significant findings from this study come from the methods used. The use of geo-spatial technology to track student movement in nature and the triangulation of this data with qualitative data proved to be a complimentary approach and enabled a more authentic glimpse of genuine student interest. We have learned from other studies with similar-aged children in nature that the presence of an adult has a notable effect on child behaviours (Green, 2016). In my study, participants were allowed to have freedom in the

boreal forest and express themselves and their genuine interests. Inquiring about their perspectives on time spent in the forest also proved to be a reliable method that added richness to the quantitative maps.

Based on the data, participant movement was influenced by their seeking for, and discovery of, flora and fauna. Since children perceive nature predominantly through their senses, where they choose to go when given autonomy is an expression of their authentic selves (Boileau, 2011; Green, 2017). This finding was verified by cross-referencing participants' quantitative movement data with their qualitative data in the form of post experience debrief responses. The discovery of flora and fauna was a significant motivator for students and something they showed enduring curiosity about during all sampling sessions. This attraction to flora and fauna also reveals a propensity for place as a focal point of learning (Sobel, 2005).

The different aspects of the landscape and loose parts found in nature also afforded the children with a variety of elements which enabled different types of play such as hiding, running, games involving their imagination (e.g., Dinosaur Island, Zombie Tag), activities involving sticks, and so on.

Contributions of the study to the field of early childhood education research

This study adds to a limited number of studies that have investigated authentic accounts of children's interest in nature. Student voice on their own education is an important aspect of inquiry-based learning and motivation. In my study, GPS technology was used as a less-invasive research tool to shed light on a students' interest in nature. GPS technology has predominantly been used with children in physical education research and not in interest-based research. In my study the findings support the conclusions from other studies regarding a child's interest in

nature and provides insight on children's interactions in the boreal forest in Yukon, Canada where research is limited.

Implications for Policy Makers

The findings in this study are valuable and relevant for policy makers associated with early childhood education and primary school education. For example, this study reveals the relationship between young children and nature in an outdoor context and the role the outdoors can play in children's development. Building curriculum around an existing area of fascination is an advantageous position for a school system as students will be more intrinsically motivated to engage. Access to natural spaces with abundant loose parts for early childhood education and primary school education should be prioritized to reflect the desire expressed by children to learn and play using these tools. Although many Yukon school grounds connect to some degree to the boreal forest, most are quite "tidy" with fixed play structures and lack natural artifacts and loose parts which would afford children with different types of creative and imaginative play. Based on the data from this study, school grounds should be re-populated with natural loose parts that reflect the natural elements of place.

The positive and strong child-nature alliance that was evident with all participants needs to be protected by policy makers as this special relationship is vulnerable to the emergence of biophobia. Biophobia infiltrates children's lives via mass media and literature portraying nature as being dangerous or dirty. These messages can have damaging effects on their special relationship with this learning environment. Hazards associated with the natural environment, such as cuts and scrapes or interactions with wildlife, need to be accepted in the same way as hazards associated with an indoor environment.

Implications for Educators

Educators often have a lot of creative freedom when it comes to program delivery and decision making; therefore, the findings from this study (e.g., students consistently and clearly expressing their interest in nature when given autonomy) make a strong case for embracing student autonomy outdoors as a tool to initiate authentic inquiry. I contend that educators should pay close attention to where students choose to go and what they choose to do when given autonomy in nature as these decisions reflect the students' authentic selves. Taking a step back as an educator to watch and take notes reduces your presence and gives you a chance to understand students' interests. Learning from exploratory sessions in nature could also enable teachers to be better equipped to extend the children's outdoor learning experiences into the classroom and provide literature related to genuine student interest. Essentially, these insightful excursions in nature become the seeds of deeper learning. Building learning on subject matter of high interest to students could also have positive effects on motivation and student agency.

Based on the findings from my study I believe that young students should be provided with opportunities to play and interact with natural loose parts. This is not a new understanding as loose parts have long been a prominent part of early childhood education; however, there appears to be something significant about natural loose parts when students are learning in nature that promotes the use of their imagination and peer interaction. A simple stick can become many different things to a child engaged in socially-constructed games with their peers.

Implications for Children

The findings in this study have important implications for children regardless of whether they find themselves in rural or urban environments. Based on the data from my study, consistent access to nature with some degree of autonomy will enable the child to voice their

authentic self. Therefore, I believe it is important to take the time to ask questions and listen to what children have to say about their experiences in nature. This study further reinforces the idea that children need to be provided with opportunities to express themselves in research which can include geo-spatial data, conversations, observations, and more. What children say and what they are interested in is not superficial or contrived. When provided with opportunities children can influence and shape their experiences, including the development of future curriculum. Ultimately, this study supports the voice of the child as an authentic and enduring voice that should not be disregarded or minimized.

Limitations

In this mixed-methods study, I collected primary data from young children in a northern Canadian forest setting across different seasons using geo-spatial technology. There were limitations to this type of data collection as it is difficult to completely remove the presence, and therefore the influence, of adults (e.g., teacher, educational assistants, and researcher) on participants due to supervision requirements. This point is made with the fact that a black bear appeared out of the forest and sat approximately 50 meters away during one of the sampling sessions. In addition to this, students would occasionally interact with an adult to show them something interesting they found such as an artifact of nature. Participants also needed to interact with their teacher for first aid due to occasional scrapes as described in the field notes.

Secondly, during the post-experience trip debrief, occasionally students would be noticeably influenced by the responses of students near them. A possible solution for this would be to conduct the interviews independently with each student away from the group.

I also wonder how much the chosen starting location for the sampling sessions influenced where students went and what they did. Was the landscape too diverse or not diverse enough? It

was a delicate balance trying to find a starting location that was sufficiently diverse and unaffected by humans, yet not too far of a walk from the school.

Another limitation was simply managing gear, namely the GPS units. If the units got too cold, they could experience battery failure. On a few occasions I needed to replace the batteries mid-session, and rarely, students would knock the GPS loose while playing vigorously in dense forest. They would then find me or a staff member for repair before re-entering their previous activity.

Leading up to data analysis it became evident that data reduction was necessary. This was necessary in order to paint a robust and clear picture for at least some of the participants. It was at this point I had to make the decision regarding which participants I would highlight in the findings chapter. I spent a great deal of time reading and re-reading their post-experience trip debrief data to scan for participants who most accurately represented the group's diversity. Some students preferred to explore slowly and on their own while other students would often stick with a friend for the sampling sessions. Some showed little in the way of a pattern from session to session, instead reacting to the environment or what their peers were doing next. Fortunately, for this study these students were predominantly guided by their senses, discoveries in nature, and by the seemingly spontaneous games they chose to play. A participant would run for 800 meters in a single session only to meander slowly for 400 meters looking for berries the next session. Not once did these students ask the teacher what to do next or claim to be bored.

Further Research

The following is a summary of considerations I have thought of regarding further research related to this study. Firstly, what would the results be if this study was repeated with both older and younger children? Do older students lose the ability to automatically engage in

nature in an authentic and exploratory way without direction? Are younger students more influenced by the presence of an adult? Secondly, what would the results look like if this study was conducted in an urban environment with children who have lived most of their lives in a large city? Would students be less or more fascinated by what they find? Would they act as independently? Finally, I have often wondered what we could learn if this type of study was conducted in a different natural area each time as opposed to returning to the same familiar starting point. Would students behave differently?

There is clearly more room to explore research topics relating to a child's interest in nature when given autonomy. As research methodologies evolve with advancements in technology, I contend that research will be able to capture increasingly more accurate accounts of genuine child interest and reduce speculation.

Conclusion

In this study I investigated children's interest in nature with a class of seven and eight-year-old students. Specifically, I addressed where students chose to go and what did they do when given autonomy in a diverse natural area. Based on the analysis, these questions have been answered with attention paid to authenticity. This study represents a model for collecting data relating to children's interests in a minimally invasive way while also using trusted methods for triangulation.

In this study the students' voices were heard and analyzed for meaning. Findings from this study were consistent to those in similar studies, further strengthening the understanding that nature holds an important and fascinating place in children's lives; the evidence is becoming too compelling to ignore.

This study was supported by experiential learning theory, sociocultural theory, and place-based theory. The findings were relevant to several aspects of each of these theories while also providing new insights that specifically focused on children's capacity to authentically engage in nature. Although the child-nature relationship has been largely overshadowed by a century or more of prescribed learning outcomes and heavily guided adult-centric interaction, this study shared insights on the important and special relationship children have with nature, particularly when given autonomy. Therefore, I argue that a more relevant and meaningful future for the child-nature relationship is one that focuses on the authentic voice and interests of the child.

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Appendices

Appendix 1: Quantitative data from sessions #3-7 captured by GPS unit.

Session #	Participant	Average Speed (km/h)	Distance Travelled (m)	Elapsed Time
3	Unit 1	1.2	740	0:38:09
3	Unit 2	1.4	833	0:35:17
3	Unit 3	1.0	569	0:33:51
3	Unit 4	0.7	421	0:36:27
3	Unit 5	1.3	688	0:32:48
3	Unit 6	1.3	713	0:32:03
3	Unit 8	1.8	1000	0:33:54
3	Unit 9	1.0	550	0:33:55
3	Unit 10	0.8	507	0:38:31
3	Unit 11	0.9	495	0:33:14
Session #	Participant	Average Speed (km/h)	Distance Travelled (m)	Elapsed Time
4	Unit 1	2.1	720	0:20:58
4	Unit 2	2.4	948	0:24:11
4	Unit 3	2.4	963	0:24:31
4	Unit 4	2.6	875	0:20:17
4	Unit 5	2.0	672	0:20:00
4	Unit 6	2.2	847	0:23:36
4	Unit 10	2.1	788	0:23:02
4	Unit 11	1.8	619	0:20:16
4	Unit 12	1.0	402	0:23:14
4	Unit 14	1.6	546	0:20:03

Session #	Participant	Average Speed (km/h)	Distance Travelled (m)	Elapsed Time
5	Unit 1	1.4	835	0:35:02
5	Unit 2	2.0	1100	0:33:28
5	Unit 3	0.6	336	0:31:24
5	Unit 4	1.1	631	0:33:50
5	Unit 5	1.4	790	0:33:21
5	Unit 6	1.3	741	0:33:54
5	Unit 8	2.1	1000	0:30:26
5	Unit 9	0.8	445	0:34:54
5	Unit 10	0.8	450	0:33:16
5	Unit 11	0.7	416	0:35:18
5	Unit 14	1.8	946	0:32:03
Session #	Participant	Average Speed (km/h)	Distance (m)	Elapsed Time

6	Unit 1	1.6	1000	0:39:22
6	Unit 2	1.5	983	0:40:30
6	Unit 3	0.8	506	0:36:23
6	Unit 4	1.5	1000	0:41:15
6	Unit 5	0.9	534	0:36:36
6	Unit 6	1.0	689	0:40:53
6	Unit 8	1.7	996	0:35:18
6	Unit 9	1.1	767	0:41:06
6	Unit 10	1.2	738	0:38:00
6	Unit 11	1.2	817	0:40:30
6	Unit 14	1.2	777	0:40:08
Session #	Participants	Average Speed (km/h)	Distance Travelled (m)	Elapsed Time
7	Unit 1	1.0	499	0:29:30
7	Unit 2	0.7	374	0:32:09
7	Unit 3	0.9	456	0:29:29
7	Unit 4	1.0	550	0:31:28
7	Unit 5	1.0	504	0:30:42
7	Unit 8	1.7	837	0:30:03
7	Unit 10	0.8	424	0:30:43
7	Unit 11	0.7	363	0:32:05
7	Unit 12	0.9	431	0:27:58

Appendix 2: Researcher field notes for session #3-7.

April 19, 2018	Session #3 • 1C moderate south wind, overcast, 15 cm of snow on ground • Using a different material for a GPS strap. Stretch-grip tape. • We heard a loud bang, like a gun shot on the walk to the site. Turned out to be an electrical transformer. • Significant amount of snow gone. • South facing slopes are bare. First session with visible bare ground • Students again ran right to the pond. • They found a beaver lodge now that some of the snow is gone • Crust of snow supported their weight along pond edge • Participant #9 hurt leg on a stick, crying. Teacher provided first aid • Collecting rocks and sticks • Participant #12 decided he wanted his GPS off. • Most students hanging out at the lodge • "Tracking a beaver" • "Researching animals" • Three digging with sticks in the dirt • Run and hide games
May 3, 2018	Session #4 • -3C, moderate south wind, overcast, almost all snow gone • First crocus flowers found • Students playing a zombie game. Most playing • Participant #9 is feeling sick • Pond is still frozen • Zombie game. Some are zombie healers and humans. If a zombie tags you, you turn into a zombie in 20 seconds. If a healer gets to you within that time you are saved. • Participant #11 hurt on a stick. Bleeding. Teacher administered first aid • Participant #3, 4 and 6 finding crocus flowers on the hillside. Excited to show teacher and other students
May 10, 2018	Session #5 • 10C, light south wind, sunny • Teacher away. Well known substitute teacher in place. • Participant #12 didn't want to wear a GPS • Pond is mostly ice free • 1 duck in pond (a buffle head) • Students circumnavigating the pond for the first time • Many watching the duck from the beaver lodge • Collecting rocks to show the teacher • Throwing sticks into the pond. Pretending a big log is the Titanic • Working together to push logs into the pond • Participants # 3, 4, and 11, together looking for bugs

	• Others playing Dinosaur Island • Students talking about the duck sitting next to the beaver lodge • Fascinated by the open water • Many have sticks digging around the pond edge • Participant 4 independently exploring the pond
May 22, 2018	Session #6 • 10C, moderate wind, sunny • Participant #12 and #11 choose not to wear a GPS • Four playing at pond edge • A lot of mud at the pond • Many mosquitos for the first time • Three boys hiding behind a stump • Many birds and birds singing • Students working together to push over stump • Students found a big pile of bear scat • Students started talking about bear awareness that they had been taught. They intentionally made more noise • Found kinnikinic berries • "Are they poisonous?" • Collecting them and looking inside • Boys playing with boys and girls with girls • Happy yelling and screaming • Throwing logs into pond • Playing patient/doctor • Participant #11 had a bag and was collecting things from the forest • Participant #3 fell into the pond! • Everyone ran to see • Other kids "I want to jump in!" • Participant #7 cold, arms in shirt, sitting on log • Participant #6 "I'm so thirsty" • Bear! All in. Black bear spotted just across the pond. Sitting, looking at us. Since it was near the end of the session we decided to head back now.
May 30, 2018	Session #7 • 15C, light south wind, warm and sunny • Participant #6 absent • Bear aware talk by teacher prior to departure because of last week's sighting • Fascination with pond and beaver lodge continues • Pretending logs are titanic ships • Pretending sticks are pencils • Students are not concerned about the bear we saw last week. No evidence of biophobia • They spent a lot of time jumping over a section of the pond edge • A beaver finally appears! It swam around, tail slapped, then dove • Students fascinated with the beaver

	• Still jumping, taking more risks each time • Participants #8 and #2 especially, others cheering on • Helping to pull each other up. Participant #8 lost shoe in pond! Fished it out with a stick • Participants #4 and #11 following beaver intently

Appendix 3: Focus participants # 3, 4, 5, & 10. Data relating to location in landscape (forest vs. barren ground).

Session # - Participant #	% Forest	% Barren	Speed (km/h)	Distance Travelled (m)
3-3	54	46	1	569
3-4	62	38	0.7	421
3-5	64	36	1.3	688
3-10	54	46	0.8	507
AVERAGE	58.5%	41.5%	0.95 km/h	546.25 m
4-3	57	43	2.4	963
4-4	57	43	2.6	875
4-5	67	33	2	672
4-10	56	44	2.1	788
AVERAGE	59.25%	40.75%	2.275 km/h	824.5 m
5-3	54	46	0.6	336
5-4	74	26	1.1	631
5-5	68	32	1.4	790
5-10	66	34	0.8	450
AVERAGE	65.5%	34.5%	0.975 km/h	551.75 m
6-3	84	16	0.8	506
6-4	66	34	1.5	1000
6-5	84	16	0.9	534
6-10	67	33	1.2	738
AVERAGE	75.25%	24.75%	1.1 km/h	694.5 m
7-3	66	34	0.9	456
7-4	70	30	1	550
7-5	68	32	1	504
7-10	64	36	0.8	424
AVERAGE	67%	33%	0.925 km/h	483.5 m
OVERALL AVERAGE	65.1%	34.9%	1.245 km/h	620.1 m

Appendix 4: Human Research Ethics Board Certificate of Approval.

University of Victoria | Office of Research Services | Human Research Ethics Board
Michael Williams Building Rm B202 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
T 250-472-4545 | F 250-721-8960 | uvic.ca/research | ethics@uvic.ca

Certificate of Approval

PRINCIPAL INVESTIGATOR	**ETHICS PROTOCOL NUMBER:** [redacted]
UVic STATUS:	Minimal Risk Review - Delegated
UVic DEPARTMENT:	ORIGINAL APPROVAL DATE: 27-Nov-17
SUPERVISOR:	APPROVED ON: 27-Nov-17
	APPROVAL EXPIRY DATE: 26-Nov-18

PROJECT TITLE **Authenticating Student Interest in Nature**

RESEARCH TEAM MEMBERS None

DECLARED PROJECT FUNDING: **None**

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

Associate Vice-President Research Operations

Certificate Issued On: 27-Nov-17

17-379 Jewell, Jesse

Appendix 5: Participant consent form.

University of Victoria

Participant Consent Form

Making Meaning of Student Affiliation with Nature

Dear Parent/Guardian,

Your child is invited to participate in a study that is being conducted by master's student, . I am enrolled in a Masters of Arts program at the University of Victoria. I am conducting research as part of my degree in Curriculum and Instruction. It is being conducted under the supervision of Dr. You may contact at) or .

Purpose and Objectives
My research attempts to gain a deeper understanding of Yukon primary students' affiliation with the natural environment by taking a closer look at what they value when immersed in this type of environment and by honouring their voice. Your child's experiences will be a sensory-based, student-led exploration of the natural environment. A GPS unit will be used to record information relating to your child's interest in the boreal forest.

Importance of this Research
The natural environment is an exciting and intriguing place for young students because they tend to perceive the natural world through their senses, whereas adults tend to perceive nature based on previous experiences and knowledge. Knowing this, primary education is well positioned to benefit from young students' curiosity-centered intellectual processes and exploratory way of learning.

This research is important because it seeks to gain a deeper, more authentic understanding of what young children value in nature. Honouring what children value in an educational context has new significance as Yukon's recently reformed curriculum places emphasis on student-centered learning practices.

Participant Selection
Your child's class is being asked to participate in this study because the class size is an appropriate size for this type of research. Additionally the school's location meets the requirements of the study due to an accessible forested area within short walking distance from the school.

What is involved?
There will be a total of 5 sampling sessions spread out over the course of the 2017/2018 school year. Each sampling session will last approximately 60 minutes and take place in a forested area adjacent to the school grounds.

Inconvenience
Participation in this study may cause some inconvenience to you, including preparing your child for an hour of outdoor learning. The school's cold weather cut off temperatures will be abided by for all sessions.

Risks
As with any experiences at school, including the classroom, there exist an element of risk. Yukon Educations Off-site Experiential Learning Trip Policy will be strictly abided by. For this research, the following risks have been identified:

- Trip and fall accidents. Mitigation: ensure students are wearing closed-toe shoes or boots. A first aid kit will be available.
- Frostbite. Mitigation: abide by Yukon Education's off-site learning trip policy. Ensure students are properly dressed before activity begins.
- Lost student. Mitigation: abide by Yukon Education's off-site learning trip policy pertaining to staff/student ratio and supervision method. Set recognizable boundaries and explain these to students. Equip each student with a whistle. Have a search protocol ready. Carry a communication device (sat phone or cell phone).

- Wildlife encounter. Mitigation: Trip leader will carry bear spray and bear bangers. Students will be educated with bear-aware material endorsed by Yukon Education.

Benefits
Given what is known about primary student learning and the outdoors, participating students stand to benefit from their involvement in this research. The activities that make up the study are connected to your child's science curriculum. Participating students are given an opportunity to express their interest in the boreal forest and their voice in this research is valued.

Voluntary Participation
Your child's participation in this research must be completely voluntary. If you do consent to your child's participation, you may withdraw at any time without any consequences. If you do withdraw from the study your child's data will be removed of all identifiers.

On-going Consent
To make sure that you and your child continue to consent to participate in this research I will request verbal assent (child's permission) at the beginning of each sessions.

Anonymity
In terms of protecting your child's anonymity the data collected during sampling will be connected to a pseudonym and a number, not your child's actual name. A pseudonym will also be utilized for the name of the school and teacher's name.

Confidentiality
Your child's confidentiality and the confidentiality of the data will be protected on a password-protected Government of Yukon computer.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the following ways; academic presentations; my master's thesis; news and/or media, and future analysis and research.

Disposal of Data
Data from this study that contains identifiers to student name, school name and teacher name will be disposed of. Paper will be shredded and digital data will be permanently deleted.

Contact
You may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this research project.

_____	_____	_____
Parent/Guardian Name	*Parent/Guardian Signature*	*Date*

_____
Name of Participant

Future Use of Data:

I consent to the use of my data in future research: _____ (Participant to provide initials)

I do not consent to the use of my data in future research: _____ (Participant to provide initials)

A copy of this consent will be left with you, and a copy will be taken by the researcher.