

Spring 5-13-2016

# How an Experience in Nature Affects Ecoliteracy of High School Students

Megan Johanna Schimek

*Hamline University*, [mschimek01@hamline.edu](mailto:mschimek01@hamline.edu)

Follow this and additional works at: [https://digitalcommons.hamline.edu/hse\\_all](https://digitalcommons.hamline.edu/hse_all)



Part of the [Education Commons](#)

---

## Recommended Citation

Schimek, Megan Johanna, "How an Experience in Nature Affects Ecoliteracy of High School Students" (2016). *School of Education Student Capstone Theses and Dissertations*. 4133.

[https://digitalcommons.hamline.edu/hse\\_all/4133](https://digitalcommons.hamline.edu/hse_all/4133)

This Thesis is brought to you for free and open access by the School of Education at DigitalCommons@Hamline. It has been accepted for inclusion in School of Education Student Capstone Theses and Dissertations by an authorized administrator of DigitalCommons@Hamline. For more information, please contact [digitalcommons@hamline.edu](mailto:digitalcommons@hamline.edu), [lterveer01@hamline.edu](mailto:lterveer01@hamline.edu).

HOW AN EXPERIENCE IN NATURE AFFECTS ECOLITERACY OF HIGH  
SCHOOL STUDENTS

by

Megan J. Schimek

A capstone submitted in partial fulfillment of the requirements for the degree of Masters  
of Arts in Education: Natural Science and Environmental Education

Hamline University

St. Paul, Minnesota

May 2016

Primary Advisor: Trish Harvey  
Secondary Advisor: Jennifer Rubin  
Peer Reviewer: Larissa Kabat

## ACKNOWLEDGEMENTS

I would like to express my great appreciation to my capstone committee. Your encouragement, support, discussions and guidance has made for a smooth journey. I cannot imagine completing this step of my educational journey without such a knowledgeable and enthusiastic team. It has been fun! Thank you!

I would also like to thank my students that participated in this capstone study. Their love for adventure and enthusiasm towards trying new things is contagious - even when it does involve spending an entire weekend in subzero temperatures. Adventure is out there!

Lastly, thank you to my family and closest friends for being my cheerleaders throughout the completion of my capstone. Although it was stressful at times, I appreciate your reminders and invitations to get out outside to build snowmen, walk in the woods, jump in puddles, search for shooting stars, skip rocks in the lake and climb trees! Life is good!

"When we try to pick out anything by itself,  
we find it hitched to everything else in the Universe."

-John Muir

**TABLE OF CONTENTS**

CHAPTER ONE: Introduction .....	5
Introduction .....	5
What is Next? .....	11
CHAPTER TWO: Literature Review .....	12
Introduction .....	12
Ecoliteracy .....	12
Ecoliteracy and Environmental Education .....	16
Demographics Affecting Ecoliteracy .....	20
Past Studies .....	23
Developing Ecoliteracy .....	27
Measuring and Assessing Ecoliteracy .....	32
Conclusion .....	34
What is Next? .....	35
CHAPTER THREE: Research Methods .....	36
Introduction .....	36
Research Paradigm and Methods .....	36
Demographics .....	37
Preparations .....	37
Action Plan .....	38
Timeline .....	39

Research Tools .....	40
Data Analysis .....	41
What is Next? .....	42
CHAPTER FOUR: Results .....	43
Introduction .....	43
Review of Data Collection Methods.....	43
Student Population Demographics .....	44
Ecoliteracy Assessment Data .....	45
Student Journal and Focus Group Interview Data .....	51
What is Next? .....	60
CHAPTER FIVE: Conclusions .....	62
Introduction .....	62
Major Learning .....	62
Review of Literature .....	63
Limitations .....	67
Implications .....	68
Further Research Directions .....	69
Communicating Results .....	70
Looking Ahead .....	71
REFERENCES .....	73
APPENDIX A: Assessment Tools.....	78
Student Survey .....	78

Pre- and Post-Assessment .....	80
APPENDIX B: Daily Journal Prompts .....	82
Day 1 .....	82
Day 2 .....	83
Day 3 .....	84
APPENDIX C: Focus Group Interview Questions .....	86

#### LIST OF TABLES

Table 1: Comparison of Pre- and PostTest Results .....	46
--	----

#### LIST OF FIGURES

Figure 1: Student population demographics .....	45
Figure 2: Pre- and posttest score comparison .....	46
Figure 3: Change in ecoliteracy scores .....	47
Figure 4: Grade differences in ecoliteracy .....	48
Figure 5: Gender differences in ecoliteracy .....	49
Figure 6: Ethnicity differences in ecoliteracy .....	50
Figure 7: First time participant vs. returning participant ecoliteracy scores.....	51

## CHAPTER ONE

### Introduction

#### Introduction

“Unless someone like you cares a whole awful lot, nothing is going to get better. It’s not” (as cited by Seuss, 1971, p. 58). These words, spoken by Dr. Seuss in *The Lorax*, serve as the foundation for my role as an educator. My past experiences, role models, and dedication to nature have contributed to me becoming a biology teacher. This role allows me to share my passions with new students each year.

In the interest of understanding more about the positive effects of nature on students’ well-being, I decided to research the following question: How does an experience in nature affect ecoliteracy of high school students?

In this chapter, I share my research question and its significance to me as a science teacher and also to the greater community. I provide background details from my childhood that eventually morphed into my passion for spending time in nature and the problems that our society is facing with having more screen time and less green time. I include my previous experiences with traveling to a residential environmental learning center located in northern Minnesota with high school students and the effects that it has on their appreciation for the natural world.

As I set out on my capstone journey, I am in search of finding out how an extended experience in nature affects ecoliteracy of high school students. The concept of ecological literacy was created in the 1990’s by David Orr, an American biologist, in response to the realization that our children will be charged to solve complex ecological

crises that have been created by past generations. “As it stands, many children know more about the plants and animals in faraway places, such as the rainforest, than they do about the nature in their own backyards” (as cited in Rhines, 2012, para. 2). We hear about global environmental problems on a regular basis, but are blind to catastrophes in our own communities, such as chemical spills, fish kills and declining bee populations.

Growing up, I was an avid reader of *Ranger Rick* (National Wildlife Federation, n.d.) and was found playing outside every chance I had whether it was making trails and tree forts in the woods, catching frogs and fireflies, skipping stones in lakes and rivers, or searching for shooting stars in the night sky. I grew up in the country and one summer, spent time with the neighbor kids and my older sisters making what we called “Camp June Bug.” We turned an unused wooded area into an ultimate nature oasis. We spent days making stick shelters, survival kits, no trespassing signs (for adults of course), a fire ring and hiking trails. We spent many nights making s’mores at the campfire, camping under the stars, climbing the trees and sharing top secrets with one another.

My parents helped foster my love for nature by always encouraging me to get involved in the things that I loved. I was able to participate in summer camps at Quarry Hill Nature Center in Rochester, MN all through my elementary years, attend a week long Wild Turkey camp at Eagle Bluff Environmental Learning Center in Lanesboro, Minnesota, and was able to travel to Belize in high school to experience the rainforest, marine ecosystems and a new culture all at the same time. My dad even got me to go deer hunting... I shot a deer and have never cried so hard in my life. Needless to say, I have



not gone hunting again. However, I still love nature and the beauty and recreational opportunities that it provides.

It is experiences like these that have fostered my love and appreciation for the environment and its resources. Unfortunately, we now live in an age that is defined by stranger danger and dwindling open spaces (Edgar, 2008, para.1). Children interact more with screens than with natural places (Sobel, n.d.). As a high school teacher, when I walk through the school hallways, I see very little interaction between students. Instead, each of them is more connected to the electronic device that they hold in their hand.

The need to connect with other life forms is innate, whether this life is a pet, a garden, or a forest, for example. Spending time in the outdoors is healthy for our physical, mental and emotional well-being. Edward O. Wilson, named this affinity for other life “biophilia” (Kellert and Wilson, 1993). Unfortunately, today many students connect nature with fear, which has become known as “ecophobia,” or “a fear of ecological problems and the natural world” (Sobel, n.d., para. 7 ). These fears could be from early exposure to devastations and gloom or negativity, such as species extinction, ocean trash gyres, rainforest destruction, global warming, acid rain, ozone depletion, lyme disease, and the list goes on and on. Some have a fear of simply going outside.

This fear needs to be addressed and the answer to overcoming this fear is simple. Sobel (n.d.), author of *Beyond Ecophobia: Reclaiming the Heart in Nature Education*, suggested that “we can cure the malaise of ecophobia with ecophilia, or supporting children’s biological tendency to bond with the natural world” (p. 2). Sobel (1998) stated that most environmentalists that were surveyed attributed their commitment to a

combination of two sources: “many hours spent outdoors in a keenly remembered wild or semi-wild place in childhood or adolescence, and an adult who taught respect for nature” (para. 8). Not one of the environmentalists explained his or her dedication as a reaction against exposure to an ugly environment. “What a simple solution. No rainforest curriculum, no environmental action, just opportunities to be in the natural world with modeling by a responsible adult” (Sobel, 1998, para. 9).

In an interview that Henley (2010) had with Richard Louv, author of *Last Child in the Woods*, Louv stated:

Plus, who's going to be bothered looking after the planet if there's no one left with any understanding of, interest in or connection to their natural environment? What we're doing instead is instilling in kids a kind of ecophobia. We're overloading them with scenarios of fear and disaster – worry about the 'environment' is crushing kids' relationship with nature. (para. 14)

In order to have respect and appreciation for the natural world in which we live, children need to be provided with opportunities to make personal connections with it. I feel that these experiences and memories will contribute to greater appreciation and knowledge, and will then promote more positive attitudes and behaviors towards protecting the environment. Rachel Carson, an environmental activist and conservationist, commented that:

I sincerely believe that for the child, and for the parent seeking to guide him, it is not half so important to know as to feel. If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are

the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil. Once the emotions have been aroused — a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration or love — then we wish for knowledge about the subject of our emotional response. Once found, it has lasting meaning. It is more important to pave the way for the child to want to know than to put him on a diet of facts he is not ready to assimilate. (Carson, 2011, p. 19)

When I first started teaching Advanced Placement (AP) Environmental Science in 2010, I was inspired to get my students outside so they could experience nature and the environment first-hand versus only reading about it in a book. In addition to creating an outdoor classroom that included a natural wooded area and a small pond that was used for hands on labs and investigations, I was approved to take my students, along with members of our Roots and Shoots environmental club to Wolf Ridge Environmental Learning Center in Finland, Minnesota. Wolf Ridge's mission is "to develop a citizenry that has the knowledge, skills, motivation and commitment to work together for a quality environment" (Wolf Ridge, 2015, para. 4). This is accomplished by,

- 1.) fostering awareness, curiosity and sensitivity to the natural world, 2.) providing lifelong learning experiences in nature, 3.) developing social understanding, respect and cooperation, 4.) modeling values, behaviors and technologies which lead to a sustainable lifestyle, and 5.) promoting the concepts of conservation and stewardship (Wolf Ridge, 2015, para. 4).

Wolf Ridge is a place where minds open to the joy and wonder of discovery of our natural world. Students are involved in direct observation and participation in outdoor activities, which stimulates an understanding of and often love towards nature.

Throughout each of the classes that they teach, self-awareness and leadership development is also promoted.

On my first trip to Wolf Ridge in 2010, we spent three frigid days in February learning about that Great Lakes, winter survival, wildlife management, orienteering, renewable energy, and conquering a ropes course challenge and rock climbing wall. Evenings were spent around the campfire, roasting marshmallows and reflecting upon each day.

I have taken groups of students back to Wolf Ridge three more times since our first field-trip. I have seen firsthand how an extended experience in the outdoors changes students, through their maturation of their appreciation for the environment as well as for themselves and others who shared in the experience. Being able to observe students walk on a frozen lake for the first time, build a fire without the use of matches and gasoline, and cheer each other on as they attempt to cross a single wire on the ropes course challenge are experiences that I would not trade for anything. These experiences are immeasurable and everlasting. These experiences contribute to ecoliteracy.

Becoming an ecologically literate individual can be as simple as making observations and learning about the nature, and one's connections to it, in our backyards. Ecoliterate individuals notice patterns and systems within nature, how people affect those

patterns and systems, and how we can use the system's resources that nature provides in a sustainable way.

As an educator, it is my responsibility to provide my students with opportunities to make connections with the natural world. It is these connections that will provide relevance, and will in turn nurture a caring for and commitment to their environment.

### **What is Next?**

The review of literature in Chapter Two provides information on studies that have been conducted on ecoliteracy of high school students. Specifically, I researched the methods for assessing ecoliteracy, as well as how ecoliteracy can be taught in both formal and informal settings. An additional component identifies the correlation between time in nature and how it affects ecoliteracy in all age groups. This background research has helped formulate my research approach to understand how an experience in nature affects ecoliteracy of high school students.

## **CHAPTER TWO**

### **Literature Review**

#### **Introduction**

Ecological literacy is the understanding of the principles of organization that ecosystems have evolved to sustain the web of life, and is the first step on the road to sustainability. (Capra, 1996, p. 297). According to McGinn (2014), “knowledge alone is not enough to constitute ecological literacy” (p. 5). Knowledge is influenced by hand’s on experiences and must be fused with behavior and a feeling of connectedness to nature. The focus of this capstone project will be on the question: How does an extended experience in nature affect the ecoliteracy of high school students?

This chapter focuses on the development of the concept of ecoliteracy and its connections to environmental education. The effect of various school and student attributes on ecoliteracy is explored in the demographics section and the conclusions of several previously conducted studies are presented, followed by a section on how skills in ecological literacy can be developed. The last section of this literature review investigates the ways in which ecoliteracy is measured and assessed.

#### **Ecoliteracy**

“When students begin to understand the intricate interplay of relationships that sustain an ecosystem, they can better appreciate the implications for survival that even a small disturbance may have, or the importance of strengthening relationships that help a system respond to disturbances” (Goleman, Bennett & Barlow, para. 27). David Orr first identified the concept of ecological literacy in response to the acknowledgement that our

children would be challenged to solve complex ecological crises that have been created by past generations.

According to Orr, “an ecologically literate person should have a basic understanding of ecology and sustainability in addition to the desire and tools to solve environmental problems” (as cited by McGinn, 2014, p. 4).

Sustainability is a qualitative and quantitative condition; demonstrating the human capacity to survive over time. It is qualitative in that we want wellbeing as well as survival and wellbeing is hard to measure. But it is also quantitative in that natural capital and ecological carrying capacity can now be measured with foot-printing tools (EcoLabs, 2014, para. 3).

McGinn (2014) analyzed a study that was conducted by McBride in 2011 entitled, *Essential Elements of Ecological Literacy and the Pathways to Achieve it: Perspectives of Ecologists* which gathered the perspectives of over 1,000 ecologists and other environmental scientists on ecological literacy. Six common dimensions were found and discussed that underlie the participants perceptions of ecological literacy. These dimensions include cycles and webs, ecosystem services, negative human impacts, critical thinking and applications, the nature of ecological science, and biogeography (McGinn, 2014, p. 4). Cherrett (1989) studied the misconceptions that students had relating to environmental education and concluded that an ecologically literate person should have an understanding of imperative ecological concepts such as ecosystem succession, energy flow, materials cycling, ecological adaptation, food webs, carrying capacity, and species diversity (as cited by McGinn, 2014, p. 5). Bruyere (2008) analyzed

the definitions for ecological literacy and identified common themes exist between each of them. Three similarities present in many of the standing definitions are knowledge, affect, and behavior. McGinn (2014) noted that “these three components of knowledge, affect and behavior must blend in order to make an ecologically literate person” (p. 5).

“Throughout evolutionary history, humans have possessed an innate need to affiliate with other forms of life” (Rogers, n.d., para.1). Edward O. Wilson described this affiliation as *biophilia*, a term that literally means “love of life” (as cited in Nova, 2008, para. 1). Rogers (n.d.) described her interpretation of the human relationship with nature in the following passage:

Anecdotal and qualitative evidence suggests that humans are innately attracted to nature. For example, the appearance of the natural world, with its rich diversity of shapes, colours, and life, is universally appreciated. This appreciation is often invoked as evidence of biophilia. The symbolic use of nature in human language, in idioms such as “blind as a bat” and “eager beaver,” and the pervasiveness of spiritual reverence for animals and nature in human cultures worldwide are other sources of evidence for biophilia. (para. 2)

Additionally, Nisbet, Zelenski and Murphy (2009) have pointed out that evidence of this biophilia can be observed by the popularity of outdoor wilderness activities, zoos and gardening, and by our relationship with animals and fondness for natural scenery. There are also well-documented health benefits associated with the natural environment, some of which include decreased stress levels and reduced symptoms of depression and



anxiety (Nisbet, Zelenski, & Murphy, 2009, p. 717). Rosen (2013) shared this advice in his article, *Rx Nature*:

Imagine a treatment that would improve your mood, make you smarter, keep you healthier and improve your relationships. How much would you invest in that therapy? It turns out there is such a thing, and best of all, it's free. It's called "nature." (para. 2)

Unfortunately, according to Sobel (n.d.), today many students connect nature with fear, which has become known as "ecophobia," a fear of ecological problems and the natural world (para. 7). These fears could be from species extinction, ocean trash gyres,, rainforest destruction, global warming, acid rain, ozone depletion, lyme disease, and the list goes on and on. The worst fear of all? Just being outside!

The answer to reversing this fear is simple. Sobel (n.d.) suggested that "we can cure the malaise of ecophobia with ecophilia, or supporting children's biological tendency to bond with the natural world" (para. 7). Sobel (n.d.) stated that most environmentalists attributed their commitment to a combination of two sources: "many hours spent outdoors in a keenly remembered wild or semi-wild place in childhood or adolescence, and an adult who taught respect for nature" (para. 8). Not one of the conservationists surveyed explained his or her dedication as a reaction against exposure to an ugly environment. "What a simple solution. No rainforest curriculum, no environmental action, just opportunities to be in the natural world with modeling by a responsible adult" (para. 9).

Sobel (n.d.) wrote “if we want children to flourish, to become truly empowered, then let us allow them to love the Earth before we ask them to save it. Perhaps this is what Thoreau had in mind when he said, “the more slowly trees grow at first, the sounder they are at the core, and I think that the same is true of human beings” (para. 45 ).

In order to have respect and appreciation for the natural world in which we live, children need to be provided with opportunities to make personal connections with it. I feel that these experiences and memories will contribute to greater appreciation and knowledge, and will then promote more positive attitudes and behaviors towards protecting the environment.

### **Ecoliteracy and Environmental Education**

In 1944, noted conservationist Aldo Leopold wrote, “Acts of conservation without the requisite desires and skill are futile. To create these desires and skills, and the community motive, is the task of education” (as cited in Coyle, 2005, p. 1). This education cannot solely happen within the walls of a school building. Rather, skills and concepts may be taught in a classroom, but students need to have the opportunity to practice and apply those skills and concepts in a natural setting to effectively learn and adopt a conservation perspective.

In October, 1977, the world’s first intergovernmental conference on environmental education was organized by the United Nations Education, Scientific, and Cultural Organization (UNESCO) (UNESCO, 1977). The Tbilisi Declaration was adopted at the close of the conference, demonstrating the important role of environmental education in the preservation and improvement of the world’s environment. The Tbilisi

Declaration “constitutes the framework, principles, and guidelines for environmental education at all levels local, national, regional, and international – and for all age groups both inside and outside the formal school system” (UNESCO, 1977, para. 4).

The Tbilisi Declaration identified the goals of environmental education:

1. To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas;
2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;
3. To create new patterns of behavior of individuals, groups and society as a whole towards the environment (para. 6).

The categories of environmental education objectives as outlined in the Tbilisi Declaration are:

*Awareness* – to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

*Knowledge* – to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

*Attitudes* – to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

*Skills* – to help social groups and individuals acquire skills for identifying and solving environmental problems.

*Participation* – to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems (UNESCO, 1977, para. 7.)

These contributions that have been made by the Tbilisi Declaration have laid a solid foundation on which educators, schools and environmental learning centers can build a strong foundation that promotes ecoliteracy in student populations.

Morrone, Mancl and Carr (2001) analyzed the work of a Hungerford and Volk (1990) that focused on using environmental education curricula to raise environmental literacy by encompassing knowledge that goes beyond an understanding of the environment. They suggested that environmental education curricula should consist of four goal levels, which were designed to produce citizens that were environmentally literate. Morrone, Mancl and Carr (2001) identified these goals as:

Level I: Focusing on building ecological foundations in areas such as interaction and interdependence, energy flow and material cycling, and ecosystem succession.

Level II: Curricula will help students understand how humans perceive and value the environment.

Level III: The investigative and evaluative curricula, develops students' ability to investigate environmental issues and develop alternative solutions to environmental problems.

Level IV: Teach students skills needed to take necessary environmental action. (p. 34)

Hungerford and Volk (1990) suggested that traditional thinking in the field of environmental education was that one can change behavior by making human beings more knowledgeable about the environment and its associated issues. Morrone, Mancl and Carr (2001) argued that “knowledge alone is not enough; developers of environmental education curricula should focus on helping citizens increase knowledge, expanding awareness, and develop skills, which will allow them to participate in solving environmental problems” (p. 3). They also pointed out that research suggests that teachers are not focusing on Level I goals; rather, they are emphasizing values and attitudes – or Level II goals – in their attempts to promote environmentally responsible behaviors, before teaching the foundational concepts and connections.

Orr (1992) also argued that teachers are failing to develop literacy by not integrating ecological concepts into other subjects. Orr believed that at every level of learning, kindergarten through postgraduate education, part of the curricula should be dedicated to the study of natural systems roughly in the manner in which we experience them. Orr (1992) suggested that:

The idea is simply that we take our senses seriously throughout education at all levels and that doing so requires immersion in particular components of the natural world – a river, a mountain, a farm, a wetland, a forest, a particular animal, a lake, and island – before introducing students to more advanced levels of disciplinary knowledge (as cited by Stone, 2015, para. 4).

The Center for Ecoliteracy runs on a guiding principle that, “the real world is the optimal learning environment” (Stone, 2015, para. 2). Louv (2005) argued that “time in

nature is not leisure time, it's an essential investment in our children's health" (p. 120). According to Stone (2015), "encountering nature in its complexity with wholeness can also help integrate teaching across disciplines and between grades – an antidote to the fragmentation and narrowing that often results from standardized testing and state mandates" (para 11). He also stated that "nature, after all, does not do science at 9:00, social studies at 10:00, and math at 11:00" (Stone, 2015, para. 13).

The foundation of this capstone project will link ecoliteracy and environmental education with a direct focus on time in nature and student's interactions with the environment and its systems. Students will have to opportunity to learn by doing and experiencing nature first hand, and thus, should increase their knowledge, attitudes, awareness, and hopefully appreciation of the natural world.

### **Demographics Affecting Ecoliteracy**

Developing ecoliteracy in children and adolescents is critical to addressing and creating solutions to meeting current and emerging environmental challenges, both locally and worldwide. There are various factors and impacts that shape personal ecological knowledge, attitudes and behaviors. Demographic analysis examines how student and school attributes affect ecoliteracy, specifically school, age, gender, ethnicity, background and experience in nature.

In Stevenson et al.'s (2013) study of *Environmental, Institutional, and Demographic Predictors of Environmental Literacy among Middle School Children*, 739 students (grades six and eight) were given the Middle School Environmental Literacy Survey (MSELS) at the start and end of science classes. The MSELS consists of eight

sections that contribute to an overall environmental literacy score. The survey itself assesses four components of environmental literacy: Knowledge, Affect, Cognitive Skills, and Behavior.

The Stevenson et al. (2013) study on school attributes found the following:

The type of school that students attended was related to some areas of environmental literacy. In the pretest, schools with a higher student/teacher ratio were behind in knowledge, Title I schools were behind in behavior towards the environment, and charter and private schools outperformed public schools in behavior. None of these school attributes were significantly related to the change in environmental literacy over the semester. Urban and rural school performed on the pretest, although students in urban schools improved more slowly than those in rural schools over the semester in Cognitive Skills. Overall, school attributes had the weakest relationships with environmental literacy. (p. 6)

Stevenson et al. (2013) found school characteristics were related to environmental literacy in somewhat expected ways. “Lower socio-economic status is generally associated with lower academic achievement, but we did not detect this relationship for any dimension of environmental literacy except Behavior” (p. 9). They also noted that income has generally been positively associated with environmental behavior.

Stevenson et al. (2013) study also revealed that student attributes have strong relationships with environmental literacy. It was noted that:

Older students tend to wane their interest in science and math in the middle school years, which could also explain the slower rate of environmental literacy

improvement among eighth graders. These findings suggest middle school grades may include an age tipping point where environmental education efforts start becoming less effective in promoting environmental literacy. (Stevenson et al., 2013, p. 9)

Stevenson et al. (2013) advocated it is not that older students cannot benefit from these efforts, but rather younger students may have the greatest capacity for learning. In 2010, the University of Iceland conducted an evaluation to assess the ecological literacy of their faculty, staff and students to collect baseline data to form a sustainability policy. An online survey was distributed to everyone with a valid University of Iceland email account. The survey contained five sections: demographics, environmental attitudes, sustainable behaviors, environmental values, and visions for the university (Davidson, 2010). The trends of this study indicated that the older the participant, the better they did on the survey.

In the Stevenson et al. (2013) study, it was noted that gender was related to environmental literacy in complex ways. Although girls underperformed boys in the pretest for knowledge, they outperformed them in affect and cognitive skills and improved faster in knowledge over the course of the semester. This gap in the pretest is supported by similar gender trends in science. Stevenson et al. (2013) pointed out that girls do often underperform boys in the sciences, but also that numerous studies have shown that women and girls hold more positive environmental attitudes and greater levels of concern for the environment.



Stevenson et al. (2013) urged that it is possible that achievement gaps in ecoliteracy are rooted in the same causes as those in other academic areas, such as differences in cultural perception of the outdoors and access to natural areas. Stevenson et al. (2013) suggested:

Minority groups experience more constraints to natural area access and can be culturally excluded from outdoor recreation. In considering outdoor recreation, safety is of particular concern to some minority groups, including blacks and Hispanics, which may lead to minority children spending less time outdoors than their white counterparts. (p. 7)

According to Stevenson et al. (2013), “time outdoors is one of the only factors that significantly impacts Knowledge, Affect and Behavior” (p. 7). Accordingly, life experiences were less important than small class sizes and challenges associated with lower incomes in schools (Stevenson, 2014).

In each of the studies that were analyzed, one common trend that reoccurred is the importance of identifying how demographics affect the results that are obtained. This capstone will take into account gender, age and ethnic differences and compare them with how ecoliteracy is affected by an extended experience in nature.

### **Past Studies**

Several previous studies have been conducted which investigate and assess the ecological literacy of students at varying ages and in various settings. Many of the studies that were reviewed in this chapter involved middle school students, college level

students, and adults. Little research has been found that specifically assessed the ecological literacy of high school students.

In 2005, Kevin Coyle, former president of The National Environmental Education & Training Foundation, released the results of a ten year study titled, “*Environmental Literacy in America.*” The study, which was carried out by the National Science Foundation’s Advisory Committee for Environmental Research and Education, was conducted due to the growing awareness that “in the coming decades, the public will more frequently be called upon to understand complex environmental issues, assess risk, evaluate proposed environmental plans and understand how individual decisions affect the environment at local and global scales” (Coyle, 2005, p. i). Coyle (2005) offered an explanation of the results of the report:

This summary provides a loud wake-up call to the environmental education community, to community leaders, and to influential specialists ranging from physicians to weathercasters. At a time when Americans are confronted with increasingly challenging environmental choices, we learn that our citizenry is by and large both uninformed and misinformed. (p. i)

Coyle’s (2005) results indicated that “most Americans believe they know more about the environment than they actually do” (as cited by McGinn, 2014, p. 7). This is also true for adults living in Minnesota. In Murphy’s (2002) *The Minnesota Report Card on Environmental Literacy: A Benchmark Survey of Adult Environmental Knowledge, Attitudes and Behavior*, it was found that 65% of Minnesota adults believe that they are knowledgeable about environmental issues and problems, yet only 36% of the state’s

adults have an above-average knowledge about the environment (p. 6). Coyle's (2005) study also found that awareness of environmental issues is high, and the American public is supportive of environmental education. In assessing correlations between knowledge and behavior, the study found that:

Environmental knowledge correlates significantly with sustainable behaviors. However, knowledge does not correlate with sustainable behaviors that require greater changes in behavior, and it does not correlate with lasting environmental stewardship meaning that that people do not fully incorporate environmental impacts into their day-to-day decision making in the short and long term. (as cited by McGinn, 2014, p. 7)

In McGinn's (2014) analysis of the Coyle (2005) study, she provides recommendations that include spreading environmental education to professionals, developing curricula for educational institutions aside from schools; and improving online environmental education dissemination and tools (p. 7).

Another study, conducted by Bruyere (2008), studied *The Effect of Environmental Education on the Ecological Literacy of First-Year College Students*. This study focused on identifying how sustainable behaviors are influenced by knowledge of environmental systems and issues. In the study, freshmen at Colorado State University were provided with pre- and post-assessments before and after two environmental education lessons. Bruyere (2008) found that "as individuals learn about ecological principles, biological cycles, and environmental systems, their environmental attitudes become more favorable

and many of their environmental behaviors become more frequent” (as cited by McGinn, 2014, p. 8).

Stern, Powell and Ardoin’s (2008) study of *What Difference Does It Make? Assessing Outcomes From Participation in a Residential Environmental Education Program* analyzed the short- and long-term impacts of participation in three and five day residential environmental education programs. In the study, they surveyed 300 students during the 2006-2007 academic year. They measured items on a 5-point Likert type scale and evaluated four indices: connection with nature, environmental stewardship, interest in learning and discovery, and knowledge and awareness of biological diversity. They found that the residential environmental education experience appeared to achieve short-term success in all of the measured outcomes. Analysis of a 3-month follow-up survey revealed that:

Increases in students’ commitments to environmental stewardship, their knowledge and awareness of the natural environment, and biological diversity remained significant. However, increases in students’ interest in learning and discovery and their connection with nature faded over time. (p. 40)

They also noted that 5-day programs and greater active engagement of visiting teachers onsite proved to be more successful in effecting desired outcomes than did the 3-day programs. The results suggested that longer program efforts may enhance the long-term outcomes of residential environmental education programs. Additionally, Smith-Sebasto and Cavern (2006) found that students exposed to both pre-visit and post-visit activities supporting a residential environmental education experience in New

Jersey showed more positive environmental attitudes. However, pre-visit experiences alone had no significant effect on outcomes without the follow-up experience; the reverse was also found (as cited by Stern, Powell, & Ardoin, 2008, p. 33). It is important that pre- and post- visit activities are implemented to provide students with the greatest learning advantage.

It is clear that there is an increasing need to promote opportunities that increase ecoliteracy in the general population. It seems that more cuts to public education are being made each year, and field trips are one of the first items eliminated. The intent of this study is to gather data on the effect that field experiences a residential environmental learning center has on ecoliteracy of high school students.

### **Developing Ecoliteracy**

In McBride's (2011) study, *Essential Elements of Ecological Literacy and the Pathways to Achieve It: Perspectives of Ecologists*, the ecologists interviewed and surveyed five means through which ecological literacy can be achieved. These include (1) education by mass media, (2) formal education, (3) financial incentives, (4) participatory/interactive education, and (5) communication and outreach by scientists.

McBride (2011) pointed out that the "primary source of general news and information about science and technology in the United States is television and the internet is the source that Americans are most likely to turn to for additional information about a specific science-related topic" (p. 167). McBride (2011) argued that efforts to promote ecological literacy must take advantage of these resources as they "serve as important information contexts that can alter and/or reinforce the views of their

respective audiences” (p. 167). McGinn (2014) urged that “wide reaching media does not create an ecologically literate person, but it has the power to expose people to ecological concepts who would not otherwise receive this initial exposure” (p. 10). In order for mass media to be effective in promoting ecological literacy, McBride (2011) stated that:

...ecologists would be required to collaborate with social researchers, communication and media professionals who can help scientists to incorporate new conceptual and practical tools and approaches for public engagement into their outreach activities, and to put an effective model of public engagement into practice. (p. 167)

Mass media is a powerful tool and has the potential to increase awareness and knowledge of environmental concepts and issues. Unfortunately for some, media may be the only exposure to nature that they ever get. To others, what they see or hear on the news could serve as a spark to seek out further information.

McBride (2011) identified the second factor for achieving ecological literacy as formal education, with respect to conventional classroom lectures, curricula and coursework across grade levels. To be effective, McBride (2011) pointed out that “efforts to promote and assess ecological literacy must be commensurate with expectations of what the literate individual should know and be able to do” (p. 168). It is argued that simply incorporating ecological knowledge into traditional curriculum is not enough to increasing students’ ecological literacy. Ecological literacy not only requires knowledge of concepts, but the acquisition of skills that students can use to make informed decisions.

Curricula that promote ecological literacy need to have well-defined learning outcomes stating what students should be able to know and do at any given grade level, coupled with appropriate tools for assessment (McBride, 2011). McBride (2011) noted that discussions about curriculum revisions for ecological literacy should focus on questions concerning

1. The types of linkages that exist or should exist between concepts and competencies
2. The best time to introduce specific competencies
3. Ways of increasing the depth and sophistication of the competencies
4. Ways of supporting the integrated development of student competencies throughout academic curriculum. (p. 171)

In addition, the usefulness of any proposed curricula depends on its potential to meet the local needs and resources of diverse formal and informal settings. McBride (2011) stressed that students need to be provided with concrete and relevant topics of investigations and experiential learning that focus on their local environments to which they can directly relate and make connections.

The third factor that McBride (2011) identified as a means to achieving ecological literacy is financial incentives. For example, “when a person is rewarded financially for adopting actions that positively impact the environment, this incentivizes good behavior despite a person’s reason for taking that action” (McGinn, 2014, p. 11).

The ecologists in McBride’s (2011) study identified “government remuneration for “green” activities and/or penalty for “non-green” activities as a potential towards

ecological literacy” (p. 171). McBride (2011) introduced the mechanism of *cognitive dissonance*, which develops when a person holds two contradictory beliefs at the same time. With this mechanism, it is believed that if incentives are used to induce behavior, attitudes will follow. “With respect to environmental literacy, providing financial incentives for pro-environmental behaviors, such as recycling, may link with and reinforce positive attitudes towards resource conservation and reuse” (McBride, 2011, p. 172).

The fourth pathway to ecological literacy as identified by McBride (2011) is participatory/interactive education, which is expressed in terms of “experiential, inquiry-based, and/or applied learning experiences for students in general, including inquiries, labs, field trips and visits to museums and nature centers” (p. 172). The respondents of the survey collectively agreed that individuals need to learn ecology by doing ecology. McBride (2011) stressed that teaching strategies for promoting ecological literacy must engage students in activities that allow them to do ecology themselves, which reflects a constructivist view of learners and learning (p. 172). This constructionist theory, according to McBride (2011) is:

...based on the knowledge that is “constructed” by learners as they attempt to make sense of their experience; that is, learners are not empty vessels waiting to be filled, but rather are active organisms seeking meaning who construct their own knowledge by integrating new knowledge into what they already know. (p. 172)



As Louv (2005) pointed out, the current generation is the first that spends more time with technology than with nature. Louv declared that most children in the United States today are suffering from “nature-deficit disorder,” which is characterized by a wide range of behavioral problems, depression, anxiety, attention disorders, diminished use of senses, and more. In the introduction to his book, *Last Child in the Woods*, Louv (2005) wrote,

Reducing that deficit—healing the broken bond between our young and nature—is in our self-interest, not only because aesthetics or justice demands it, but also because our mental, physical, and spiritual health depends upon it. The health of the earth is at stake as well. How the young respond to nature, and how they raise their own children, will shape the configurations and conditions of our cities, homes—our daily lives. (p. 3)

Scholars such as Coyle (2005) and Louv (2005) suggested that participatory/interactive education, such as mapping their school and its surrounding community, will yield more ecologically literate people than work inside of structured institutions alone. Residential environmental education programs offer opportunities for students to explore the environment first hand, experience adventure-based challenges, and develop stewardship skills in active outdoor settings. This direct contact with the natural world allows students to develop an in-depth understanding of the fundamental ecological principles, which can be integrated back into classroom lessons. Stern, Powell and Ardoin (2008) stated that “these programs are typically geared to enhancing environmental attitudes, increasing environmental knowledge and literacy, promoting

citizenship skills, and encouraging stewardship behaviors that not only take place on site but also continue once the students return to their home communities” (p. 32). “These programs additionally offer opportunities for personal growth by encouraging teamwork, collaboration, and the development of leadership skills, which serve participating students well in their academic and professional futures” (p. 32).

McBride (2011) identified the fifth and final pathway to ecological literacy to be communication and outreach by scientists, which is expressed in terms of debate, discussion, translation, and collaboration among scientists and other professionals (p. 174). McGinn (2014) added that “individuals become more connected when they can learn directly from an authority that conducts research versus reading information from a book or news article” (p. 12). It is also suggested that “scientists should more effectively communicate their science, and workshops on communicating for ecologists would bolster the effectiveness of communicating” (McGinn, 2014, p. 12).

Achieving ecological literacy is not impossible, but it does not happen without the collaboration and communication of media, scientists, governments, educators and students at all grade levels and in both formal and informal settings. Having an ecologically literate population means having a population that will be able to make informed decisions and take actions to solve the world’s environmental issues.

### **Measuring and Assessing Ecoliteracy**

Numerous attempts have been made to measure levels of environmental literacy, ecological literacy and ecoliteracy. According to Morrone, Mancl, and Carr (2001), “applied studies mainly involve developing and implementing survey instruments to test

how much responders know about the environment, how people value the environment, knowledge of environmentally responsible behaviors, and participation in those behaviors” (p. 35).

Many instruments attempt to measure one or more elements of environmental literacy. These instruments use multiple choice questions as one test of knowledge levels. Attitudes, values, and behavior are generally measured by using Likert-type scales and ranking (Morrone, Mancl & Carr, 2011, p. 36.)

Nisbet, Zelenski and Murphy (2009) have constructed the Nature Relatedness (NR) Scale to describe individual levels of connectedness to the natural world. “The concept of nature relatedness encompasses one’s appreciation for and the understanding of our interconnectedness with all other living things on the planet” (p. 178). Nature relatedness focuses much more on just activism, separating it from environmentalism. Nisbet, Zelenski and Murphy (2009) pointed out that:

It is not simply a love of nature or enjoyment of only the superficially pleasing facets of nature, such as sunsets and snowflakes. It is also an understanding of the importance of all aspects of nature, even those that are not aesthetically appealing to humans (e.g. spiders and snakes). (p. 718)

Other models for evaluating ecoliteracy do exist, but most simply do not cover the realm that the Nature Relatedness Scale does. For example, the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000) “captures views about how humans interact with nature but lacks an emotional or personal aspect and does not explore how people feel about actually being in nature” (Nisbet, Zelenski & Murphy, 2009, p. 718).

The Connectedness to Nature Scale (CNS) was published by Mayer and Frantz (2004) and suggested an affective measure of community and nature. The CNS attempts to measure a sense of inclusion or closeness with nature on both an emotional and cognitive level, however, as Nisbet, Zelenski and Murphy (2009) pointed out, it fails to address the physical aspect of human-nature relationships, which is a key element of individual sense of connectedness. Clayton's (2003) Environmental Identity Scale (EIS) is another useful tool that measures self-identification, but fails to capture the experiences and emotions that are related to nature (Nisbet, Zelenski & Murphy, 2009, p. 719).

There is a wide array of assessment tools that can be implemented to calculate ecoliteracy, each having a few components that are stronger than others. For this capstone research, an assessment will be created that incorporates components from the Connectedness to Nature Scale (Mayer & Frantz, 2004) and the Nature Relatedness Scale (Nisbet, Zelenski & Murphy, 2009).

## **Conclusion**

There are many factors that contribute to an individual's ecological literacy. To be ecologically literate, not only knowledge on environmental systems, but also the issues that affect those systems, the relationships between, and the interdependence of members of ecological systems are key. Ecoliterate individuals must be able to apply those principles to solve complex environmental problems and take action to address environmental issues that affect the planet to create sustainable communities.

Ecoliteracy is developed through knowledge and experiences. It cannot be taught in an environmental science class alone. Instead, it needs to be integrated into all areas of

curriculum and students need to be provided with opportunities to experience the natural world first hand. As Sobel wrote, “if we want children to flourish, to become truly empowered, then let us allow them to love the Earth before we ask them to save it” (Sobel, n.d., para. 44).

### **What is Next?**

In the next chapter, I will describe the proposed methodology for designing and implementing an assessment of the ecoliteracy of high school students before and after an extended experience in nature at a residential environmental learning center. The means for both quantitative and qualitative data assessment tools will be discussed, along with justifications for each of the tools.

## CHAPTER THREE

### Research Methods

#### Introduction

The focus of this research was to address the question: How does an experience in nature affect ecoliteracy of high school students? This study investigates how an extended three-day weekend field trip to a residential environmental learning center in northern Minnesota affects ecoliteracy of high school students. My personal connection to this topic was explained in Chapter One, followed by literature review in Chapter Two. This current chapter focuses on the process and methods used to collect data in the capstone study. It also describes the demographics of the students involved in the study, the data collection tools that were used, and a timeline in which the research was collected.

#### Research Paradigm and Methods

For this study, a mixed methods research approach was utilized. This form of data collecting involves the collection and analysis of both qualitative (open-ended) and quantitative (closed-ended) data. According to Creswell (2014), author of *Research Design*, “the core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone” (p. 4).

Specific methods used in this study involved the implementation of pre- and posttests that analyzed the ecoliteracy of the students one week before and immediately after the field experience. The specific assessment used contained questions from both

the Connectedness to Nature Scale (CNS) (Mayer and Frantz, 2004) and the Nature Relatedness Scale (NRS) (Nisbet, Zelenski, & Murphy, 2009). In addition to the pre- and post-assessments, students completed daily guided journaling exercises and focus group interviews were conducted to provide an additional sources of data.

### **Demographics**

This study involved a group of 28 high school students in grades 10-12 from a rural public high school in southeastern Minnesota. The students that participated were invited along on this optional field experience as a result of their involvement in the school's student environmental club or enrollment in either the Advanced Placement Environmental Science course or sophomore level biology courses.

Demographic information was collected from each of the students on the pretest assessment. This information included age, gender, ethnicity, as well as the average number of hours spent outdoors in a typical week.

### **Preparations**

Many preparations were made in order to assure the safety and confidentiality of the students involved in this study. Before any research pertaining to this study was conducted, a Non-Exempt Human Subjects Committee Application was submitted to Hamline University and school district paperwork was completed to allow students to participate in the field trip. Parents and guardians also completed liability forms for the residential learning center, as well as a consent form that gave their child permission to participate in this study. An informed consent letter was provided to students and their parents/guardians that outlined the purpose of this research study and how the students

would participate. Assurance of confidentiality and voluntary participation and explanations of potential risks, discomforts, costs, and benefits were also explained in this consent letter, which was then followed by a consent statement from the residential learning center. Each of the students included in this study had the completed paperwork on file at the school and on the field experience.

### **Action Plan**

This study focused on investigating the effects that an extended experience in nature, specifically at a residential environmental learning center, had on the ecoliteracy of high school students. A group of 28 high school students (grades 10-12) were given a pretest that included questions from the Connectedness to Nature Scale (CNS) (Mayer and Frantz, 2004) and the Nature Relatedness Scale (NRS) (Nisbet, Zelenski & Murphy, 2009). The questions on this test included a Likert type survey where students were asked to answer the closed-ended questions in terms of the way they generally feel. These questions contribute to the attitudes and behaviors associated with ecoliteracy. This pretest also included a section that gathered students' demographic information that included the age, sex, ethnic background, and average number of hours spent outdoors each week.

One week after the pretest, students traveled by bus to a residential environmental learning center in northeastern Minnesota where they spent three days in nature as they participated in classes relating to environmental science, outdoor recreation and team building. Specific class offerings included a ropes course challenge, snowshoeing, Northwoods mammals, rock climbing, and frozen lake studies. Students were also



provided with an opportunity to hike around a nearby state park to see a waterfall and Lake Superior up close. Each evening, students completed guided journal entries that asked them to reflect on their experiences from the day's activities. At the end of the trip, focus group discussions were held where students shared their thoughts and feelings about how the experience affected their knowledge, attitudes and behaviors towards the environment. These focus groups were made of up 3-4 students that volunteered to participate.

At the conclusion of the field experience, students were provided with a posttest that was identical to the pretest. This posttest also had additional open-ended questions for students to share how they specifically felt about how each experience affected their knowledge, attitudes and behaviors towards the natural environment and a Likert type scale for which the data was converted to a number and analyzed.

### **Timeline**

The start date for this study was February 8, 2016, which is when the pretest was administered to students during a lunchtime meeting. Students then traveled to the residential environmental learning center on Friday, February 12, 2016 and stayed there until Sunday, February 14, 2016. During this time, students participated in outdoor, environmental and team building experiences as well as self reflection in a natural, northern MN setting. At the conclusion of the trip students were immediately provided with the posttest that measured their ecoliteracy. The entire process was completed within a two-week time period, by February 19, 2016.

## Research Tools

Several research tools were implemented in this study to collect data with an explanatory sequential mixed methods integration. The reason for selecting this mixed methods approach is to explain quantitative results with qualitative data, which provides a more in-depth understanding of the quantitative results that are obtained (Creswell, 2014).

Before any data was collected, students completed a student demographic questionnaire (see Appendix A) that gathered data relating to their gender, age, race, and coursework taken. Identical pre- and posttests (see Appendix A) were utilized to measure students' ecological literacy before and immediately after their experience at the residential environmental learning center as a means for quantitative data collection. On these assessments, students responded to a 5 point Likert scale that contained 20 items from the Connectedness to Nature Scale which was developed by Mayer and Frantz (2004) and the Nature Relatedness Scale by Nisbet, Zelenski and Murphy (2009).

Student responses from these 20 questions were combined and averaged to create an ecoliteracy index. Individual student pre- and posttest scores were analyzed and the difference was calculated to determine the effect that the overall experience at the residential learning center had on their knowledge, attitudes, and behaviors towards the natural environment.

In addition to the quantitative assessments, qualitative assessment measures that included student journals (see Appendix B) and focus groups discussions (see Appendix C) were also incorporated to provide a more in-depth understanding of the results of the

pre- and posttest. Both of these tools allow students to provide historical information and personal experiences and reflections that may have affected the results of the quantitative assessment tools. The daily journal entries were analyzed and common themes in responses were identified and analyzed. These additional tools helped to identify if prior student attributes (e.g., experience, knowledge, and skills) may have contributed to ecoliteracy.

At the end of each day, students were provided with several journal prompts (see Appendix B) and were asked to reflect on how the activities that they participated in that day affected their knowledge, attitudes and behaviors about the environment. The journal prompts had a scale on which students ranked their feelings. Each scale item was assigned a Likert type ranking number that was used for analysis.

Shortly after returning from the environmental learning center, three focus group interviews were held with groups of two to four students who volunteered to be interviewed. Students were presented with several questions (see Appendix C) and their responses were recorded. Common themes in student responses were identified and analyzed to provide a basis and understanding for the ecoliteracy pre- and posttest results.

### **Data Analysis**

At the conclusion of the trip, the overall scores of the pre- and post-assessments of ecoliteracy were compared for each of the students that participated in the study. The average score from items 1-14, which came directly from the Connectedness to Nature Scale, (Mayer & Frantz, 2004) was then compared with the average scores from items

15-20, which came directly from the Nature Relatedness Scale (Nisbet, Zelenski & Murphy, 2009) to determine if the scores from the two assessments were similar.

Student journals and interview questions and responses were reviewed to gain insight on the results that were obtained on the quantitative assessment. This information helped to provide a subjective description and background to help understand each student's personal experience on this field trip.

### **What is Next?**

In this chapter, the methods and procedures of this study were examined. The research paradigms and methodology, preparations, demographics, action plan, research tools, timeline, and limitations of the study were outlined to describe the research performed and analyzed in this study. Chapter Four presents the analysis of the data collected by the pre- and posttests and student journals and small focus group interviews. This information will be analyzed to see what inferences and conclusions can be made regarding the question: How does an experience in nature affect ecoliteracy of high school students?

## **CHAPTER FOUR**

### **Results**

#### **Introduction**

The focus of this capstone study was to investigate how a three day experience at a residential environmental learning center in northern Minnesota affects ecoliteracy of high school students. In Chapter One of this capstone study, the researcher's personal connection to the topic was described. Chapter Two provided an examination of literature and previous studies carried out on the topic, looking specifically at the development of the concept of ecoliteracy, how ecoliteracy is assessed, and the factors that affect it. In chapter three, the study's process and the methods used to collect the data were addressed. Chapter Four explores the data collected during the study, analyzes and interprets the results, and connects the results to the focus question: How does an experience in nature affect ecoliteracy of high school students?

#### **Review of Data Collection Methods**

Quantitative and qualitative data collection methods were implemented in this capstone project. Students took a pretest before going on the field experience to the residential environmental learning center that measured their baseline level of ecoliteracy (see Appendix A). This assessment also included demographic information, and students answered questions about their age, grade, gender, race and other background information. At the completion of the field experience, students took an identical posttest that measured their ecoliteracy after the weekend experience at the residential environmental learning center.

The overall scores from the pre- and posttests of ecoliteracy were compared for each of the students that participated in the study. The average score from items 1-14, which came directly from the Connectedness to Nature Scale, (Mayer & Frantz, 2004) was then compared with the average scores from items 15-20, which came directly from the Nature Relatedness Scale (Nisbet, Zelenski & Murphy, 2009) to determine if the scores from the two assessments were similar.

Qualitative data collection methods included the use of daily student journal entries (see Appendix B) and three small focus group interviews (see Appendix C) that were held after the experience. Student journals and interview questions and responses were reviewed to gain insight on the results that were obtained on the quantitative assessments. This information helped to provide a subjective description and background to help understand each student's personal experience on this field trip and how it may have contributed to ecoliteracy scores.

### **Student Population Demographics**

There were 28 students in grades 10-12 that participated in this capstone study. All of these students are currently enrolled in a public high school located in a rural, southeastern Minnesota town. A breakdown of the demographic information is illustrated in Figure 1.

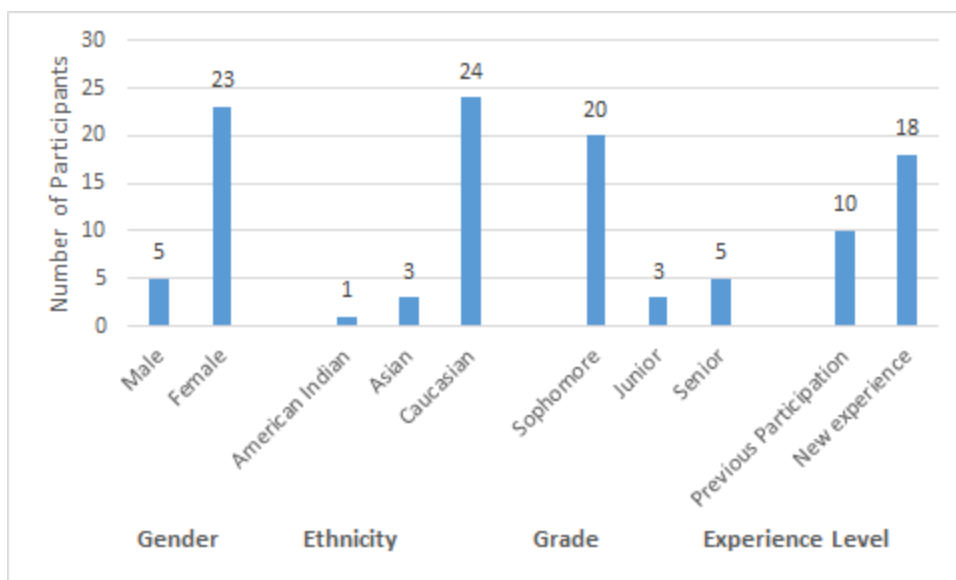


Figure 1. *Population demographics for the group of students who participated in a three day field experience at a residential environmental learning center in northern Minnesota.*

Each of the 28 participants completed the pre- and posttests that measured their ecoliteracy before and after their experiences at the residential environmental learning center. Twenty-three of the participants submitted their daily journal reflections for review and eight students volunteered to be part of the small focus groups that met after the field trip to discuss and reflect on their experiences at the residential environmental learning center.

### **Ecoliteracy Assessment Data**

Each of the 28 students that participated in this capstone study also participated in taking both the pre- and posttests that assessed their ecoliteracy levels before and after the experience the residential environmental learning center. On these assessments, students responded to a 5 point Likert scale that contained 20 items from the Connectedness to Nature Scale which was developed by Mayer and Frantz (2004) and the Nature

Relatedness Scale by Nisbet, Zelenski and Murphy (2009). Averages were calculated for each of the 20 items. In addition to an overall average score, separate averages were calculated for items 1-14 and 15-20 to determine if there were differences in the assessment tools themselves. Table 1 and Figure 2 show the averages that were calculated for the overall assessments, as well as for the items that came directly from the Connectedness to Nature Scale (items 1-14) and the Nature Relatedness Scale (items 15-20).

Table 1

	Overall Ecoliteracy (Average of items 1-20)	Connection to Nature Scale (CNS) (Average of items 1-14)	Nature Relatedness Scale (NRS) (Average of items 15-20)
Pre-Test	3.58	3.54	3.67
Post-Test	4.11	4.06	4.25

*Comparison of Pre- and Post Test Results*

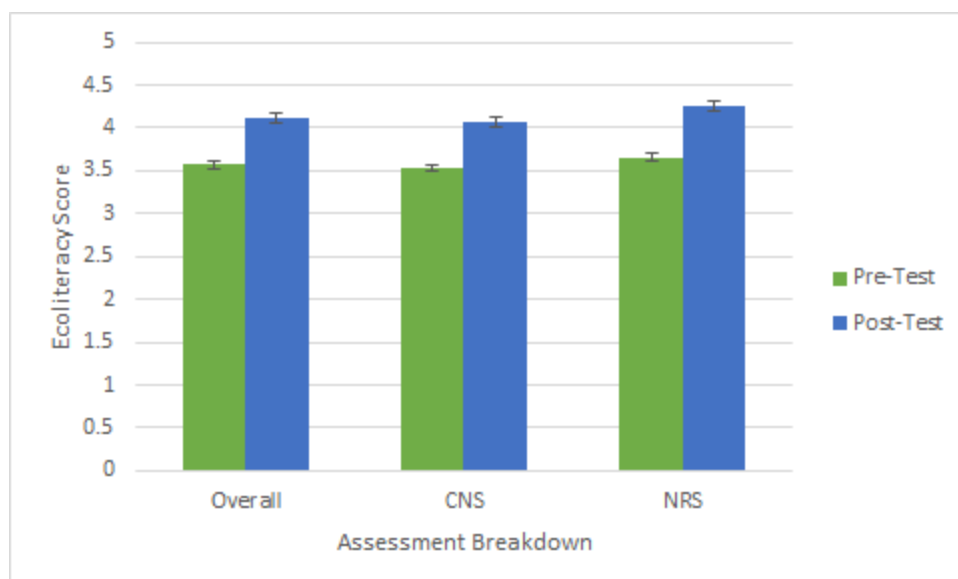


Figure 2. Breakdown of the pre- and posttest scores for each of the ecoliteracy assessments used. Data derived from Table 1.



Overall, 26 of the 28 students showed an increase in their ecoliteracy score after having participated in the the field experience at the residential environmental learning center. As a whole, the group average increased 0.53 points on the overall assessment, 0.52 points on the Connection to Nature Scale assessment items and 0.58 points on the Nature Relatedness Scale items. Two students showed a decrease in their ecoliteracy score at the end of the weekend experience. Figure 3 shows the change in scores from the pre- and posttest for each of the participants of this study

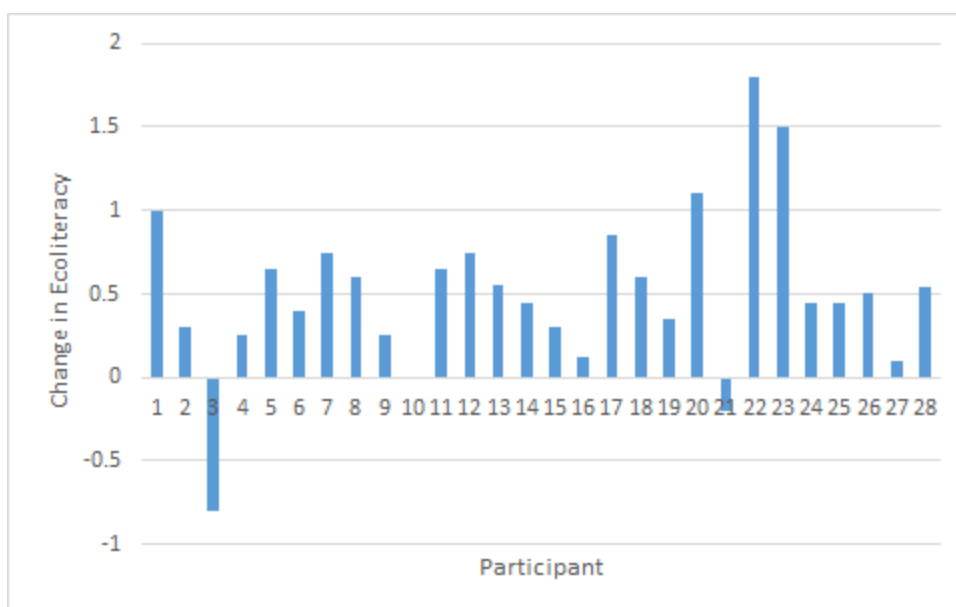


Figure 3. *Changes in ecoliteracy scores (posttest score - pretest score) for each of the participants of the three day field experience at a residential environmental learning center in northern Minnesota.*

In addition to exclusively looking at the averages for the group, ecoliteracy averages were calculated and comparisons were made between grade level in school, gender, race, and previous participation in this field experience (see Figures 4-7).

Figure 4 shows the average overall pre- and posttest results for each of the grade levels that were represented in the study. According to the data, there is an inverse

correlation between grade and pretest scores on the ecoliteracy assessment. Sophomore level students had the highest scores on the pretest (3.69) and showed the least amount of growth on the post assessment (4.12), an average gain of 0.42 points per student. The average pretest score for the junior participants was 3.44 and increased to 4.15 on the posttest, a growth of 0.71. Seniors showed the greatest growth between the pre- and posttests. Their average ecoliteracy score on the pretest was 3.14, which increased to 4.09 on the post-assessment, a growth of 0.95.

R-squared values we calculated to measure how close the data are to the fitted regression line. The  $R^2$  value of the pretest was 0.9985, which decreased to 0.191 on the posttest.

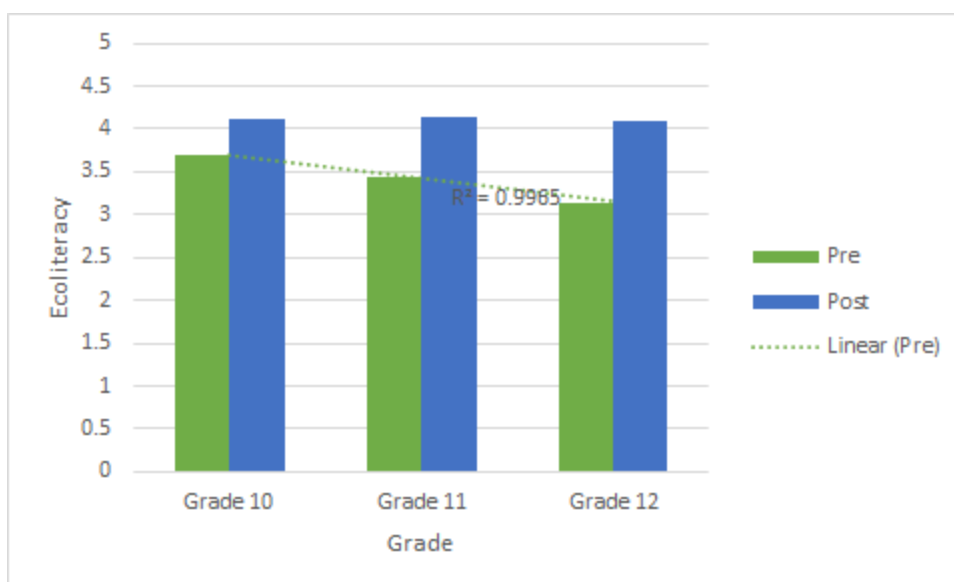


Figure 4. *Grade comparison of changes in ecoliteracy after a three day experience at a residential environmental learning center in northern Minnesota. (Sample sizes: Grade 10 (20), Grade 11 (3), Grade 12 (5))*

Gender differences in ecoliteracy levels were also compared for the pre- and post-field trip experience. According to the data that has been collected, both genders

showed positive growth in overall ecoliteracy scores, but males outperformed females on both the pre- and post-assessments for ecoliteracy. The average score on the pre-assessment for males was 3.91 which increased to 4.51 on the posttest, illustrating a growth of 0.6. Females started with an average score of 3.5 on the pretest, which then increased to 4.03 on the posttest, which correlates to a growth of 0.53. (Figure 5).

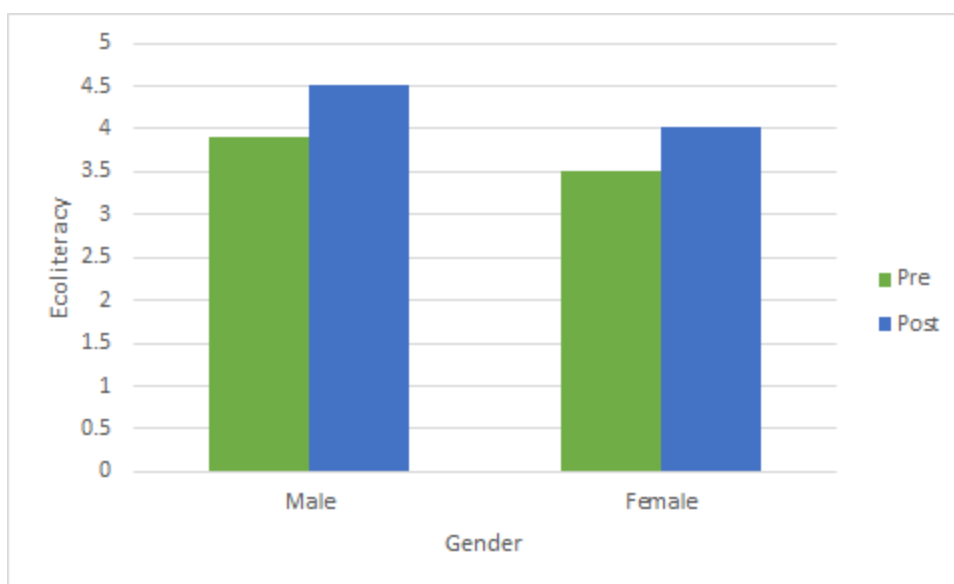


Figure 5. *Gender differences in ecoliteracy for the group of students that attended a three day field experience at a residential environmental learning center in northern Minnesota. (Sample sizes: Male (5), Female (23))*

Of the 28 students that participated in this study, 24 were Caucasian, three were of Asian descent and one identified as American Indian, as shown in Figure 1. Race does have potential to influence ecoliteracy, so the average overall ecoliteracy scores for these three demographic groups were calculated and analyzed, which is also illustrated in Figure 6. The one student that identified herself as being Native American had the highest score on the pretest of the three groups, which was 4.35. This student showed no change on the posttest. Asian students had the lowest average score on the pretest, which

was 3.18, and showed the most growth on the posttest, which increased to 4.16, an increase of 0.98. Caucasian students, which made up the majority of the student population, had an average pretest score of 3.6 and increased to 4.09 on the posttest, an increase of 0.49.

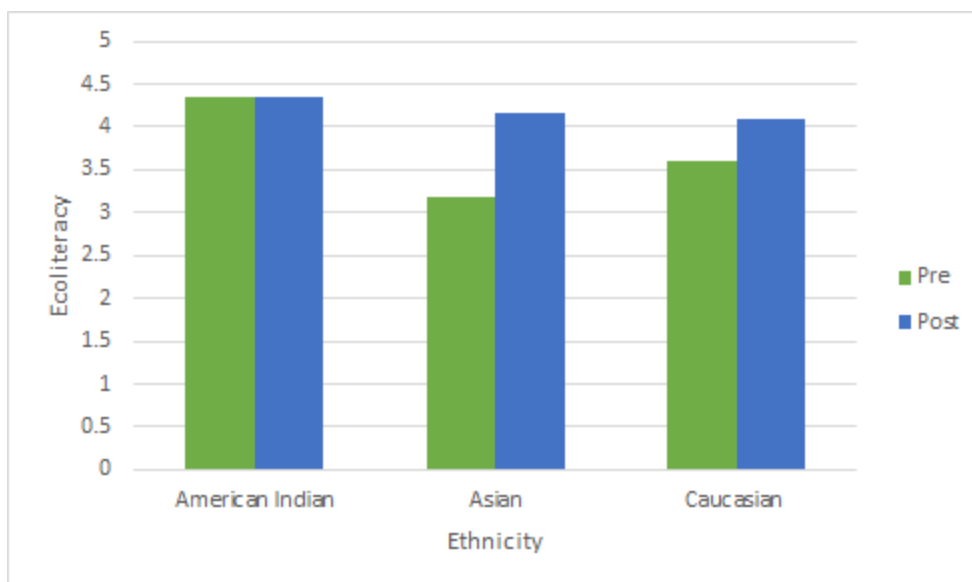


Figure 6. *Ethnicity differences in ecoliteracy for the group of students that attended a three day field experience at a residential environmental learning center in northern Minnesota.. (Sample sizes: American Indian (1), Asian (3), Caucasian (24))*

The optional field trip opportunity to travel to the residential environmental learning center in northern Minnesota presents itself to the student body on an annual basis. The students that are invited to participate are those that are enrolled in the biology or AP Environmental Science classes or are members of the school's environmental club. There is potential for students to participate in this experience for more than one year, so the scores on the pre- and posttests were compared for those that have participated in this experience in past years and those who are participating for the first time.

Of the 28 students that traveled on this year's field trip and participated in this capstone study, 10 students had gone on this field trip the previous year. According to the data collected, students who had gone on the field trip had, on average, lower pretest scores and showed a greater increase in their scores on that posttest than those participating in the experience for the first time. Specifically, the average pretest score for the ten students with prior experience was 3.3 and increased to 4.1 on the posttest, an increase of 0.8. The 18 students who were experiencing this trip for the first time had an average pretest score of 3.7, which increased to 4.13 on the post-assessment, a growth of 0.43. The data is illustrated in Figure 7.

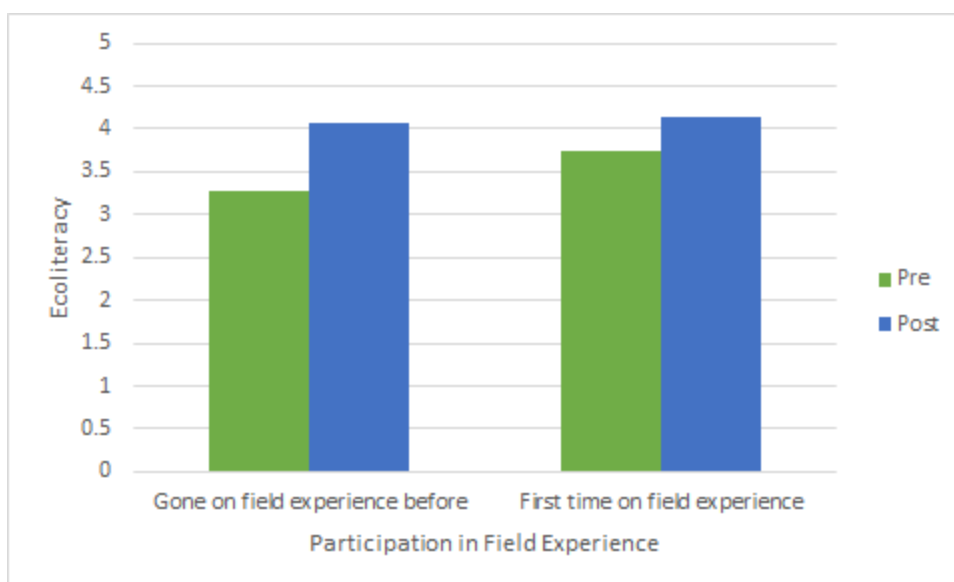


Figure 7. *First time participant vs. returning participant ecoliteracy scores for the group of students that attended a three day field experience at a residential environmental learning center in northern Minnesota. (Sample sizes: Returning (10), First time (18))*

### **Student Journal and Focus Group Interview Data**

In addition to the pre- and posttests that provided quantitative measurements of ecoliteracy before and after a three-day experience at a residential environmental learning

center, daily journal reflections and focus group interviews were analyzed and common themes were identified from the responses that were provided. This information helped to provide a subjective description and background to help understand each student's personal experience on this field trip. They also provided insight to possibly decipher some of the differences in ecoliteracy scores that were identified for each of the demographic categories that were evaluated.

Each of the daily journal responses asked students to rank and reflect on the level of knowledge that was gained and connectedness to nature that they experienced throughout the day. On day one, 15 of the 23 responding students who submitted their journals reported having gained a lot of new knowledge, whereas eight students reported having gained a little new knowledge. On this same day, 15 students reported feeling more connected to nature and eight experienced having no change in their connectedness. No students reported having no new knowledge gained or having less of a connection to nature. Further reading into the reflections revealed that most students attributed to their increase in knowledge being directly related to a class that was taken on the wolf populations in Minnesota and the management techniques for those populations. Of the eight students who reported having learned a little new knowledge, six explained that that they had previous knowledge from biology classes or previous experiences at the residential environmental learning center.

Fifteen of the 23 students who submitted their journal reflections indicated that they experienced an increase in their connection to nature. One student mentioned that "I felt more connected to the wildlife when we were learning about the wolves and the

effects that we have on wolves. Riding behind a pack of dogs through the wilderness made me feel more connected.” Another comment made was, “Today when I was riding and driving the dog sled, I saw the beautiful surroundings and I realized on a larger scale how small I am in this large world.” Many of the comments that were made by individuals that experienced no change in their connection to nature dealt with the sub-zero temperatures that were experienced and students not dressing appropriately. One student commented that, “I was already pretty connected I feel but the cold made me want to be less connected” and another claimed that “It was too cold to be outside and enjoy life. I appreciate warm sandy beaches.”

All of day two was spent at the residential environmental learning center, which overall seems to correlate with an increased amount of knowledge gained and connectedness to nature. Nineteen of the 23 students reported having gained a lot of new knowledge, while the other four students reported they learned a little new knowledge. Students attributed much of the new learning to the Northwoods mammals class that was taken in the afternoon. This class had both indoor and outdoor components where students spent time identifying animals based on their skull structures, and then hiking outdoors while looking for signs (tracks, scat, etc.) of the various animals. One student commented that “Today I learned a lot at the mammal class. We looked at the different skulls and I learned differences between the animals' structures and why they are structured like that. I also learned how to track animal tracks and determine the animals they came from.”

In addition to the Northwoods mammals class on the second day, students also learned how to use snowshoes and trudged through the snow for approximately three miles to an overlook of Lake Superior. All of the participants indicated that the second day made them feel more connected to nature, and many attributed that increased connectedness to their snowshoe experience. A few journal reflections from this experience include:

- “When we went to Lake Superior, the view was amazing and made me love the world more.”
- “Today, the Lake Superior was the most beautiful I had ever seen it. While gawking at it, I envisioned the glaciers tearing apart the land and forming the Great Lake. Exploring in the woods by myself and with friends also truly made me feel more connected with nature. Overall, I felt more one with nature and I also found it much easier to find myself while adventuring today.”
- “Sitting on the ridge overlooking Lake Superior really showed me that there are things that are bigger than me and my problems. Looking at the peaceful surroundings really dialed me into nature.”

Students also had the opportunity to experience Chickadee Landing, a remote setting in the woods with man-made wooden benches shaped like people and dressed in clothes. Bird feeders surround the benches and are often frequented by chickadees. Students sit on the benches in silence with bird seed on their head and in their hands, waiting to be visited by a bird that is in search of a “free lunch.” Seven students journaled



about how this experience contributed to their increased feelings of connectedness to nature.

- “When we were feeding the birds, they would just come and land on you and it just felt like the birds trusted you.”
- “I felt very connected to nature when the birds landed on my head and I could see the birds so close.”

On day three of the trip, students participated in a frozen lake study class, traveled to a nearby state park and then ventured home. Eleven students reported having learned a lot of new knowledge on this day, 11 learned a little new knowledge and one reported that no new material was learned. One student commented that “I learned a lot because I have never been ice fishing and never been on a frozen lake. I learned how to cut ice and also how to measure it.” Considering that Minnesota is the “Land of 10,000 Lakes,” I found it particularly interesting to find out how many students had never been to a lake in general, let alone stand on a frozen one. Many students had comments similar to this one, “I chose a lot because I don't really know a lot about frozen lakes or what goes on underneath them. It was cool to get to use the camera and fishing gear to see plankton and other fish.” Of the students who reported having learned a little new knowledge, many mentioned that they had taken the class last year and remembered much of the material that was presented. For example, one student commented that “I had already done the Frozen Lake Study class last year, so what I learned was more about the people that I was with. The people that I interacted with over the weekend were people who I have always wanted to be on friendly terms with, but school politics get in the way. On the hike I

learned something I was aware of, but did not specifically have knowledge about.

Updrafts and air pressure on the lake shore.”

Even though there was only one formal class on the third day of the trip, all of the students that were interviewed reported feeling more connected to nature. This is primarily attributed to the free time that was spent exploring the nearby state park.

- “Hiking and sliding through the beautiful, healthy woods was an inspiring and fun-filled journey to be a part of in nature. Also, the view of Lake Superior and the icicles on the cliff sides blew my mind. I felt the beautiful, fresh, and overly calm nature around me. It was all eye opening and comforting at once.”
- “I found peace and harmony within the woods and by the lake. I felt even more like a piece of the world than ever. It was awesome to get away from society and just live and discover. I wish I had that more often.”
- “Hiking at Tettegouche was definitely a factor that made me feel more connected to nature. The time spent this weekend just watching and admiring the wilderness is irreplaceable. Just that silence and quiet time was indescribable and truly made your connection to wildlife deeper.”
- “Hiking and sliding through the beautiful, healthy woods was an inspiring and fun-filled journey to be a part of in nature. Also, the view of Lake Superior and the icicles on the cliff sides blew my mind. I felt the beautiful, fresh, and overly calm nature around me. It was all eye opening and comforting at once.”

These are just a few of the many reflections that shared the common theme of how just being in nature contributed to an increased sense of connectedness. Although

students enjoy spending time in nature, there are a variety of factors that serve as barriers that keep them from experiencing nature on a regular basis. Some of these barriers that students have identified include weather, creepy animals, technology, homework, and jobs. One student noted in their journal entry that:

Technology is a definite barrier that stands between me and engrossing myself in nature. Even when I do decide to go outside, I usually bring my phone or music with me. I enjoy to run, and though I don't need music, I often times bring it along instead of just taking in the noises of nature and the world that surrounds me.

Other factors that affect the amount of time I spend with nature are the extreme temperature changes. Though I enjoy laying on the beach or building snowmen, the insane cold and smoldering heat aren't reasons I get off the couch and go enjoy nature. Other reasons I don't spend as much time with nature as I should are all the activities that I am involved within. I am active in many clubs, organizations, dance classes, and I work hard at school. I don't have much extra time to spend and the time I do have, I don't always choose to spend wisely with nature.

In one of the daily journal responses that students completed at the conclusion of the trip, they were asked to reflect on how the three days at the residential environmental learning center impacted their overall ecoliteracy. All of the students responded in ways that illustrate positive growth and expansion of their initial level. Many students attributed time in nature to an increased level of ecoliteracy. For example, one student noted "I have learned about wild animals and how important and special they are. I also

feel like being more outside and more connected makes me want to learn more about nature and how we as humans affect it.” Another commented that “This experience reconnects me with Mother Nature and the Earth. It helps me to understand animals and their thinking process. It gives me a good example of how people could live in harmony with nature.” Yet another student who spends much time in the outdoors on a regular basis mentioned that:

Overall, I do not think that my ecoliteracy was changed a highly significant amount. However, I will say that my ecoliteracy has been deepened. Take the wolves issues as an example. I discovered that my love of wolves had often blinded me to the case argued against them. While I remain biased toward the issue, I am no longer ignorant. Otherwise, much of what we learned was how humans have impacted that natural world. More specifically, how humans have taken it upon themselves to manage the other species. Humans must balance this job with their own survival. While many think humans should just let nature do its thing, the damage done by humans would surely result in the human population being threatened in some, whether by loss of food or water, or perhaps something different.

One student went into great depth in journal reflection, and covered many of the same points that others brought up in their interpretations of how this weekend experience affected their overall ecoliteracy. This student shared:

I believe Wolf Ridge has affected my ecoliteracy immensely. Though I enjoyed and respected nature in the past, I was yet again reminded by this indescribable

experience just how much nature impacts our lives. One way it affected my ecoliteracy is through the knowledge I gained. The knowledge I learned in the classrooms about mammals, wolves, and frozen lakes opened my eyes to how much I was completely clueless about the creatures and elements around me. Through this intake of knowledge, I feel I have expanded my ecoliteracy. Another way I feel I was affected is through the quiet moments we took to observe and take in nature as a whole. When we sat at the overlook while snowshoeing and sat on the edge of land staring out at Lake Superior as gigantic snowflakes drifted from the clouds in slow motion, I felt an emotion towards nature I hadn't felt before. To just sit, think, and take in the beauty around me, I believe, made me more ecoliterate. Both times as I observed, I wished to stay in that moment forever. I would then think about how nature used to be before humans became so selfish of its resources. Eventually, I would attempt to imagine a world in the future, when all of nature is destroyed. Through these thoughts I have grown passionate and adamant that I will do my very best to keep the beauty of nature alive.

During the focus group interviews, students were asked to compare their connections with nature before and after the experience at the residential environmental learning center. Six of the eight students that were interviewed students that were interviewed mentioned or agreed that they had always liked being outside as children, but have gotten more distant because of school, work and other extracurricular activity

schedules. One student commented that “I like being outside and I do feel connected, but I would only get out when it was convenient.”

After having spent three days participating in hands-on activities and exploring nature first hand, all eight of the participants said they felt more of a connection with nature. One shared “I found peace and harmony within the woods and by the lake. I felt even more like a piece of the world than ever. It was awesome to get away from society and just live and discover. I wish I had that more often.” Another student explained that this experience added value to neat nature pictures. “When I go back and look at that pictures I took of the the clear blue sky, trees, icicles or of the view of Lake Superior, it’s like I am stepping back into that setting. I am able to appreciate it more because I was able to see it and experience it and discover it for myself.” Another student added that “This experience has reminded me that it’s important to slow down and allow myself time to appreciate everything that surrounds us. I want to go back.”

According to the data collected on this three day experience at a residential environmental learning center, there is an overall positive correlation between time spent outdoors and an increase in ecoliteracy among high school students, as evidenced by both quantitative and qualitative data from this study. This trend appears regardless of grade, gender, race and previous participation in similar experiences.

### **What is Next**

Chapter Four took a close look at the results of the study that focused on the question, How does an experience in nature affect ecoliteracy of high school students? Data collected through pre- and post-assessments and through the analysis of student

journals and focus group discussions showed an increase in ecoliteracy scores and variation among demographic categories analyzed over the course of three days at a residential environmental learning center.

In Chapter Five, I reflect on the study as a whole. This reflection includes a review of the purpose of the study and the learning that has taken place as a result of the study. Connections to the review of literature are made and the limitations of the study are expanded. Lastly, final thoughts are shared followed by potential directions for further research.

## CHAPTER FIVE

### Conclusions

#### Introduction

Having an ecologically literate population means having a population that will be able to make informed decisions and take actions to solve the world's environmental issues. The focus of this capstone research has been to investigate how an experience in nature affects ecoliteracy of high school students. Chapter Five serves as a conclusion to the project that was carried out and the results that were obtained through the varied means of data collection and analysis. The literature review from Chapter Two is revisited, limitations are addressed and further research directions are discussed. Throughout this chapter, I reflect on the most important components that I can take away as both a learner and as a teacher.

#### Major Learning

As I was selecting a topic on which to focus my capstone research, I immediately knew that I wanted to investigate how an experience at a residential environmental learning center in northern Minnesota affects ecoliteracy of high school students. I have taken students on this trip several times and I have seen first-hand how it affects students' attitudes and behaviors towards and knowledge about the environment. However, I did not have any quantifiable data to back up my generalizations.

Overall, it can be concluded that participation in a three-day experience at a residential environmental learning center improves ecoliteracy of high school students. Twenty six of the 28 participants showed an increase in their overall ecoliteracy scores at



the end of the field trip and all of the students who submitted journal responses indicated that they have an increased understanding of nature and the role that they have with the environment. In one of the focus group interviews, one student commented and all agreed that “being exposed fully within nature creates a new level of respect for all life around you.” Although it does not appear that demographic information can be used as a predictor of ecoliteracy, I was surprised by a few trends in the results. For example, sophomores scored higher than juniors and seniors and first time participants scored higher than those who had gone on the field experience before. These findings will be discussed in the review of literature.

### **Review of Literature**

Many of the results that I have obtained through this study support the conclusions that were made in previous investigations relating to how demographics affects ecoliteracy. Connections to my research study and the conclusion of past studies will be presented in this section.

A Stevenson et al. (2013) study noted that gender was related to environmental literacy in complex ways and that females tend to have lower knowledge pretest scores than males. However, females tended to outperform males in affect and cognitive skills and improved faster in knowledge over the course of the semester that they were studied. They also noted that females tend to have more positive environmental attitudes and greater levels of concern for the environment. According to the results that I obtained, males had higher pretest and posttest scores than females. However, due to the small

sample of male subjects that participated in this study though, concrete conclusions cannot be made.

According to the data that I collected, the three Asian students showed the greatest improvement in ecoliteracy. The 24 Caucasian students also showed growth and there was no change in the pre- and posttest data for the one Native American student. However, due to the lack of diversity in numbers of students representing the various ethnic backgrounds, specific conclusions cannot be made about how race affects ecoliteracy.

Age was also a demographic factor that was studied in Stevenson and colleagues' (2013) analysis of middle school children and the factors that affect their ecoliteracy. They found "middle school grades may include an age tipping point where environmental education efforts start becoming less effective in promoting environmental literacy" (p. 9). My study analyzed the data from high school students and found that sophomores had the highest pretest scores, followed by juniors and then seniors. Seniors showed the most growth in their ecoliteracy over the course of the three days at the residential environmental learning center. Again, there are variables that affect this and having a larger sample size would have allowed for more concrete conclusions to be made, but I feel that older students benefit from these experiences in nature just as much, if not more, than their younger counterparts. The seniors showed the largest increase in ecoliteracy on the pre- and posttest scores, which supports my idea that they benefited and gained knowledge. All of the seniors that went on this trip were females, and had gone on the trip the previous year. All of the sophomore students are currently enrolled in a biology

class that had finished an ecology unit shortly before this trip, which could have contributed to the higher scores on the pretest.

The piece of data that surprised me the most in this study is that students who had previously participated in this field experience scored lower on the pretest than the students who were participating for the first time. One contributing factor to this trend could be that these students are more critical of themselves and had higher expectations for the trip. One of the questions on the student survey that was filled out before the field experience asked students to identify the reasons why they decided to participate in their experience again. Two of the student reflections read:

- I decided to go on this trip again for many reasons. The last trip was both enjoyable with friends, but it also taught me a significant amount about myself and nature. It was a unique experience I definitely don't come by often. I learned to face my fears when I felt like I was taking risks. I also learned what it was like to interact with nature more than what I usually do. There was so many discoveries made on this trip last year that I found within myself and in nature. I am excited to be reminded of the experiences again this year and hopefully to learn more.
- I decided to go on the Wolf Ridge Trip again because it had been such a great experience when I went last year. It will always be one of my favorite high school memories. I had great times with my friends, made new friends, and got to try new things. Plus there is just something special about spending a good weekend in the wilderness.

Bruyere (2008) wrote *The Effect of Environmental Education on the Ecological Literacy of First-Year College Students*, which focused on identifying how sustainable behaviors are influenced by knowledge of environmental systems and issues. In the study, freshmen at Colorado State University were provided with pre- and post-assessments before and after two environmental education lessons. Bruyere (2008) found that “as individuals learn about ecological principles, biological cycles, and environmental systems, their attitudes toward the environment become more favorable and many of their environmental behaviors become more frequent” (as cited by McGinn, 2014, p. 8). The greatest threat to the environment is people who are not educated about it. Experience in nature naturally sparks sustainable actions and attitudes.

I found similar results in the discussions that were held with the small focus groups. My students were asked to reflect on whether any of the activities that they participated in while at the residential environmental learning center, have been carried over into their daily lives. Many students made connections to the Conservation Challenge that they participate in while at the residential environmental learning center. Students earn points by unplugging electrical devices when not in use, turning off the lights when they leave a room, making sure water faucets are not leaking, and recycling and composting waste when possible. Naturalists at the environmental learning center would check the dorm rooms, trash cans and water faucets and if violations were noted, the group would lose points for their irresponsible behaviors. Groups that do not lose any points over the course of their stay are awarded with a Conservation Challenge plaque that they can take back to their school and display. Although this challenge was simple,

students appreciated being held accountable and having consequences for poor decision making. They each discussed how their actions at home have changed and they now unplug their cell phone chargers when they leave for school, recycle more and make more of a conscious effort to turn off the lights when they are the last to leave a room. McBride (2011) identified financial incentives can be used as a means to gaining ecological literacy. There were no financial incentives in this simple challenge, but the plaque that was received for the positive behaviors can be likened to those financial incentives.

### **Limitations**

There are limitations to this study. Of the students that chose to go on this field experience, they all had a previous appreciation for the outdoors and the environment. A larger sample of students, and including students with more diverse attitudes regarding nature, would benefit the study and enhance the data set. Ideally, it would have been beneficial to take all of the students in an entire grade to perform this capstone study and attain more representative results of this particular high school student body. However, due to logistics and budget restrictions, this was not possible.

Another limitation is that the pre- and posttests did not include any specific content knowledge questions. Knowledge is one of the contributing factors that determines ecoliteracy, so having a tool that is able to assess specific knowledge before and after the three-day experience at a residential environmental learning center would be advantageous and provide a more accurate measurement of ecoliteracy. Multiple choice questions that align to each of the courses learning targets could be written and included in the pre- and post-assessments.

An additional limitation was identified with the small focus group interviews. Several of the students volunteers were nervous about being audio recorded and held back providing lengthy and detailed responses to the questions they were asked. It seemed as though within each focus group, one student dominated the conversations and the other students simply agreed with what that one student had shared. If this study were to be repeated, it would be beneficial to have one-on-one interviews to get more variety in the responses as well as more genuine responses that are shared by the students.

### **Implications**

In order for environmental education programs to be effective, students need to learn by doing and/or by having the environment as their classroom. Louv (2005) and Coyle (2005) both suggested that participatory/interactive education will yield more ecologically literate people than academic work inside of structured institutions alone. Residential environmental education programs offer opportunities for students to explore the environment first hand, experience adventure-based challenges, and develop stewardship skills in active outdoor settings. Stern, Powell and Ardoin (2008) stated that “these programs are typically geared to enhancing environmental attitudes, increasing environmental knowledge and literacy, promoting citizenship skills, and encouraging stewardship behaviors that not only take place on site but also continue once the students return to their home communities” (p. 32). Many of these learning centers offer pre- and post visit activities that classroom educators can use to make connections to the school curriculum. They also provide resources and ideas for students to adopt more sustainable practices at home. Stern, Powell and Ardoin (2008) also added that “these programs

additionally offer opportunities for personal growth by encouraging teamwork, collaboration, and the development of leadership skills, which serve participating students well in their academic and professional futures” (p. 32).

Field trip opportunities that allow students to experience nature should be made a priority. Sobel (n.d.) wrote “if we want children to flourish, to become truly empowered, then let us allow them to love the Earth before we ask them to save it. Perhaps this is what Thoreau had in mind when he said, ‘The more slowly trees grow at first, the sounder they are at the core, and I think that the same is true of human beings’” (as cited by Sobel, n.d., para. 45). Experiences in nature and outdoor settings is crucial to enabling students to develop an appreciation of the environment. This is important because the students of today will be the decision makers of tomorrow.

### **Further Research Directions**

There are several areas that can be further expanded upon and studied to provide more accurate and significant results to addressing how experiences in nature affect ecoliteracy of high school students. The students for this particular capstone study took a pretest before their experience at the residential environmental learning center and then took a posttest at the conclusion of the trip. No other quantitative assessments were given to the students after this time. The results that were obtained show the immediate effect that the experience had on ecoliteracy, but it would be interesting to see if the experience has lasting effects on ecoliteracy and/or shapes future behaviors. Smith-Sebasto and Cavern (2006) analyzed the short- and long-term impacts of participation in three and five day residential environmental programs. They evaluated four indices: connection

with nature, environmental stewardship, interest in learning and discovery, and knowledge and awareness of biological diversity. They concluded that residential environmental education experiences appeared to achieve short-term success in all of the measured outcomes. An analysis of a 3-month follow-up survey revealed:

Increases in students' commitments to environmental stewardship, their knowledge and awareness of the natural environment, and biological diversity remained significant. However, increases in students' interest in learning and discovery and their connection with nature faded over time. (Smith-Sebasto & Cavern, 2006, p. 40)

Additional research could also be done that looks at how ecoliteracy is impacted by repeat experiences at residential environmental learning centers. I was surprised by the difference in scores of my students that had previously gone on a similar field experience versus those that were going for the first time. I was under the assumption that students going on the trip for the second would have higher pretest scores than those that were going for the first time, but this was not observed in the data. Instead, students that had participated in this experience in previous years displayed lower ecoliteracy scores at the start of the experience than students who were participating for the first time.

### **Communicating Results**

The results of this capstone study will be presented to my local school board and administration to support and encourage future field trip opportunities that allow students to learn by doing and experiencing nature first-hand. My school board requires



pre-approval for all field experiences, and these data can be used to illustrate the positive impacts of field experiences similar to this one.

In addition, these results will be shared with the residential environmental learning center that served as our field site. They may be able to use the results and student reflections for future advertising and funding requests.

Lastly, my school's Arts, Academics and Athletics Foundation has continually supported this field trip by providing monetary support. I am excited to share the results of this study with them so they can see how this experience supports their mission of providing financial support to enrich and enhance educational experiences.

### **Looking Ahead**

Perhaps David Strayer said it best when he commented, "at the end of the day, we come out in nature not because the science says it does something to us, but because of how it makes us feel" (as cited by Williams, 2016, para. 29). A primary goal that I have as an educator is to provide my students with resources and opportunities that allow them to make connections with the natural environment. My hope is that many of them will discover that nature makes them feel better and will simply develop a desire to spend more time in it.

When we allow the world to be our classroom and encourage students to explore, they learn how nature works and their relationship with nature is fostered. They learn that everything starts with the sun,, all living and nonliving things are connected and interrelated, and that biodiversity is essential. They also learn that people need nature to

survive. This provides a foundation upon which they can make connections, ask questions, investigate, learn, and develop into lifelong stewards of the planet.

Spending time in nature is important and this capstone has shown me that all students can benefit from opportunities that allow them to discover and explore the environment on their own. Providing these opportunities not only increases students' ecoliteracy, but also promotes and encourages them to make conscious efforts to live more sustainably, so future generations won't be left with the task of fixing more of our mistakes.

## REFERENCES

- Bruyere, B. (2008). The effect of environmental education on the ecological literacy of first-year college students. *Journal of Natural Resources and Life Sciences Education, 37*, 20-26.
- Carson, R. (2011). *The sense of wonder*. New York: Open Road Media.
- Capra, F. (1996). *The web of life: A new scientific understanding of living systems*. Anchor Books.
- Cherrett, J. M. (1989). Key concepts: The results of a survey of our members' opinions. *In Ecological Concepts*. Oxford, UK: Blackwell Scientific Publications.
- Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. *In S. Clayton & S. Opatow (Eds.), Identity and the Natural Environment (pp. 45-65)*. Cambridge, MA : MIT PRESS.
- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches*. Los Angeles: Sage.
- Coyle, K. (2005). Environmental literacy in America. *The National Environmental Education and Training Foundation*.
- Davidson, M. (2010). *Ecological literacy evaluation of the University of Iceland faculty, staff, and students; Implications for a university sustainability policy*. University of Iceland.

- Dunlap, R., Van Liere, K., Mertig, A., Jones, R. (2000). New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, 3, 425-442. Doi: 10.1111/0022-4537.00176
- EcoLabs. (2015). *Eco-Literacy*. Retrieved from <http://www.eco-labs.org/about/eco-literacy>
- Edgar, T. (2008). *Why ecoliteracy?* BC Teachers' Federation. Retrieved from <https://bctf.ca/publications/NewsMagArticle.aspx?id=14944>
- Goleman, G., Bennett, L., Barlow, Z. (2013). *Five ways to develop "ecoliteracy."* Retrieved from [http://greatergood.berkeley.edu/article/item/five\\_ways\\_to\\_develop\\_ecoliteracy](http://greatergood.berkeley.edu/article/item/five_ways_to_develop_ecoliteracy)
- Henley, J. (2010, June 4). Richard Louv: Let them climb trees. *The Guardian*. Retrieved from <http://www.theguardian.com/lifeandstyle/2010/jun/05/nature-deficit-disorder-richard-louv>
- Hungerford, H. & Volk, T. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education*, 21, 8-21. doi: 10.1080/00958964.1990.10753743
- Kellert, R. R., & Wilson, E. O. (1993). *The biophilia hypothesis*. D.C: Island Press.
- Louv, R. (2005). *Last Child in the Woods*. Chapel Hill, NC: Algonquin Books.

- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*, 503-513.
- McBride, B. B. (2011). Essential elements of ecological literacy and the pathways to achieve it: Perspectives of ecologists. Available from ProQuest Dissertations & Theses Global.
- McGinn, A. (2014). Quantifying and understanding ecological literacy: A study of first year students in liberal arts institutions. *Dickinson College Honor Theses*. Paper 169. Retrieved from [http://scholar.dickinson.edu/student\\_honors/169](http://scholar.dickinson.edu/student_honors/169)
- Morrone, M., Mancl, K., & Carr, K. (2001). Development of a metric to test group differences in ecological knowledge as one component of environmental literacy. *The Journal of Environmental Education, 32*, 33-42.
- Muir, J. (1911). *My First Summer in the Sierra*. Boston: Houghton Mifflin. 110.
- Murphy, T. P. (2002). The Minnesota report card on environmental literacy: A benchmark survey of adult environmental knowledge, attitudes and behaviors. *Saint Paul, MN: Hamline University Center for Global Environmental Education*.
- National Wildlife Federation. (n.d.). Ranger Rick. Retrieved from <http://www.nwf.org/Kids/Ranger-Rick.aspx>

- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, 41(5), 715-740.  
doi:10.1177/0013916508318748
- Nova. (2008, April 1). A Conversation with E. O. Wilson. Retrieved from <http://www.pbs.org/wgbh/nova/nature/conversation-eo-wilson.html>
- Orr, D. (1992). *Ecological literacy: Education and the transition to a postmodern world*. Albany: State University of New York Press
- Rhines, B. (2012, March 15). Test your eco-literacy. Retrieved from <http://patch.com/new-york/peekskill/eco-literacy>
- Rogers, K. (n.d.). Biophilia hypothesis. *Encyclopedia Britannica*. Retrieved from <http://www.britannica.com/science/biophilia-hypothesis>
- Rosen, L. (2013, March 8). Rx nature. *Deirdre Imus Environmental Health Center*. Retrieved from [http://www.childrenandnature.org/2013/03/08/rx\\_nature/](http://www.childrenandnature.org/2013/03/08/rx_nature/)
- Seuss, Dr. (1971). *The lorax*. New York: Random House.
- Sobel, D. (1998). *Beyond ecophobia*. Retrieved from <http://www.yesmagazine.org/issues/education-for-life/803>
- Sobel, D. (n.d.) *Beyond ecophobia*. Retrieved from [http://www.eenorthcarolina.org/Documents/beyond\\_ecophobia.pdf](http://www.eenorthcarolina.org/Documents/beyond_ecophobia.pdf)
- Smith-Sebasto, N., & Cavern, L. (2006). Effects of pre- and posttrip activities associated with a residential environmental education experience on students' attitudes toward the environment. *The Journal of Environmental Education*, 37, 3-17.

- Stern, M. J., Powell, R. B., & Ardoin, N. M. (2008). What difference does it make? Assessing outcomes from participation in a residential environmental education program. *The Journal of Environmental Education*, 39(4), 31-43.  
doi:10.3200/joe.39.4.31-43
- Stevenson, K. T. (2014). Building of environmental literacy among middle school students: The role of in-school, out of school, and psychological factors. *Available from ProQuest Dissertations & Theses Global*.
- Stevenson, K. T., Peterson, M. N., Bondell, H. D., Mertig, A. G., & Moore, S. E. (2013). Environmental, institutional, and demographic predictors of environmental literacy among middle school children. Retrieved from <http://dx.doi.org/10.1371/journal.pone.0059519>
- Stone, M. (2015). Children, nature, and ecoliteracy: The case for environmental project-based learning. *Children and Nature Network*. Retrieved from <http://www.childrenandnature.org/2015/03/25/children-nature-and-ecoliteracy-the-case-for-environmental-projectbased-learning/>
- UNESCO. (1977). The Tbilisi Declaration. *Report of the Intergovernmental Conference on Environmental Education organized by UNESCO*. Tbilisi (USSR). Retrieved from [http://www.gdrc.org/uem/ee/EE-Tbilisi\\_1977.pdf](http://www.gdrc.org/uem/ee/EE-Tbilisi_1977.pdf)
- Williams, F. (2016, January). This is your brain on nature. *National Geographic*. Retrieved from <http://ngm.nationalgeographic.com/2016/01/call-to-wild-text>
- Wolf Ridge Environmental Learning Center. (2015). Our story. Retrieved from <http://wolf-ridge.org/about/>

**APPENDIX A****Student Survey**

How an experience in nature affects ecoliteracy of high school students.

**Age** \_\_\_\_\_

**Gender (please circle)**

Male                  Female

**Race (please circle)**

Caucasian                  Black                  Hispanic                  Asian                  American Indian  
Other

**Grade (please circle)**

10                  11                  12

**Courses taken (or currently enrolled in)**

Biology                  Natural Resource Science                  AP Environmental Science

**Have you previously gone on the Wolf Ridge Adventure?**

Yes                  No

**If yes, what factors influenced your decision to participate in this experience again?**

**If no, what factors influenced your decision to participate in this experience?**

**On average, how many hours do you spend outdoors each week? Does this change throughout the course of the year? Explain.**

**What factors detract or serve as barriers that keep you from experiencing nature?**



The mission of Wolf Ridge Environmental Learning Center is “To develop a citizenry that has the knowledge, skills, motivation and commitment to work together for a quality environment.” This is accomplished by:

- a. Fostering awareness, curiosity and sensitivity to the natural world
- b. Providing lifelong learning experiences in nature
- c. Developing social understanding, respect and cooperation
- d. Modeling values, behaviors and technologies which lead to a sustainable lifestyle
- e. Promoting the concepts of conservation and stewardship

**Please rank these learning targets (a-e) with a 1 being the most important and a 5 being least important.**

### Pre- and Post-Assessment

Please answer each of these questions in terms of the way you generally feel. There are no right or wrong answers. Using the following scale, in the space provided next to each question simply state as honestly and candidly as you can what you are presently experiencing.

- |                          |                          |                |                       |                       |
|--------------------------|--------------------------|----------------|-----------------------|-----------------------|
| 1                        | 2                        | 3              | 4                     | 5                     |
| <b>Strongly disagree</b> | <b>Disagree a little</b> | <b>Neutral</b> | <b>Agree a little</b> | <b>Strongly agree</b> |
- \_\_\_ 1. I often feel a sense of oneness with the natural world around me.
  - \_\_\_ 2. I think of the natural world as a community to which I belong.
  - \_\_\_ 3. I recognize and appreciate the intelligence of other living organisms.
  - \_\_\_ 4. I often feel disconnected from nature.
  - \_\_\_ 5. When I think of my life, I imagine myself to be part of a larger cyclical process of living.
  - \_\_\_ 6. I often feel a kinship with animals and plants.
  - \_\_\_ 7. I feel as though I belong to the Earth as equally as it belongs to me.
  - \_\_\_ 8. I have a deep understanding of how my actions affect the natural world.
  - \_\_\_ 9. I often feel part of the web of life.
  - \_\_\_ 10. I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'.
  - \_\_\_ 11. Like a tree can be part of a forest, I feel embedded within the broader natural world.
  - \_\_\_ 12. When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.
  - \_\_\_ 13. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.
  - \_\_\_ 14. My personal welfare is independent of the welfare of the natural world.
  - \_\_\_ 15. My ideal vacation spot would be a remote, wilderness area.
  - \_\_\_ 16. I always think about how my actions affect the environment.
  - \_\_\_ 17. My connection to nature and the environment is a part of my spirituality.
  - \_\_\_ 18. I take note of wildlife wherever I am.

\_\_\_\_ 19. My relationship to nature is an important part of who I am.

\_\_\_\_ 20. I feel very connected to all living things and the earth.

Questions 1-14 were derived from the Connectedness to Nature Scale (Mayer and Frantz, 2004)

Questions 15-20 were derived from the short-form version of the Nature Relatedness Scale (Nisbet, Zelenski & Murphy, 2009)

## APPENDIX B

### Student Journal Reflection Prompts

#### Day 1

Please reflect on today's activities, specifically the effect it has had on your environmental knowledge, attitudes and behaviors.

1. How would you rank the **amount of knowledge** that you have gained as a result of today's activities?

No new knowledge                      A little new knowledge                      A lot of new knowledge

Please reflect on why you chose the response above, specifically stating at least one or two factors that influenced your decision.

2. How would you rank the **relevance or importance** of the knowledge for your life?

3. How did today's activities affect how **connected** you feel with the environment?

Less connected                      No change                      More connected

Please reflect on why you chose the response above, specifically stating at least one factor that influenced your decision.

4. List at least two items that you enjoy the most in nature.

5. Name at least two specific factors that affect the amount of time that you spend in the outdoors on a weekly basis.

**Day 2**

Please reflect on today's activities, specifically the effect it has had on your environmental knowledge, attitudes and behaviors.

1. How would you rank the **amount of knowledge** that you have gained as a result of today's activities?

No new knowledge                      A little new knowledge                      A lot of new knowledge

Please reflect on why you chose the response above, specifically stating at least one or two factors that influenced your decision.

2. How would you rank the **importance** of the knowledge for your life?

3. How did today's activities affect how **connected** you feel with the environment?

Less connected                                      No change                                      More connected

Please reflect on why you chose the response above, specifically stating at least one factor that influenced your decision.

3. Describe a **local** environmental issue and what you believe should be done about it.

**Day 3**

Please reflect on today's activities, specifically the effect it has had on your environmental knowledge, attitudes and behaviors.

1. How would you rank the **amount of knowledge** that you have gained as a result of today's activities?

No new knowledge

A little new knowledge

A lot of new knowledge

Please reflect on why you chose the response above, specifically stating at least one or two factors that influenced your decision.

2. How would you rank the **relevance or importance** of the knowledge for your life?

3. How did today's activities affect how **connected** you feel with the environment?

Less connected

No change

More connected

Please reflect on why you chose the response above, specifically stating at least one factor that influenced your decision.

4. Describe how the activities that you have participated in over the past three days compare to the learning that takes place in the classroom back at school.

5. The mission of Wolf Ridge Environmental Learning Center is “To develop a citizenry that has the knowledge, skills, motivation and commitment to work together for a quality environment.” This is accomplished by:

- a. Fostering awareness, curiosity and sensitivity to the natural world
- b. Providing lifelong learning experiences in nature
- c. Developing social understanding, respect and cooperation
- d. Modeling values, behaviors and technologies which lead to a sustainable lifestyle
- e. Promoting the concepts of conservation and stewardship

Please rank these learning targets (a-e) with a 1 being the most important and a 5 being least important.

Describe how the learning target that you ranked as number 1 was addressed over the course of this experience.

6. Please describe at least two ways how you feel this experience has affected your overall ecoliteracy.

## APPENDIX C

### Focus Group Questions

1. Take a moment to reflect on your experience at Wolf Ridge and pick out a memory that you like.
  - a. Which activity did you enjoy most?
  - b. Is there anything that you would like more of if you could go back? If so, what?
  - c. Is there anything that you would like less of if you could go back? If so, what?
  - d. Is there anything that you didn't like? If so, what?
  
2. Have any of the activities that we have participated in prompted you to make positive behavioral changes towards the environment?
  
3. Are there any aspects of this field experience that you will carry over into your daily life? Describe at least two if possible.
  
4. Do you feel that it is important for individuals to understand the role that they play in their environments? Explain.
  
5. Think about yourself before you went to Wolf Ridge.
  - a. How were you connected with nature?
  
6. Think about yourself now, after having experienced three days at Wolf Ridge.
  - a. Do you feel more or less connected with nature? Please explain why you think this increased or decreased connection occurred.