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## **ENVIRONMENTAL EDUCATION LESSONS CONNECTING MIDDLE SCHOOL STUDENTS TO THE NATURAL WORLD**

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ENVIRONMENTAL EDUCATION LESSONS CONNECTING MIDDLE SCHOOL  
STUDENTS TO THE NATURAL WORLD

by

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

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“Those who contemplate the beauty of the earth  
find reserves of strength that will endure as long as life lasts.”

-Rachel Carson

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## CHAPTER ONE

### Introduction

#### Chapter Overview

Spending time in nature is an experience that can have positive impacts on people of all ages. Nature experiences can provide a way to relax, a means to be physically active, and be an opportunity to learn about the connectedness within our natural world. Students coming through classrooms are becoming more connected to technology than nature (Louv, 2008, pg. 57). It is imperative to create ways to peak interest and facilitate opportunities where appreciation and importance of nature and the living systems within it can be developed through environmental education. Providing educators with environmental education based lessons that are aligned with Minnesota standards will provide one way to help students reconnect with the natural world. Educators can include environmental education lessons into curriculum despite the fact that current Minnesota science standards lack inclusion of environmental education for middle school students. The research question guiding this capstone project is: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?*

The first chapter will introduce the development of the research question and project while providing rationale for including components of environmental education into middle school curriculum. The project will be aligned with the Minnesota science standards, and my hope is that educators will be able to use this with ease along with what is already being done in classrooms and that students' major take away is that all of

our actions have impacts on the environment, and we can all do small things to make a difference.

## **Rationale**

### ***Environmental Education***

Environmental education is based on the belief that all people can make decisions about the environment, make choices and take actions that can take future generations into consideration, and that people can live sustainably with nature (Across the spectrum: Resources for environmental educators, 2016). Implementing environmental education in middle school can provide a way for students to observe, collect data, and make environmentally responsible choices. Environmental education fosters critical thinking skills, integrates the students' natural world around them, and integrates a multidisciplinary approach to facilitate growth in learners.

Including environmental education in middle level education is not just a way to teach students about protecting the habitat systems, how important clean water is or the importance of pollinators to food supplies; but also provides a way to foster future environmental stewards. As an educator, helping students understand why each part of the environment plays such a significant role in overall systems, has an important place in learning. We must be knowledgeable about causes of population declines, interrelationships between organisms, the importance of clean water, and what we can do to help in our own backyards and communities. By studying various components of environmental education, students are offered an opportunity to develop an appreciation for nature and its complex systems.

### *Academic Standards and Lessons*

Although the Minnesota middle school science standards contain no specific focus on environmental education, including it within the curriculum can promote the environmental literacy of students and connect them to the community. If educators are able to encourage students to be environmentally aware, students will begin to understand problems in the environment and that even small actions taken to reverse issues such as pollution, climate change, or invasive species can help preserve our earth. However, for educators to do this, it is important if I am investigating which middle school environmental education lessons aligned with science standards enable students to connect with the natural world, that it be set up in a way in which includes an ease of use and practicality for educators who are already being asked to do just this one more thing. Educators often have to weigh out what they “have time” for. We can make time for environmental education.

The new set of standards being released by the Minnesota Department of Education have even less of an environmental focus than what was previously included in the 2009 standards. Educators who may not be comfortable with environmental education need a vehicle that will at the very least, get them started introducing the idea of environmental education to their students.

The goal of creating plans for teachers to incorporate environmental education into curriculum is not only to get students outside and develop a connection to the natural world, but to allow them to develop a curiosity about the world around them and in turn be able to advocate for causes that need a voice. The units that incorporate



environmental education for each grade level will integrate easily with standards based curriculum. In addition they will give students a way to participate in hands-on experiences.

## **Context**

### ***Childhood Experiences***

Appreciating nature and how it works was instilled in me from childhood.

Growing up as a child of the outdoors, my curfew was the sunset. Rain or shine, warm temperatures, or temperatures so cold your breath was taken away as you walked out the door. My mom taught me bird identification skills as we sat by the window on frosty winter mornings. A female cardinal, blue jay, dark-eyed junco, and the difference between a chickadee and a nuthatch was learned at an early age. She also taught me the calls each bird makes, and often I can hear them and say what they are before they are seen. A whole flock of sparrows will rarely go unnoticed in the winter.

My dad taught me the differences between wood ducks and mallards, the difference of their shapes in flight and the sounds they make as they call. Although I never hunted with my dad, I learned about how hunting and fishing regulations are monitored and help keep populations in check. Fishing with my dad on the shores of Mille Lacs in the 80's, we watched over time how invasive zebra mussels took over our dock and covered rocks in front of our small chunk of property. We witnessed changes in the fishing regulations due to fish populations, and all the while watching the pelicans, water birds and bald eagles look for their next meal. When we first had our place on Mille Lacs, bald eagle sightings were few and far between. Today, eagles are a more

common sight along the lake shore, as they look for “floaters” as my dad calls them, when he refers to fish that have already met the end, or will shortly in the talons of a predator.

In sixth grade I attended Wolf Ridge Environmental Learning Center. This experience further fostered the appreciation of nature, as I can clearly remember feeling the texture of a freshly chewed tree from a beaver, the view of autumn colors from the top of a peak we hiked a long time to get to, the feel of actual wolf fur on a real live wolf, whose name was Cree. It was then I decided I wanted to be a science teacher.

### ***Professional Experiences***

My first teaching job out of college was at a charter school in the Northwest suburbs which had a focus on science and outdoor education. I taught grades five through eight, which included life, earth, and physical science. When debating with the idea of getting my masters degree, I could never fully commit on a master’s program until I saw the Natural Science and Environmental Education program at Hamline. After I had read through the program plan and goals, I knew this was it. This is what I wanted to do.

Through the course of the masters program, I had the privilege to attend classes led by Bryan Wood, the director of the Audubon Center of the Northwoods. He opened my eyes to the realm of possibilities of where this degree could take someone. The experiences in Brian’s classes included running through a field and laying down, just to see a Woodcock do it’s dance, walking through the woods to hear the calls of Barred Owls, freezing my toes off to identify different trees in the middle of winter, learning

how to tap trees for maple syrup, and listening to the deafening chorus of frogs that sang in the wetland. I soaked it all up. I breathed in all of the experiences that connected me to the earth, and was inspired by the inspiration in the natural beauty of how nature works. Connecting with nature is an inspiration in itself, reminding us that things are not always easy, the beauty is in the details, and to give thanks for what we have. For me, nature brings me back to myself. This is why it is important to me to include environmental education in middle school education and share that connection to nature with students.

One of the sites I am connected to is Sherburne National Wildlife Refuge, as it is close to my home. My family and I enjoy volunteering and hiking there, as well as adding information to iNaturalist on observations that we make. Each small act of environmental stewardship has an impact on research, making the world a better place, and teaching others about what we can do to ensure the beauty of the natural world is preserved for future generations.

I am sharing this love and passion for nature with my own two children. I see the wonder and amazement on their faces, and I think about what that must have been like for my parents to see from their perspective. When we randomly found an owl pellet one day in the yard under some pine trees, there was an instant science lesson on the kitchen table. Neighbor children were invited to join, much to the awed disgust of some of their parents, but it became a neighborhood science lesson. Many of them didn't even know what an owl pellet was!

Being a middle school science teacher, I see how students are excited to be able to go outside and do nature journal observations. I see how they are intrigued by the discovery of a spider's funnel web, about a nest they watch get filled with eggs, the baby birds inside of it, and the parents feeding the baby birds. I watch their nods of understanding when we observe the leaves change color, and then discover how that happens. We can make time to include environmental education into a middle school science curriculum as a way to promote a connection to the natural world.

### **Conclusion**

Environmental education has the capability to incorporate a multi-disciplinary approach to education, develop critical thinking skills and create opportunities for students to learn about the world around them. Creating plans that educators can easily incorporate into the curriculum provides a means to share the experience of the love of nature with students in a manageable way. Addressing the question *which middle school environmental education lessons aligned with science standards enable students to connect with the natural world* gives students a chance to have memorable moments involving nature that will stick with them into the future.

In chapter two, I will provide research of literature relating to environmental education including nature-deficit disorder and environmental education. Chapter two will also review Minnesota science standards as well as existing environmental education curriculums that tie into standards, and will discuss implementing and assessing environmental education. Chapter three of this capstone will provide a detailed explanation of the project, including explanations for format of lessons and context in

which an environmental education lesson would be used in a middle school classroom. Reflection on the project itself, along with my own personal journey of learning while completing this curriculum project will be discussed in chapter four.

## CHAPTER TWO

### Review of Literature

#### Chapter Overview

As discussed in Chapter One, I grew up a child of the outdoors and am concerned for the conservation of lands and species. Now focusing on science education in my professional career, environmental education is in the forefront of my mind as I work to inspire students to make a connection to the natural world around them. Providing experiences in nature for students can facilitate the opportunities to observe, wonder, and connect to the natural world. The purpose of this research is to answer the question: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?*

Being able to connect to the natural world, as described by Restall and Conrad (2015), means “understanding how people identify themselves with the natural environment and the relationships they form with nature” (as cited in Grimwood, 2018). These relationships can be a combination of emotional, mental, or physical interactions with the environment. According to Grimwood (2018), children’s connection to nature builds resilience and fosters their ability to care and connects to nature with a bigger picture in mind of the broader world around them.

Chapter Two will review literature behind the themes of Nature-Deficit Disorder, environmental education, science and environmental education standards, and how to implement and assess environmental education. Nature-Deficit Disorder will describe how, over time, children have been spending less time outdoors (Louv, 2008) and the

implications that has on their own health, and their relationship with the environment. The environmental education section will cover the positive outcomes associated with taking students outside the box of a regular classroom setting. Next, Minnesota state science standards and environmental education standards are discussed, as the standard requirements are part of the driving motivation for this research. Implementation of environmental education includes making connections to a place, age appropriate expectations, and role models for environmental stewardship.

Together, the literature reviewed will help guide the capstone project that will be used to develop curriculum units for middle school to enhance what is being done in the classroom to include components of environmental education while addressing science standards for the state of Minnesota. Therefore, researching both environmental education standards and Minnesota Science standards individually will help develop understanding of how they can be cohesively combined to connect students with the natural world while meeting learning goals. Finally, when assessing which programs and lessons educators can implement, there are proven elements of successful programs along with guidelines for how programs can be evaluated for quality.

### **Nature-Deficit Disorder**

Richard Louv is credited with defining Nature-Deficit Disorder as “the human costs of alienation from nature, among them: diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses (p. 36). Without exposure to the outdoors, students will lack the ability to build understanding and connections to the world around them. This will also result in students having a difficult

time developing their own personal story with nature. When students are able to explore their surroundings and make connections to establish their relationship to nature, it may “move their thinking towards the responsibility to preserve and conserve nature” (Roberts & Kruse, 2019).

Without the ability to build connections to the natural world around them, students may be faced with health implications such as obesity and mental health issues (Louv, 2008, pp. 47-50). In addition, when future generations spend less time outside, their limited connection with nature will lack understanding of how organisms in nature coexist. Ultimately, this will impact their ability to effectively bring about change regarding environmental issues.

In a survey conducted by Wood and Pennock (2008), over one hundred students were asked a series of questions regarding Nature-Deficit Disorder. Of the students surveyed, roughly 53 percent reported that they themselves experience Nature-Deficit Disorder (NDD). However, almost 86 percent of students surveyed reported that their peers had experienced Nature-Deficit Disorder. When asked if Nature-Deficit Disorder was a problem to be concerned about today, 85 percent of students responded “yes.” It is intriguing that students view their peers as having more of a problem than themselves. Even without realizing the need to resolve their own lack of nature experiences, they recognize NDD as a problem that needs to be addressed.

### ***Physical and Mental Health Implications of Nature-Deficit Disorder***

There has been a shift from a more rural culture to a more urbanized culture. As recently as the 1950’s, families had agricultural connections and children would expend



energy in physically constructive ways (Louv, 2008, p. 102). Children are spending their free time differently, and much of that time is devoted to digital devices. As homes throughout society have become more saturated with technology than ever before, students come home from a day at school to sit with screen time (Lowell, 2008).

According to Hofferth and Sandberg (2001) in “How Children Spend their Time,” the number of nine to twelve year-olds who participate in outdoor activities has declined by fifty percent from 1977 to 2003. Equally important, the amount of free play time children have has decreased by a total of nine hours per week over the last 20 years (as cited in Lowell, 2008). The Centers for Disease Control also found that the amount of television children watch corresponds directly with body fat, and that children ages six to eleven spend approximately thirty hours each week watching television (as cited in Louv, 2008, p. 47). According to the National Survey of Children’s Health in 2003, there is little discrepancy between students in rural versus urban areas in obesity rates (as cited in Lowell, 2008).

In 2004, Children’s Hospital and Regional Medical Center in Seattle stated that each hour of TV watched per day by preschoolers increases the likelihood of concentration problems and other symptoms of Attention Deficit Hyperactivity Disorder (ADHD) by age seven. ADHD is a disorder described with symptoms that include difficulty paying attention and following directions with tasks, listening difficulties, and impulsivity. Of the eight million children diagnosed with mental disorders in the United States, the most common is ADHD. In the United States, the medications used to reduce the effects of ADHD are used to treat symptoms are prescribed on a higher number of

patients than the rest of the world. The silver lining with this is that studies have suggested that nature may be a good way to minimize the symptoms of ADHD (Louv, 2008, pp. 100-102).

When students are affected with Nature-Deficit Disorder, they are lacking opportunities to connect with the natural world. Without connections to nature, students' ability to be able to identify issues or changes in their own environments would decrease, therefore environmental problems that may have been identified by community members or grassroots movements will continue to fall to the wayside. Grimwood (2018) states by ensuring regular access to the outdoors, relationships with nature that will result in positive outcomes for people and the planet can be accomplished.

### ***Summary***

In summary, nature-deficit disorder is becoming more prevalent as society shifts to a more sedentary lifestyle. The mental and physical effects that correlate to Nature-Deficit Disorder can be mitigated with exposure to the outdoors. Incorporating environmental education into curriculum can provide students opportunities to connect with nature, improving their mental and physical health as well as fostering future environmental stewards, which is discussed in the next theme.

### **Environmental Education**

According to Hungerford (2009), environmental education is “an interdisciplinary effort aimed at helping learners gain the knowledge and skills that would allow them to understand the complex environmental issues facing society as well as the ability to deal effectively and responsibly with them” (p. 2). With the alarming statistics of declining

mental and physical health in students in relation to nature-deficit disorder, schools can play a role in reducing negative implications of the disconnection to nature by incorporating environmental education into the curriculum (Louv, 2008). Introduction to nature through outdoor education includes benefits, such as boosted levels of attentiveness and engagement for learners, reduced stress, and increased physical activity (Kuo, Barnes, & Jordan, 2019).

### ***Goals of Environmental Education***

The National Council for Science and the Environment indicated that in order to meet the environmental challenges faced locally, in the country, and around the world, we need environmental education to be a fundamental approach to help with environmental protection (as cited in Potter, 2010). The goals of environmental education set by the Tbilisi Declaration are (as cited in Potter, 2010; Across the Spectrum, 2006) include:

- Fostering a clear awareness of and concern about economic, political and ecological interdependence in urban and rural areas.
- Providing every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment.
- Creating a new pattern of behavior among individuals and groups towards the environment.

To achieve the goals set forth for environmental education, there were also five educational objectives laid out including awareness, knowledge, attitudes, skills and

participation, which are often referred to as “environmental literacy” (Across the Spectrum, 2006). Environmental literacy is a complex web of building skills to make responsible decisions, analyzing multi-faceted relationship systems, and seeing many sides of a topic as a member of a community. This goes beyond rote memorization of facts in order to understand the interrelationships of systems and how they function as one (Excellence in Environmental Education: Guidelines for Learning, 2010). Due to the inherent goal of responsible citizenship as a part of environmental education, it should not simply focus on environmental issues, but rather educate for the environment, promoting critical thinking, collaboration, and local investigations (Short, 2010).

### ***Positive Outcomes of Environmental Education***

When students are given opportunities to participate in learning with tangible experiences in nature, they are using all of their senses, “which is the optimum state of learning” (Louv, 2008). In a 2019 report, Kuo, Barnes and Jordan indicated positive associations with incorporating nature into instruction that were “consistently positive across diverse student populations, academic subjects, instructors and instructional approaches, educational settings, and research designs.” In addition, outdoor experiences can have a positive outcome on academics, develop social skills and promote environmental stewardship (Kuo et al., 2019; Louv, 2008). James and Williams (2017), claim that “when learning is active, experiential, and applied in real-world contexts, it is memorable and more easily committed to long-term memory.”

Academic benefits from environmental education that have been reported by researchers include improved ability to focus on a task, a reduction in the symptoms of

ADHD, and boosted cognitive functioning (Kuo et al., 2019; Louv, 2008; Selhub & Logan, 2012). James and Williams (2017) conducted a study involving students at a school where environmental education was a spotlight learning method. In this qualitative study, middle schoolers who previously had difficulties with task completion were reportedly more focused and engaged while participating in outdoor activities. Other qualitative studies collectively indicated improvement of student abilities with perseverance, leadership, communication skills and critical thinking (Kuo et. al., 2019; James & Williams, 2017).

As well as academic benefits for students, nature can provide emotional and physical growth. By allowing social interactions, students are offered a chance to support each other as they work to identify a tree, or give emotional support as they try to overcome a fear of spiders by observing funnel webs. Students today have many stressors, and “nature experiences can relieve some of the everyday pressures that lead to childhood depression” (Louv, 2008). In addition to academic and emotional benefits of outdoor experiences, students who are walking outside, exploring areas, and making observations are being physically active (Kuo et al., 2019; Louv, 2008).

Finally, in research initiated by Tanner (1980) and studied by Chawla (1999), Corcoran (1999) and Palmer (1993), students who have a good role model that utilizes environmental education are more likely to learn an environmentally literate and active adulthood. This also included reading nature books to students and other tools for supporting student learning objectives. As reported by Birsdall (2013) and Gough (2008), “an environmental approach to science education can increase the relevance of

science to students' lives and motivate students to be effective producers and consumers of science” (as cited in Hayes, Wheaton & Tucker, 2019).

### *Summary*

Inspiring the next generation of citizens who are active participants in environmental issues as adults can be accomplished through environmental education. With academic, as well as emotional and physical growth that can develop as a result of environmental education, educators should incorporate environmental lessons into multi-disciplinary lessons into curriculum, which is sometimes difficult to do given time considerations of formal schooling hours. These lessons and projects can advance the goals of developing awareness for, and inspiring the need for, environmental protection and improvement needed in an environmentally literate citizen (Hungerford, 2011; Across the Spectrum, 2006). In addition to fostering scientific literacy, incorporating environmental education can aid in reducing the negative implications of Nature-Deficit-Disorder (Louv, 2008) by encouraging perseverance, leadership and critical thinking (Kuo et. al., 2019; James & Williams, 2017). By closely evaluating state and environmental education standards, educators can implement lessons and projects that encourage scientific literacy as well as allowing students to build connections to the natural world. The way the current standards for Minnesota are written, there are no specific mentions of incorporating environmental education into curriculum. By integrating Minnesota standards with an environmental education focus, lack of exposure to nature and the outdoors can be diminished, and the promotion of appreciation for nature can begin.

## **Science and Environmental Education Standards**

When beginning to think about incorporating environmental education into curriculum, educators must consider state standards, in order to meet required expectations of education. While environmental education standards do exist, the current state of these standards in many classrooms has been brushed aside, according to Berliner (2011), Blazer (2011), Cawelti (2006), Erskine (2014), due to the higher emphasis that is being placed on schools to be competitive per standardized test scores (as cited in James & Williams, 2017). In order to meet state requirements, educators need to be creative in tying state standards and environmental education frameworks together to achieve the many social, academic, and mental health benefits found while incorporating a connection to the outdoors. With the Minnesota Science Standards new draft being closely linked to the Next Generation Science Standards (NGSS), educators must understand how the practices of science education can combine with elements of environmental education in curriculum (Hayes et al., 2019).

Although the Minnesota Science Standards and Environmental Education Standards are set up entirely different, in a study by Hayes et al. (2019), several educators went through an institute where they developed learning experiences combining environmental education topics with NGSS standards. The NGSS “encourage project-based learning approaches and real-world problem solving that environmental education does so well.” Teachers worked for four months to be able to develop and implement a stewardship class project. It was evident in teacher feedback from the institute that the NGSS practices tied with environmental education learning experiences

offered students a chance to foster a deeper level of understanding in science concepts. One teacher reported, “The advantage to incorporating these new standards [NGSS] is that we now have much more liberty to justify our environmental stewardship project by demonstrating the integration and application of these standards.” Another teacher mentioned the ability to easily weave together the required standards and environmental facets that provide important elements and tangible experiences.

### ***Minnesota Science Standards***

The Minnesota K-12 Academic Standards in Science (2019) are currently under revisions, in the draft phase, and waiting to be approved by the Commissioner of Education. The standards are the “set of expectations for achievement in science,” that focus on ensuring that students become scientifically literate. According to the National Research Council (NRC, 1996) “scientific literacy enables people to use scientific principles and processes to make personal decisions of scientific issues that affect society” (as cited in MN K-12 Academic Standards).

Based on three dimensions of science understanding, the 2019 draft of the Minnesota Science Standards include: science and engineering practices, cross-cutting concepts, and disciplinary core ideas. These three core ideas are based on the foundational elements of NGSS. While the three dimensions have elements of performance expectations, they also set the stage for what students should know and be able to demonstrate. Students receive practice with science and engineering ideas involving the practice of scientists and engineers throughout their schooling with this first dimension. This section focuses on ideas pertaining to scientific method, as well as



design and engineering practices. The second dimension, cross-cutting science concepts, “connect knowledge from the various disciplines of science and engineering into a coherent scientific view of the world.” Disciplinary Core Ideas is the third dimension, where the different branches of science; physical, life, earth and engineering, technology, and the application of science to “provide an understanding of the world.”

Organized into standards and benchmarks, each grade level of the Minnesota State Standards builds upon a previous. From Minnesota Statute 120B.018, each standard is a “summary description of student learning in a required content area.” There are thirteen standards from kindergarten to grade twelve, and they are “grouped into four strands and eight substrands.” Benchmarks are, according to MN statute 120B.18, “specific knowledge or skill that a student must master to complete part of an academic standard by the end of the grade level or band” (Minnesota Academic Standards in Science, 2019).

### ***Environmental Education Standards***

Excellence in Environmental Education: Guidelines for Learning (K-12), are based on environmental education goals set at the Tbilisi Declaration and are designed to fit into education systems in fourth, eighth and twelfth grades; with many suggestions throughout the document on adaptations for other grade levels. The standards are divided into four strands: questioning, analysis and interpretation skills, knowledge of environmental processes and systems, skills for understanding and addressing environmental issues, and personal and civic responsibility. While supporting 21st century skills, the guidelines are closely connected to other disciplinary standards, and

was developed with the “input of literally thousands of teachers, school administrators, environmental educators, scientists, and parents.”

### *Summary*

In an effort to meet high state standard expectations, environmental education is able to facilitate the level of critical thinking skills through project-based designs that will enhance understanding of science concepts for students (Hayes, et al., 2019; James & Williams, 2017; Kuo et al., 2019). As stated, both the environmental education and the Minnesota State Standards may be set up differently, but one thing they have in common are elements of scientific literacy. Being able to address environmental and scientific issues that affect society is one objective that both sets of standards work to accomplish within each grade level as students progress with their schooling. Using both state and environmental education standards to develop curriculum for students, educators can help students connect to the natural world through environmental education while meeting state standards as well. There are many considerations to take into consideration when analyzing standards and benchmarks to decide where it is appropriate to integrate environmental education, which are explored in the next theme.

### **Implementation of Environmental Education**

When considering incorporating environmental education into curriculum, in order to foster an appreciation and understanding of nature, educators should encourage connection through a scientific way of learning (Grimwood, 2018). Students that come into science classes may believe that “nature can only be found in isolated locations” such as parks, prairies, or the forests. However, educators want to be able to encourage

students to develop an understanding that nature is not limited to remote locations, all the while making the connection that humans are a part of the system of nature in their own spaces at school, and where they live (Roberts & Kruse, 2019).

Broda (2002), states that educators should think about using the outdoors as a tool to facilitate learning experiences as experiences in the environment can be applied to many subjects while providing a foundation for teaching skills and attitudes that will grow an appreciation for the outdoors. Cole (2007), believes that understanding the ideas of environmental education are “culturally specific, not universal ideas.” There are many ways to create a varied approach that will be applicable to a student’s local community. Stated by Turner and Pei (2002), “an individual’s positionality or social identity shapes the way a person experiences and perceives the environment (as cited by Cole, 2007). When educators incorporate local themes into education in the outdoors, students will make meaningful connections, and “application of science concepts in a real life context is extremely valuable” (James & Williams, 2017). When incorporating environmental education into curriculum, educators should ensure students are making developmentally appropriate connections, use strategies for elements of success in environmental education, and be a model for environmental responsibility.

### ***Making Connections***

In Rachel Carson’s Book, *Silent Spring* (1956), there is a focus on being connected to nature in order to be able to understand it and begin to develop questions to inspire learning. Carson states, “If facts are the seeds that later produce knowledge and wisdom, then the emotions and impressions of the senses are the fertile soil in which the

seeds must grow” (p. 49). David Sobel (1996), offers the suggestion that young people be given time to “bond with the natural world, to learn to love it, before being asked to heal its wounds” (p. 9).

While making connections to the environment, discussions should identify both how nature influences the way humans and other organisms live as well as the coexistence with nature that will guide understanding towards preserving and conserving nature (Roberts & Kruse, 2019).

### ***Age Appropriate Expectations***

When identifying appropriate lessons for middle school students, it is imperative to meet students where they are at in a developmentally appropriate way. While the goal of environmental education is to develop an environmentally literate citizen who will make good decisions for future generations, being asked to solve the world's environmental crises in middle school is not the place to start. Rather, we should be allowing students to spend time getting to know the nature around them. “No tradegeties before fourth grade,” Sobel (1996) claims. When children start to enter their teenage years, it is an appropriate time to introduce social action. When Chawla was completing research for an article “Children’s Concern for the Natural Environment,” she found the two key factors that adults: time with nature as a child, and an adult who modeled environmental respect (as cited in Sobel, 1996).

With all ages of students, Louv (2005) and Wattchow and Brown (2011) state that it is beneficial to encourage unorganized exploration time outdoors prior to beginning a lesson. This encourages individual or small group questioning and observation time (as

cited in Roberts & Kruse, 2019). Young adolescents learn when they are able to interact with their peers and contribute to learning in hands-on ways. According to Vygotsky (1978), “cognitive development occurs for students when they interact with other people to provide the necessary learning to take place.” Bloom’s taxonomy (1981) classifies learning skills based on basic skills such as “identifying” to a set of more complex skills such as “analyzing,” where students have a better chance to demonstrate mastery of content (as cited in Warren & Flinchbaugh, 2003). As a way to enable students to connect with one another and with the natural world, learning outside fits the type of development appropriate for middle school, as students prefer active learning experiences and are curious and show desire to learn what they recognize as applicable in their lives (Wiles & Bondi, 2001, p. 36, as cited in Broda, 2002).

### ***Taking Students Outside***

Taking classes outdoors is a natural element in environmental education. For many teachers, taking classes outside of the normal classroom space is cause for concern over student safety and classroom management (Simmons, 1998). In *Moving the Classroom Outdoors: Schoolyard Enhanced Learning in Action*, Broda (2011), gives guidance on how to address these concerns. For effective classroom management, Broda indicates that the first step is establishing expectations prior to heading outside. Once outside, specifically inform students of where the activity is taking place while using the smallest area necessary to complete the activity. Other strategies that are effective is the use of a signal to gain student attention, as well as a meeting place to form a circle, rather

than a clump of students. Finally, use a time frame that is kept in mind for the progression of activity.

### *Environmental Responsibility*

“Conservation will fail unless it is better connected to people, and people start out as children who need to revere their connection to nature from a personal, rather than intellectual, viewpoint” (Lowell, 2008). Short (2010), emphasizes that educating “for” the environment with the goal of developing citizens who care about taking environmental actions also depends on the personal development of the individual. In addition,

No positive participation by young students should ever be discouraged, regardless of how insignificant the immediate environmental impact may appear to be. Children experiencing small-scale successes can become empowered and motivated for a lifetime of responsible actions on a larger scale. (...) [W]hen resulting from engaged, student-led investigations and planning sessions, the local participation may improve odds for acquisition of the precursors to adult, responsible behaviors. Although the most effective environmental impacts might be the ambiguous end goal, limiting the range of actions for youth could considerably restrict vital experiences shown to be important for mature and significant actions later in life.

If action is the goal of learning about the environment, then the action that is desired as an outcome of environmental education of “that which maintains or improves conditions necessary for ecosystem stability, biological diversity and abundance” (Short,

2010). Five outcomes of teaching environmentally responsible behaviors, classified as either public or private sphere actions, were identified and researched by Monroe (2003), who reviewed the works of Stern (2000), and Winther, Volk and Hungerford (1994). The first public behavior includes actively participating in environmental activism. The second public behavior includes “non-activist political behaviors,” such as donations, joining an organization, or voting. Consumerism is the third behavior, classified as a private sphere, and this includes purchasing items that would be environmentally friendly. Actions such as putting up bird houses, participating in wildlife counts, and planting native species in a rain garden would qualify as what is called ecosystem behavior.

### ***Summary***

When implementing environmental education, connecting student lives to the natural world in the surrounding community in which they live offers the connection needed to establish a bond with nature (Cole, 2007). Especially for middle school students, spending time in nature with a positive role model (Sobel, 1996) that can identify and develop questions to encourage learning in a collaborative way can have a chance to master science content by developing a connection to analyzing the world around them. The next theme examines evaluation of whether or not the activities students participate in are successful in developing scientifically literate and environmentally conscious citizens.

### **Assessment of Environmental Education**

Environmental education programs should be evaluated to ensure high quality lessons and units are utilized to enhance student learning experiences. If educators are able to design a program that is well thought out and incorporates state as well as environmental standards, students have the potential to learn about the environment, but also about “human-ecosystem connections, science and other subject matter, ... also about enhancing environmental and social connection, self-efficacy, motivation, curiosity, and inspiration” (Powell, Stern, Frensky & Moore, 2019).

### ***Elements of Success***

The North American Association for Environmental Education (NAAEE) developed *Environmental Education Materials: Guidelines for Excellence* (2009), that is a set of recommendations for “developing and selecting environmental education materials.” These guidelines were developed by a team of “environmental education professionals from a variety of backgrounds and organizational affiliations.” The group took on the challenge of developing guidelines from ideas that would prove to be usable, with input from teachers, administrators, environmental scientists, and curriculum developers over a series of revisions. The NAAEE guidelines provide a way to look at existing materials and as new materials are being developed through six different characteristics that are accompanied by indicators that give examples of what to look for. The NAAEE published the guidelines to “promote the use of balanced, scientifically accurate, and comprehensive education materials and programs that advance environmental literacy and civic engagement.”



The six guidelines from the NAAEE include fairness and accuracy, depth, skill building, action orientation, instructional soundness, and usability. The NAAEE states that materials should present the diverse environmental problems and issues in a factual way that is open to inquiry. The depth of these materials should be set at appropriate developmental levels while fostering an awareness of the natural world. The materials should apply skills that contribute to life-long learning that enable students to think creatively about addressing environmental concerns. These skills then translate to promoting a sense of personal connection to bettering one's community with action orientation. An effective learning environment, as described by NAAEE relies on strategies to create a learning environment such as learner-centered instruction, allowing students to make connections to their lives, is focused on goals and objectives with assessment of student understanding. Finally, the materials should be implemented easily with a design that is logical, adaptable, and fits with state, local, or national requirements.

### *Assessment of Programs*

Theodore May (2000), completed research that helps to define teaching environments along with teaching conditions and practices that are conducive to successful environmental education programs. In May's study, 500 environmental educators from various parts of the United States were surveyed to assist in defining variables that collectively result in a successful program, and the resulting framework from the study is flexible for a wide range of academic settings that individual teachers can use to improve their practice. The three overlapping categories included teaching conditions, teacher competencies, and teaching practices. Educators surveyed rated the

teaching conditions necessary for highly effective environmental education to include flexible curriculum and a collaborative learning environment. For teacher competencies, the top three rated skills were listening and questioning skills, the use of diverse educational strategies, and the ability to be resourceful in accessing curriculum materials. Lastly, the teaching practices that resulted in the top three were the use of personal and student strengths and passions, experiential teaching orientation, and cooperative and inclusive learning.

In research that identified environmental education outcomes for adolescents in the twenty-first century (EE21), Powell et al. (2019) developed a survey for fifth through eighth grade students of six different environmental education programs in both urban and rural locations. The researchers reviewed existing perspectives of outcomes for environmental education, including environmental literacy, positive youth development, academic achievement and twenty-first century skills.

As a result of the EE21 survey, the researchers identified twelve factors that proved to be relevant in identifying outcomes of environmental education programming. The factors studied include enjoyment, a connection to place, interest in learning, twenty-first century skills, self-awareness, self-efficacy, environmental attitudes, action orientation, motivations for stewardship, motivation for collaboration, and motivation with school. From this work, the survey can be adapted and incorporated in multiple settings for evaluation purposes, not just for specific programming. While there are limitations with the survey such as social desirability and age appropriateness of length

and question format, this survey could be used in multiple types of environmental education programs.

### ***Summary***

When choosing programs, lessons, or units of study in environmental education, it is important to evaluate whether or not these programs not only work toward the goal of environmental education, but promote outcomes of state standards. Many environmental education standards can enhance connections to local places while being able to meet requirements of state and local standards (NAAEE, 2009; May, 2000; Powell et al., 2019). Part of investigating middle school environmental education lessons aligned with science standards includes evaluating quality environmental education programming and quality teaching strategies that promote student motivation for learning while developing connections with the natural world.

### **Conclusion**

This chapter reviewed the literature on Nature-Deficit Disorder, how environmental education can benefit students, how standards in science and environmental education are set up, how to implement standards into curriculum, and how to assess environmental education materials for quality. It is an educator's task to ensure environmental education lessons incorporated into curriculum build connections with nature using successful strategies. By facilitating growth in learning through experience while building connections to nature, implementing lessons that allow for students to learn in an optimal way, and ensuring quality lessons and units are being implemented, educators are encouraging learning in a way that builds a connection with

the natural world while being a role model for future environmental stewards. Chapter three will identify lessons that can be implemented into middle school curriculum standards to help foster a connection to the natural world.

Chapter three will provide a detailed explanation of the project addressing the question: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?* A lesson outline for nature journaling, as well as a description of lessons that can be used in middle school will be supported by explanations of setting and participants, as well as research theories the project utilizes will be included in the following chapter.

## CHAPTER THREE

### Project Description

#### Chapter Overview

This chapter provides a full description of unit plans that will address science and environmental education standards for middle school students. The unit plans will utilize environmental education strategies that promote connections to a student's natural world around them while being linked to Minnesota science standards. Incorporating nature into instruction has been shown to have positive outcomes within multiple subjects, diverse populations, and educational settings (Kuo, et al., 2019). In addition, experiences in nature can have a positive outcome on academics, provide social skills development and promote environmental stewardship (Kuo et al., 2019; Louv, 2008). The purpose of this capstone is to complete the research question: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?*

Chapter three will discuss the rationale behind the capstone unit plans including supporting evidence for the benefits of environmental education. The curriculum design model will use the Understanding by Design framework, and provide a unit outline template for each of sixth, seventh and eighth grades as well as the nature journaling activities. The timeline, setting and participants, and assessment of the benefits of connecting with nature within science curriculum will also be discussed.

## **Rationale**

Research indicates that students benefit academically, physically and with emotional growth when environmental education lessons are implemented. These lessons also provide social skills development and promote environmental stewardship (Kuo et al., 2019; Louv, 2008). The unit plans contained in this capstone are intended to promote student's connections to the natural world while meeting requirements of Minnesota state science standards. Allowing students opportunities to connect with the natural world will advance the goals of developing awareness for and inspiring the need for environmental protection and improvement needed in an environmentally literate citizen (Hungerford, 2011; Across the Spectrum, 2006).

While taking students outside for nature journaling in my 6th grade classroom, I observed students that were engaged with learning and understanding new concepts. We looked at dew on a spider web, and discussed how it formed. While doing so, students observed a spider in a funnel web, and we talked about different types of webs we have seen. This led to further studies on different types of webs and spiders, something that normally most people have aversions to. Learning to understand and accept the things that sometimes we think may be scary does not just apply to things in nature, but to life in general.

I have always been amazed at how students come into the classroom with no idea about how many different types of trees there are. After careful observation, the number of different types of trees they are able to identify dramatically increases! Then comes the questions about what trees are native and what that means, as well as invasive species

education. Involving students in topics that are interesting to them, and they can develop an awareness of different environmental topics in the community not only connects students to their local habitat systems, but provides opportunities to appreciate species that may otherwise go unnoticed. In addition, when my students have come back in after being outside to make observations, they are more attentive in class after getting a breath of fresh air. Making observations in nature notebooks is something students look forward to, and will remind me about doing because they want to. By creating these unit plans, the focus will be to integrate environmental education in to all grade levels at the middle school level.

### **Curriculum Design**

The unit plans for this capstone are based on Understanding by Design (UbD) curriculum frameworks, outlined by Wiggins and McTighe (2011). In this design method, units should be planned backwards to be able to have a clear understanding of what students should achieve with their learning (p. 7). With the use of essential questions, the learning objectives are clear to the students and will serve as a way to facilitate an active learning environment for students (p. 15). Student understanding is developed with teachers as coaches of learning through the use of big ideas to make meaning of learning. Then, students are able to apply that learning within new contexts (pp. 3-4). Students are engaged in active learning when they are able to create meaning and make sense of information by using inferences and making connections. In addition, students should be able to then transfer this knowledge independently in new situations (pp. 102-105).

In a successful unit plan, all learning goals build from knowledge and skill to transfer and meaning. The identified goals are structured with open-ended essential questions that build on ideas to get students to the part of learning where they are able to draw upon what they have learned to autonomously apply skills in real-world situations (pp. 65-68). See Appendix A for a modified version of the UbD unit plan goals template that was used to construct unit plans used in this capstone project.

### **Project Description**

Each grade level is focused on a particular aspect of environmental education that is tied to the state standards. In addition, there is a commonality among each grade level with the use of nature journals as a way to track seasonal changes over time that is connected to Minnesota state standards, as well as environmental education goals. The grade level unit plans are designed to span approximately two weeks during a sixty minute class period. Nature journaling will be continued throughout the school year at each grade level.

### ***Nature Journaling***

The essential question that formed the work to be done in nature journaling at each grade level was: What do people do to help them understand their environment? Teaching through the use of nature notebooks can connect to science literacy skills, no matter the science content caught. In addition, linking nature journaling to classroom activities allow students to develop connections to the environment (Cormell & Ivey, 2012).



By using the connected piece of nature journaling at each middle school grade level, nature will be the text. Students will seasonally experience local flora and fauna and observe the active living things in nature in a place close to them (Weber, 2018) which will not only get students outside more often, but improve the impact of environmental education. Nature journaling can develop skills for students, according to Walker and Roth (2000), that can improve writing, drawing and critical reflection skills. In addition, students can also benefit by being able to paraphrase and critically reflect while developing a sense of place (as cited in Warkentin, 2011). See Appendix B for a nature journal template design.

### ***Project Learning Tree***

Project Learning Tree (PLT) (2019), has many activities that correlate with state and national science standards. Many lessons are multi-disciplinary and provide storylines to group activities around a central focus (p. 4-5). This base for learning is also how the new draft of the Minnesota Science Standards are set up. In addition, PLT helps develop science skills that will develop an awareness and appreciation for the natural world such as observing, classifying and categorizing (p. 5). One of the main goals of PLT is to teach students how to think, not what to think, along with supporting the overall goals of environmental education to support the mission of advancing environmental literacy and promoting environmental stewardship (p. 3).

### ***Sixth Grade***

The essential questions forming the backbone of work for sixth grade will be:  
How does climate affect living systems? This essential question will meet the Minnesota

science standard 6E.1.1.1.3 “Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.”

Climate change is a challenge that faces our planet today. According to Project Learning Tree’s Carbon and Climate, a project of the Sustainable Forestry Initiative, (2020), not everyone agrees about the severity of the effects of climate change and the effects it has on people and the environment. To address the topic of climate change, science teachers can educate students to accurately read and represent data while engaging critical-thinking skills.

### ***Seventh Grade***

The essential question that will form the foundation of the seventh grade unit will be: Why are trees known as the lungs of the earth and how do trees adapt to their environment? The lessons will tie in information on photosynthesis and energy flow in an ecosystem. These lessons will address Minnesota science standard 7L.3.2.1.2 “Construct an explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.”

### ***Eighth Grade***

Students in eighth grade will focus on water, and connections will be made to elements, thermal energy, and temperature. The essential question that will guide the learning of the unit for eighth grade will be: How do the properties of water play an important role in the earth’s system? The essential question will address Minnesota science standards 8P.1.1.1.1 “Plan and conduct an investigation of changes in pure

substances when thermal energy is added or removed and relate those changes to particle motion.”

### ***Assessment***

The goal of the unit plans is to enable students to develop deeper connections to the natural world. A survey given to students prior to and after the use of a curriculum can help gauge the effectiveness of the level of connection with the environment (Murphy, 2011). The survey uses three question categories from Powell’s environmental education outcomes for adolescents in the twenty-first century (EE21) survey (2019). The question categories included on the survey will be learning, environmental attitudes, and environmental stewardship. The questions used will be able to help determine the effectiveness with the use of the learning units as well as nature journaling. See Appendix C for the questions and response choices that will be included in the capstone project.

If the unit plans meet the goal of the intended purpose of allowing students to develop connections to nature, the surveys should indicate an increase in understanding of environmental interrelationships, and a deeper understanding of the environment that will encourage environmental stewardship.

### **Setting and Participants**

The unit plans contained in this capstone were written for a middle school setting for students in grades six, seven, and eight. The units could be used in any middle school science classroom. While specific Minnesota state standards were tied into lessons within each unit, these standards are based on Next Generation Science Standards

(NGSS) and with some slight modifications, could be used in other states as well. While the nature journaling component of the units is the same throughout each grade level, it can be modified to meet the needs of other grade levels.

### **Timeline**

The timeline for this capstone is two semesters. The development of background information and literature review was completed between February and May of 2020. Unit plans were developed and a reflection was completed by August of 2020. The nature journaling unit and slides were outlined and developed first, with the use of the unit outline template. The grade level units were planned next, using the unit plan template as well, along with the creation of Google slides for each unit. The content reviewer was able to provide feedback and suggestions for improvements, and modifications were made to include guest speakers and other experiential learning opportunities for students during the drafting phase of the unit plans. Another revision to the slides included student information pages in order to better develop the background knowledge for students about the topics of trees, climate, and water.

The surveys used at the beginning and the end of each unit were developed last, with the overall goals of connecting students to the natural world as well as meeting science standards as a focus for the survey questions.

The capstone was completed and presented in August of 2020. Presentation of the work was completed in a format that would demonstrate for fellow educators how to use the resources developed. The curriculum designed in the project will be used starting with the 2020/2021 school year. Limitations to the implementation of the curriculum

would be what format learning is delivered in the fall of 2020. This is a curriculum that is designed to be taught in person, and the use of this in an online or hybrid format will need to be modified. In addition, the time limitation of two weeks for each unit does not allow much time for students to be able to better connect with the natural world. The nature journaling at each grade level will work to solve this, but more units could be developed in the future to foster a deeper connection for students.

### **Conclusion**

This chapter uses a description of the curriculum that will be developed to answer the research question: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?* As previously explained, connections to the natural world will help facilitate collaboration among students and help develop connections to the natural world through observations and units of study. Research supports that engaging students in environmental education will result in academic, social and physical benefits (Kuo et al., 2019; Louv, 2008). The middle school setting will be a focus of the participants in the curriculum, as well as how the effectiveness of the curriculum will be measured. Chapter four will include a reflection of the curriculum writing process and will describe the plan to use the curriculum.

## CHAPTER FOUR

### Conclusion

#### Chapter Overview

The development and creation of this capstone project was to make an effort to compile a curriculum for middle school students that would give them opportunities to connect with the natural world. By using environmental education activity guides, completing research, and brainstorming with colleagues, I was able to create a combined sixth through eighth grade nature journaling experience, as well as a unit for climate, trees, and water. Allowing students opportunities to explore the world outside of the four classroom walls will help develop a connection to the environment around them.

The fact that students today are spending less and less time outdoors versus indoors is one that I could no longer look past. Developing an opportunity for educators to take the time to teach how the little things are connected to the big things within a living environment, my hope is that the capstone will provide inspiration to students to want to know more about the world we are a part of. Lessons that are grounded in foundations of environmental education will allow students to meet standards in this area, as well as state standards. The intent of this project was to answer the research question: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?*

This chapter will cover discoveries in the undertaking of this work as a researcher, writer, and learner; and how this work was beneficial to me in developing a deeper

understanding of the importance of being able to connect students with the outside natural world. Also included in this reflection will be the implications of work in a professional setting, and the limitations that may exist in implementation of the unit plans. I will also discuss how this project will be communicated with fellow colleagues, and how this work will benefit science teachers and students. Lastly, I will cover future project ideas such as a continuation of environmental education inclusion with middle school students.

### **Research and Project Creation**

The literature surrounding the many positive impacts of environmental education, and the lack of inclusion of environmental education in the formal classroom setting helped support the concept of including environmental education as a way to teach in the middle school setting. To begin to understand how to best meet requirements for environmental education as well as Minnesota state science standards, I examined both documents closely. Due to the primary focus of connecting students with the environment, I also examined the lack of nature exposure, as well as what the goals of environmental education, which helped frame the selection and inclusion of nature journaling and unit topics for each grade level. This research was done to ensure that lessons could be used to not simply meet standards, but address the overall goals of environmental education which include developing awareness of issues along with attaining knowledge and skills to protect the natural environment.

Completing the research portion of the project introduced me to many new authors and work that I had not read before, which expanded my knowledge base, as well

as opened my eyes to additional works that have since been added to my reading list. One such author is Robin Wall Kimmerer, who authored *Braiding Sweetgrass*. In this book, Kimmerer ties together indigenous knowledge with scientific facts about plants. I believe expanding my knowledge base on these wisdoms will not only help me share this information with students, but this is also an important part of history, that is largely the untold story in education. This project also helped me to review the work of Richard Louv, and his work *Last Child in the Woods* was the foundational piece of beginning my research project. All of the research I found was in support of taking students outdoors to experience nature in some way. With all of the supporting literature, this led to the creation of a reflective nature journaling piece for all grade levels, as well as a unit for each grade level in water, climate, and trees.

When writing the lesson units with the Wiggins & McTighe (2011) Understanding by Design (UbD), discussed in Chapter Three of this paper, it was evident that using backwards planning and forming essential questions to shape each unit would prove valuable. The main focus of this project is to better connect students to the natural world while meeting standards. The pre and post assessment, although informal, can serve as a reflection on how to improve units in the future. While planning each unit and student learning experiences, it became evident that the teacher would need a guide of some sort to follow, so the formation of Google Slides that accompany each unit took formation that follows each unit plan. This was an unexpected addition to the unit plans, but one that ultimately will better serve the students and teachers with communication of expected learning outcomes and activities.



While completing this project, the idea of being connected to the natural world was always at the heart of lessons that were chosen, activities that students could be a part of, and readings that were to be included. When the main focus of implication of a project is to connect students to the natural world, there are also broader overarching intentions that are significant for the future.

### **Implications**

I have heard in discussions with other environmental educators that people take care of what they care about, and care about what they know about. It is my hope that the implication of this project is not only to get students to know about the natural world around them, but to inspire them to care about it, and then encourage them to take care of it. Developing knowledge through the use of nature journaling, as well as the topics of trees, climate, and water are some of the biggest topics that face crisis in our environment. As David Sobel (1996) has written, it is important “that children have an opportunity to bond with the natural world, to learn to love it, before being asked to heal its wounds (p.9).” If a connectedness to the natural world is the ultimate goal, we need to provide time in which to allow students to develop a relationship with the environment.

Implications for educators may be to get them a bit out of their comfort zone and learn something new as well. I will, without a doubt, be out of my comfort zone presenting this information to my fellow colleagues and in answering questions they may have about incorporating environmental education into our middle school curriculum. Even so, what will push me to overcome those fears of being out of a comfort zone is the desire to share what I have learned and influence others in a way that will emphasize

citizenship and environmental stewardship. However, time is the key word in writing curriculum and asking teachers to be able to incorporate environmental education into curriculum, which is just one of the limitations this project faces.

### **Limitations**

At first thought, when asked to include environmental education into the curriculum, many educators will make the claim that there is not time for such activities. With a culture focused on standardized testing, teachers tend to want to make sure they are using class time to cover material. Implementing this project would require planning as a middle school science department. Obviously, all of the teachers wouldn't want to take their classes out observations at the same time on the same day, as you would have roughly one third of the student population outside. Since one of the thoughts behind nature journaling is to observe with the senses, this can be hard to do with so many out at once. However, once we establish guidelines and a routine with students, the when and where issues should easily work itself out. Unless it rains. Yet, teachers have always been good at adapting.

An additional limitation to this project are the units themselves. Being that each grade level unit only lasts two weeks, that does not allow much time to connect with the topic on a level needed to cultivate a deep relationship with each of the three components. Nature journaling will allow for students to keep track of observations throughout the year, but this requires time dedicated to that purpose at least once every two weeks. This is often something that can easily be brushed aside for various reasons, so it is imperative that students continue the journal observations.

In order to implement the nature journaling for this project, a team of middle school science teachers would need to coordinate outdoor activities so that students and teachers knew who was going out when. Having a plan in place to allow the staff to understand who was using what area when will avoid having too many people in one place at one time. Furthermore, answering questions about going outside, having emergency plans in place, and bringing a radio or phone to communicate with office staff may be necessary.

Having students take both pre and post surveys would facilitate in planning any changes necessary to the units, as well as ways to make improvements. This would also allow teachers to change over time in student responses to measure the effectiveness of the unit plans. For the grade level unit plans, grade level teams could meet to discuss strategies for implementing the units.

### **Benefit to Profession**

Understanding how to analyze and incorporate environmental education into middle school science curriculum, teachers can work to help students develop not just academic knowledge, but life skills for caring for the environment in the future. Taking students outdoors can help build relationships and connect students with a part of themselves they didn't know they were missing. Providing educators with a solution to help integrate environmental education into curriculum will merge something that needs to be done with something that should be done.

When students are involved with environmental education, the time they spend indoors can be reduced, and skills such as questioning, analyzing, interpreting, reasoning

and problem solving can be practiced. Cognitive and behavioral benefits of exposure to nature and time spent outside can improve student attentiveness when they are inside the classroom. Additionally, when students are learning about the world around them, it can promote a sense of place in the community, and inspire them to move to action in bringing a community together with a sense of stewardship.

Not only does environmental education give a foundation to respect for the environment, but it provides connections to many standards of education that can be combined for a collaborative curriculum planning among language arts, art, math, social studies, physical education and science teaching.

### **Future Projects and Recommendations**

While this project contains a thorough unit for nature journaling, the additional grade level unit plans could be extended to incorporate a more in-depth study for a longer period of time. Due to the fact that I teach 6th grade students, I can visualize a whole year's worth of state standards being merged with environmental education to provide a complete curriculum for 6th graders that meets state standards while having an environmental education focus. Also including other subject area teachers to form a comprehensive unit with ties into each class would be a benefit for students to see that their learning has connections into multiple subject areas.

In addition, in order to help facilitate a deeper connection to the natural world, including local history and perhaps, for sixth grade, a connection with social studies as a collaboration for landforms and geologic history of place could be included. Making something more pertinent to a student's own surroundings is an impactful way to create

connections with a sense of community and place. Lastly, allowing students to explore their own questions that arise from units of study can be a powerful tool to help facilitate skills needed for lifelong learning.

### **Conclusion**

This capstone project has allowed me to explore the focus question: *Which middle school environmental education lessons aligned with science standards enable students to connect with the natural world?* My own experiences of being outside and connecting with nature, as well as supporting literature for how beneficial outdoor experiences are for students has driven the work in this project. I have created unit plans for nature journaling as well as a unit plan for each middle school grade level and look forward to implementing, improving, and collaborating with others in providing students with an opportunity to better connect with the natural world.

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**Appendix A**  
**Unit Plan Goals Template**

Unit Topic:	
Grade(s):	Time Frame:
Essential Question(s):	
Minnesota State Standards:	
NAAEE Guidelines:	
Key Understandings:	
Learning Events:	
Day	Classroom Activities Summary

**Appendix B****Nature Journal Outline Template**

Date: \_\_\_\_\_ Time: \_\_\_\_\_ Temperature: \_\_\_\_\_

Weather: \_\_\_\_\_ Cloud Cover: \_\_\_\_\_ Wind: \_\_\_\_\_

Location: \_\_\_\_\_ Moon Phase: \_\_\_\_\_

Observations:

What this makes me think of...

Questions I have...

One new discovery from today:

## Appendix C

### Pre and Post Assessment Questions

Category: Learning

Question: How much (do you know about) did you learn about each of the following things as a result of (nature journaling, climate unit, tree unit, water unit)

Anchors: on a linear scale from one to five, with one being nothing at all and five being a huge amount.

Items:

- How different parts of the environment interact with each other
- How people change the environment
- How changes in the environment can impact my life
- How my actions affect the environment
- How to study nature

Category: Environmental Attitudes

Anchors: Not at all, somewhat agreed, strongly agreed

Items:

- I feel it is important to take good care of the environment.
- It is important to protect as many different plants and animals as we can.
- Humans are a part of nature, not separate from it.
- I have the power to protect the environment.

Category: Environmental Stewardship

Question: Did this... make you any more likely (How likely are you to) to do any of the following things within the next year?

Anchors: no more likely, somewhat more likely, way more likely

Items:

- Help protect the environment
- Spend time outside
- Talk with my family about ways to protect the environment