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Using Dr. Howard Gardner's Theory Of Multiple Intelligences To Connect 4th-8th Grade Students To Nature

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USING DR. HOWARD GARDNER'S THEORY OF MULTIPLE INTELLIGENCES TO CONNECT 4TH-8TH GRADE STUDENTS TO NATURE

by

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"If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in."

– Rachel Carson

"It's hard to imagine how this next generation is going to save the environment if they haven't actually spent time in it."

– Unknown

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CHAPTER ONE

Introduction

How do you view the natural world around you? How did your experiences as a child or young adult influence your perception of nature, the environment and your connection to it? Ask these questions to a room of people and you are likely to receive a variety of unique responses. Some of us have strong connections to the outdoors, established before we can even remember their origins. Others can pinpoint the specific moment or experience: a memorable camping trip with friends or family, reading a powerful book or poem, or watching an award-winning nature documentary. People perceive the world around them in different ways, build relationships through different experiences, and have certain preferences for how they learn and create memories. In fact, there is a theory that defines these intellectual preferences, which are referred to as "multiple intelligences." Herein lies the purpose of my capstone: ***How can we use the theory of multiple intelligences to connect 4th-8th grade students to nature?***

Climate change, wildlife exploitation, urban sprawl, natural resources conservation, waste disposal—these are just a few of the environmentally-related issues that are some of the most current hot-button topics, both in our country and internationally (Kukreja, 2017; Ketti, 1998). Generations will continue to deal with these situations in the future, many on an even greater and more urgent scale than any previous generation before them. Therefore, it is important to connect individuals, especially youth, with nature and the outdoors so that we can have an environmentally-conscious

society that better understands and connects with these issues and is therefore more prepared to deal with them.

My capstone project focuses on creating a diverse curriculum that will engage students in grades 4-8 with nature and the environment through activities that utilize multiple intelligences (Gardner, 1983). Multiple intelligences have been implemented in a number of formal classroom settings for decades, but research on how they have been used in the environmental and outdoor education fields is limited. The curriculum will primarily be used in a non-formal environmental education center where I work, but will be adaptable to a variety of environments and time constraints, and will include activities designed so that even educators with a limited science background and experience will be able to use them effectively. The curriculum fulfils education standards as defined by the Minnesota State Academic Standards established by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO).

This first chapter reflects on the events in my life, both personal and professional, that have influenced my passion for the environment; I also asked others to share the experiences that helped shaped their interests in nature and the outdoors. While chapter one briefly touches on the importance of nature and how our connections and experiences with it influence our beliefs, behaviors, mental and physical health, and policies, these benefits are more thoroughly explored in chapter two.

Personal Background

Growing up in a small town in Wisconsin, the natural world was deeply woven into our community. The beautiful Kinnickinnic River was a central feature of my

hometown, and I spent many hours after school and during the summers exploring the ponds and wetlands of "the Kinni" watershed, observing the seasonal changes and how they affected the animals that lived there. I found a natural inclination towards science and biology, fueled by regular trips to the Minnesota Zoo and Science Museum of Minnesota and participating in school organizations like Odyssey of the Mind. My family also helped cultivate a connection with the outdoors through time spent at our family cabin, camping trips to local state parks, and long summer road trips to national parks like Yellowstone, the Grand Tetons, and Glacier. Through middle and high school these early, positive experiences with nature matured through participation in Boy Scouts, church trips to the Boundary Waters, and school canoeing trips on the Namekagon River. Knowing that I wanted to pursue a career that involved science and the environment, I attended the University of Wisconsin – Stevens Point, a school with a long history of excellence in the science and natural resources disciplines.

After graduating from Stevens Point with a biology and chemistry degree, but without any clearly decided post-college plans (except for knowing that I was not ready to jump into the research field or enroll in a Master's degree program), I applied to a 12-month fellowship at Eagle Bluff Environmental Learning Center in southeastern Minnesota. Eagle Bluff is a non-profit residential environmental learning center (RELC) that offers overnight and day-use programs for K-12 students and adults focused on science, adventure, and cultural topics.

This was my first exposure to the field of environmental education. Suddenly I was getting to take kids outside to do all of the same things that I loved to do as a kid—explore the woods, catch animals in ponds, go canoeing and hiking—and there was an

entire career field based on this! Eagle Bluff was an opening that led to similar opportunities around the country and internationally, all focused around a common theme: teach students about science and the environment using the actual outdoors as a classroom.

Other's Experiences

Having worked in the field of environmental education for many years, I have met a lot of people who have also chosen to pursue a career in the outdoors. I decided to conduct an informal study and ask them about the people or experiences in their life that influenced their current passion for the environment. I sent out a group email asking them to reflect on the question "*What childhood experiences shaped your interest in nature and the environment?*" with the caveat that their identities would remain anonymous (so they would feel more comfortable sharing personal information). I received a number of responses back. Some of those who responded credited early exposure and familial influence as important factors:

- *We spent a lot of time hiking in State Parks and attending interpretive programs as a family. That sparked my interest and was fed by science classes (5th grade and up) that I found very enjoyable.*
- *As a family, every summer we would go to Voyageur's [National Park] and camp for three nights. The appreciation and joy I got from those trips likely pushed me toward an environmental field. Other family vacations were always centered around NPs as well. Yellowstone, Glacier, Redwoods.*
- *Family vacations. My parents made sure that when we went on vacation it was to places that allowed us to get away from the hubbub of everyday life and away*

from the crowds. We spent an enormous amount of time hiking and visiting the beautiful natural spaces around us. As a kid, I didn't appreciate it because I wanted to go where my friends were going but as an adult I could not be more appreciative. Those trips taught me to appreciate the quiet and taught me to take a step back to enjoy the beauty around me both big and small.

- *Family camping trips (parents get credit for this), playing outside (with friends), Boy Scouts (Dad volunteered a bunch of time and money to make this possible), working at camp (ages 14-21), and volunteering at a nature center in high school.*

Other's interests formed later, as young adults through school programs:

In high school, I was accepted into our school's Summer Science Institute program between Junior and Senior year. 24 students and two teachers piled up in a school bus along with a van and trailer and headed out west for three weeks of tent camping and learning in national parks. The program was a biology and geology trip where we got to learn about these subjects while being surrounded by the things we were studying. It remains to this day one of the most formative experiences I had that helped direct my path.

Some responded to the kinesthetic and physical opportunities afforded by nature:

- *Growing up we always played outside and I was really into climbing trees. We had this great big maple tree that was perfect for climbing. We also went camping at a campground where my siblings, cousins, and friends would run around like a bunch of hooligans.*

- *I believe what helped shape my interest in nature when I was younger was unstructured time spent outdoors such as building forts, climbing trees, etc. Once I became older, learning about the different processes of organisms in biology and science classes helped to grow a deeper appreciation for the outdoors and all that lived there.*

Finally, one was engaged via literary means:

> *For me, I didn't really have any concrete experiences (that I can point to at least) with the outdoors until high school. I had done the occasional backpacking or fishing trip, but they didn't manifest in my ethos or actions until far later. What I would say changed things for is in senior year, I read A Sand County Almanac for a class assignment. After that, it was a new world I was living in. I was inspired to go outside, ask questions about the outdoors, and perhaps most importantly seek to protect and enhance the natural world. For the first time, I felt tied to a place. Within a year I was happily signed up to major in Environmental Studies, and was set down the path I'm on now. I could go on much more, but I think in short, my experience speaks to the power of books, literature, and philosophy in the formation of (modern) 'environmentalists.' Leopold gave me the very rough etchings of a worldview, of which nature stood at the center.*

These responses from my friends, family and co-workers supported the idea that there are many different pathways for people to develop a connection with nature and a passion for the environment. The goal is finding which pathway works best for each individual.

Importance of Connecting with Nature

Exposure to nature has been shown to have a range of benefits, including improved physical health, reduced mental stress and anxiety, building community with fellow human beings, and strengthening family bonds (as evidenced in many of the survey responses). Positive impacts specifically in children include:

- Enhances focus and cognitive abilities (Wells, 2000)
- Supports creativity and problem solving (Kellert, 2005)
- Improves academic performance across multiple disciplines (American Institutes for Research, 2005)
- Reduces Attention Deficit/Hyperactivity Disorder (ADHD) symptoms in children as young as five years old (Kuo & Taylor, 2004)
- Improves social relations with others (Burdette & Whitaker, 2005)
- Improves self-control and self-discipline within inner city youth, and particularly in girls (Taylor, Kuo, & Sullivan, 2001)

In addition to these benefits, those children and young adults will one day be the adults helping influence, write, and vote on policies to protect the environment—even more reason to establish positive connections with nature early and often.

But how can we harness these benefits without knowing how to give everyone those same influential experiences that I and my peers had. In order to help with this, I wanted to look at the psychology behind how individuals make connections. This led me to the research of Dr. Howard Gardner, an American developmental psychologist who first proposed the theory that people possessed different kinds of minds and therefore learn, remember, and understand in different ways (called “intelligences”) (Gardner,

1983). According to Gardner's theory, presenting an idea to someone in their preferred intelligence style could help them better understand the idea, and therefore make a connection more strongly with that subject. Gardner's theory has been used frequently in education since it was first introduced, so I decided to use it as a framework to create a nature hike incorporating activities based on the current eight defined intelligences, with the goal that every student would find at least one activity that spoke directly to them and helped them make a personal connection with the outdoors during the hike.

Summary

This chapter touched on my personal background, and the experiences of others, and how it influenced my research question, **"How can we use the theory of multiple intelligences to connect 4th-8th grade students to nature?"** to help provide opportunities for children and young adults to make deeper, more personal connections with nature and the environment. It listed some of the physical, mental and emotional benefits that these connections and exposure to nature have on children, and introduced the theory of multiple intelligences and their potential use in the outdoors.

In chapter two, a review of the literature covers important background information regarding the various aspects involved in the project, including: an overview of environmental and outdoor education (including the definition, major influences, and history in both the United States and internationally), more in-depth information and research supporting the importance of nature exposure in children and young adult growth and development, background on Dr. Howard Gardner's theory of multiple intelligences, and finally how this theory might be utilized in the non-formal teaching setting often seen in environmental and outdoor education.

CHAPTER TWO

Literature Review

In this second chapter, a review of literature will provide information related to the research question: **How can we use the theory of multiple intelligences to connect 4th-8th grade students to nature?** The chapter will first focus on the definition of environmental education and related fields, its history in the United States and internationally, notable figures, and how exposure to nature has been shown to benefit not just children and young adults ages 5-18 (K-12), but also college students and adults. It will then take an in-depth look at Dr. Howard Gardner's theory of multiple intelligences, first proposed in his 1983 book *Frames of Mind: The Theory of Multiple Intelligences*, as well as touching on other relevant teaching methods and theories currently in use in the environmental education field. Finally, it explores how those intelligences and learning styles could be integrated into an environmental education curriculum for students in grades 4-8.

Defining Similar Environmental-Related Fields

This section will help distinguish between the similarities and differences of closely related areas and terms often used in the environmental-related fields. Based on the complex nature of the environment, as well as personal and cultural experiences, the term "environmental education" may invoke a wide variety of definitions and purposes from various people. Some individuals might say it is the broad focus on all scientific aspects associated with the environmental (*i.e.*, ecosystems, botany, biology, geology, atmospheric science), while others may define it simply as the experience of exposing

individuals to the outdoors, with or without the scientific slant. Still others may combine it with the actions of "environmentalism." In fact, environmental education is a multi-discipline field that influences several other complementary areas with intersecting philosophies. For the purposes of clarification, the following section will identify and define some of these related fields often associated with the environment.

Environmental Education (EE)

The U.S. Environmental Protection Agency (EPA) defined Environmental Education (EE) on its public website as:

> A process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions. (EPA, 2017, para.1)

It also identified five components of EE:

1. Awareness and sensitivity to the environment and environmental changes.
2. Knowledge and understanding of the environment and environmental changes.
3. Attitudes of concern for the environment and motivation to improve or maintain environmental quality.
4. Skills to identify and help resolve environmental challenges.
5. Participation in activities that lead to the resolution of environmental changes (EPA, 2017).

The North American Association for Environmental Education (NAAEE), used a slightly modified definition: "[EE] is a process that helps individuals, communities, and

organizations learn more about the environment, and develop skills and understanding about how to address global challenges" (NAAEE, 2017, para.1). Other descriptions may also be offered by individual organizations. For example, the Kansas Association for Conservation & Environmental Education (KACEE), a private, non-profit 501(c) organization active in promoting quality, unbiased and science-based EE since 1969, offers a more extensive description:

> Environmental education may be best defined as a process directed at creating awareness and understanding about environmental issues that leads to responsible individual and group actions. Successful environmental education focuses on processes that promote critical thinking, problem solving, and effective decision-making skills. Environmental education utilizes processes that involve students in observing, measuring, classifying, experimenting, and other data gathering techniques. These processes assist students in discussing, inferring, predicting, and interpreting data about environmental issues. Environmental education is not environmental information […] Environmental education is not environmental advocacy. (KACEE, 2017, para.1)

Environmental education also incorporates aspects from the fields of environmental studies and engineering. Environmental studies focus on social sciences to understand human relationships and interactions with the environment and nature (*i.e.*, policy, politics, law, economics, pollution control) (National Center for Education Statistics, 2017), while environmental engineering focuses on design and technology for improving environmental quality (Lucas, 2014).

The types of organizations that primarily utilize EE include schools (both K-12 and higher education), museums, zoos, aquariums, national and state parks, and environmental learning centers; prominent EE organizations include NAAEE and the National Environmental Education Foundation (NEEF).

Outdoor Education (OE)

Similar to environmental education, outdoor education (OE) is another multi-disciplinary field with a larger focus on the psychosocial aspects of nature and the environment. An often-cited definition proposed by Texas school teachers George and Louise Donaldson in 1958, was "Education *in, for, and about* the outdoors" (Donaldson & Donaldson, 1958, p.17). OE is not mutually exclusive from EE, but instead often incorporates many of the same aspects and components, as well as parts of Experiential Education (ExE). It is "a means of curriculum enrichment, whereby the process of learning takes place out of doors. Outdoor education broadly includes environmental education, conservation education, adventure education, school camping, wilderness therapy, and some aspects of outdoor recreation" (Lappin, 1984, p.3). It often involves learning in small groups that have personal, social, educational, therapeutic, and environmental goals, with an emphasis on the relationships concerning humans and natural resources (Neill, 2003; Priest, 1986).

Originally focused mostly on nature study, the term 'outdoor education' is increasingly used to refer to a wide range of organized activities that take place in predominantly outdoor environments, including hiking, camping, rock climbing, ropes courses, and team-building activities (low ropes courses) (Outdoor Education, n.d.). It is often synonymous with 'adventure education' (promoting learning and personal growth

through adventure-centered experiences) and ‘wilderness education’ (promoting personal growth through expeditions into wilderness areas).

OE is primarily utilized in areas such as summer camps, environmental learning and nature centers, and wilderness/outdoor therapy programs; prominent OE organizations include the National Association for Outdoor Education (NAOE), the International Scouting Movement and the Boy & Girl Scouts of America, Outward Bound, and the National Outdoor Leadership School (NOLS). The educational learning center where this curriculum will be primarily used runs programs that fall under this definition of outdoor education, including summer camps. Therefore, it is important to consider the aspects of OE as pertinent background information.

Experiential Education (ExE)

This third and final area was long considered an aspect of outdoor education, the idea of “learning by doing or experience […] outdoor education may be viewed as experiential, especially when the learning takes place through experiences” (Ford, 1986, p.7). The Association for Experiential Education, founded in the 1970’s, defined experiential education as “a philosophy that informs many methodologies in which educators purposefully engage with learners in direct experience and focused flection in order to increase knowledge, develop skills, clarify values, and develop people’s capacity to contribute to their communities” (Association for Experiential Education, n.d., para.1). AEE lists a number of principles related to this definition, including experiences supported by reflection, analysis and synthesis; personal results that form the basis for future learning; and opportunities for learners to examine their own values (Association for Experiential Education, 2002). While ExE often takes place in outdoor settings, it can

happen anywhere individuals learn by doing; therefore, it is regularly incorporated into the nature of environmental and outdoor recreation.

Environmentalism

Environmental science and outdoor education may be confused with environmentalism. However, while both deal with the protection of the world that we live in, environmental science is the "objective, unbiased pursuit of knowledge about the workings of the environment and our interactions with it", while environmentalism is a "social movement dedicated to protecting the natural world" (Russo, 2013, para.2).

History and Notable Figures

The idea of "nature study", which later developed into the basis for modern environmental education, began in the late 19th/early 20th century through the influences of French philosopher Jean-Jacques Rousseau and Swiss-American naturalist Louis Agassiz. Robert Baden-Powell established the Scouting movement in 1907, and the first Outward Bound program began in Wales during World War II, laying the groundwork for modern outdoor education (Baden-Powell, 1908; Outward Bound, n.d.).

The sixties and seventies were a time of great developments in all environmental and outdoor related fields. In 1969, a group of individuals at the University of Michigan's School of Natural Resources, led by Dr. William Stapp, developed a definition and major objectives that influenced many of the current definitions of EE. Their report stated: "Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work towards their solution" (Stapp et al., 1969, p.30). Other contributions included the

creation of the National Outdoor Leadership School (1965) and the Association for Experiential Education (1976), first publication of *The Journal of Environmental Education* (1969), the first Earth Day (1970), and the Environmental Education Act of 1970, which established community programs to support elementary and secondary environmental education (EPA, 1990). In 1990, Congress enacted the National Environmental Education Act (NEEA) to renew the federal role in environmental education (it expired in 1996, but is still indirectly funded through the EPA).

In 2009, a federal bill referred to as the No Child Left Inside Act, was proposed to amend the Elementary and Secondary Education Act (No Child Left Behind Act) of 2001 so that it would include environmental education. While the legislation did not pass, it did lead to the creation of the No Child Left Inside Coalition, which works to increase EE in a variety of schools, zoos, museums, and other organizations. In June 2011, Maryland became the first state to require mandatory environmental literacy classes for all students before graduation (Bell et al., 2010) and eight other states have also applied assessment tools (including standardized testing) to determine the impact of EE curriculum and instruction on students (Campaign for Environmental Literacy, 2007). The importance of EE is also recognized internationally. A 2014 report by the United Nations Educational, Scientific and Cultural Organization (UNESCO) emphasized that EE is vital for safeguarding future generations because it imparts a societal respect for nature and enhances the public's environmental awareness (UNESCO, 2014).

Benefits of Exposure to Nature

This section will delve more deeply into studies that have provided evidence to support the importance of nature exposure on the development of children, adolescents, and adults.

Physical and Mental Benefits

While it offers opportunities for direct physical activity, research has increasingly shown that exposure to nature and the environment has other physical and mental benefits to learners of all ages, including:

Decreased stress: Individuals who spent two nights in a forest had lower levels of cortisol, a stress hormone, than those who spent the same amount of time in a city; exposure to natural settings also resulted in decreased heart rate and increased vigor (Li, 2010; Mao et al., 2012a).

Cardiovascular benefits: Elderly patients who spent one week in a forest showed reduced signs of inflammation and hypertension (Mao et al., 2012b).

Improved vision: Higher levels of total time spent outdoors (as opposed to indoor physical activity) was associated with a lower prevalence of nearsightedness (myopia) in 12-year-olds (Rose et al., 2008). Researchers also found that outdoor activity during school recess reduced the onset of myopia in elementary students from 17.65 percent to 8.41 percent (Wu et al., 2013).

Increased memory, concentration, and creativity: Students who spent time walking around a natural environment scored 20 percent better on a memory test than students who walked down an urban city street (Berman, Jonides, & Kaplan, 2008). University students with natural views from their dorm windows scored better on tests of directed attention (Tennessen & Cimprich, 1995). After four days of immersion in nature and the corresponding disconnection from multi-media and technology, adults and children demonstrated a 50 percent increased performance on a creativity, problem-solving task (Atchley, Strayer & Atchley, 2012).

Emotional and Social Benefits

In addition to the physical and mental aspects, exposure to nature also demonstrates emotional and social benefits:

Reduced levels of depression and anxiety: People who spent 90 minutes in a natural area as opposed to a high-traffic urban setting showed decreased neural activity in the subgenual prefrontal cortex, an area of the brain associated with depression. Individuals who live in urban areas had a 20 percent higher risk of anxiety disorders and a 40 percent higher risk of mood disorders as compared to people in rural areas; people born and raised in cities are also twice as likely to develop schizophrenia (Bratman et al., 2015).

Sense of community: Tenants of public housing with trees and green space around their buildings reported knowing more people, having stronger feelings of unity with neighbors, were more concerned with helping and supporting each other, and had stronger feelings of belonging than tenants in tree-less buildings (Coley, Kuo, & Sullivan, 1997). When individuals in an fMRI machine were shown nature scenes, the parts of the brain associated with empathy and love were activated; when shown urban scenes the parts associated with fear and anxiety were activated (Kim, et al., 2010).

Interpersonal skills: Studies have indicated that playing in natural environments encourages social interaction between children and that children who play in nature have more positive feelings about each other (Bixler, Floyd, & Hammutt, 2002; Moore, 1996). Children with exposure to natural play areas also had increased language development, and social and collaborative skills (Moore & Wong, 1997).

Educational Benefits

Repeatedly, both government and independent organizations have demonstrated that environmental education and/or student's exposure to natural elements improves student achievement, mental well-being, and physical fitness. When integrated as a core curricula, EE reduced the need for behavior management, increased student engagement and ownership in achievements, and had a measurable impact on student success in the disciplines of science, reading, math, and social studies (NEEF, n.d.). In their 2000 report *Environmental Science and Engineering for the 21st Century*, the National Science Foundation (NSF) stated:

> The twin goals of learning are to acquire knowledge and gain skills such as problem solving, consensus building, information management, communication, and critical and creative thinking. Environmental issues offer excellent vehicles for developing and exercising many of these skills using a systems approach…changes should be made in the formal educational system to help all students, educators, and educational administrators learn about the environment, the economy, and social equity as they relate to all academic disciplines and their daily lives. (NSF, 2000, p.4)

Schools that undertake systemic environmental education programs consistently score higher on state standardized tests over schools without EE programs and high school students who participated in environmental education programs also increased their critical thinking skills performance on tests (Bartosh et al., 2007; Ernst & Monroe, 2004).

Future Benefits

The National Science Foundation (NSF) Advisory Committee for Environmental Research and Education stated that exposing students to environmental science early and often will be greatly significant for their future as adults:

> 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. Creating a scientifically informed citizenry requires a concerted, systematic approach to environmental education […] to prepare the future environmental workforce at many levels—researchers, teachers, resource managers, and technicians—and to raise the environmental literacy of the general public. (NSF, 2003, p.50)

Environmental education is the important process of developing a society that is aware of and concerned about the problems facing our environment as a whole, and has the knowledge, skills, attitudes, motivations, and commitment to work both individually and collectively towards solutions to those problems, as well as the attempting to prevent new issues from arising (UNESCO, 1977).

Multiple Intelligences (MI) Theory

In the 1970s and 80s, the research of American psychologist Howard Gardner helped him develop a theory that there are a number of intellectual strengths, as opposed to a singular dominant ability, and that individuals demonstrate preferences for one or more of these defined areas. This theory, the basis for my capstone research question,

helps develop curriculum that will better engage students and help them connect with the subject matter (the environment).

Gardner

Howard Earl Gardner is an American developmental psychologist who first proposed the theory (hypothesis) of multiple intelligences in his book *Frames of Mind: The Theory of Multiple Intelligences* (1983). He enrolled as an undergraduate at Harvard in 1961 to study history, eventually moving his focus to social relations. After graduated in 1965 he worked with other professionals at Harvard to develop Project Zero (PZ), a research project studying the mental processes involved in the arts and artistic activity. PZ was strongly influenced by American philosopher Nelson Goodman's 1968 book *Languages of Art*, and is considered to be the starting point for Gardner's multiple intelligences theory ("Howard Gardner's multiple intelligences," n.d.; "History," n.d.).

Gardner developed his ideas on multiple intelligences (MI) to counter the standard psychological view of intellect: that an individual's intelligence was dominated by a single "general ability" (g-factor) or general intelligence (aka 'IQ'). He claimed that intelligence is more than IQ because a high IQ in the absence of productivity does not equate to intelligence (Gardner, 1999). While the MI hypothesis was thought to be mostly of importance to the field of psychology, it was soon adopted by education, teaching, and training fields as well.

Original Seven Intelligences

In his 1999 book *Intelligence Reframed: Multiple Intelligences for the 21st Century*, Gardner listed the eight criteria that a candidate intelligence area must fulfill in order to be identified as a true "intelligence":

1. **Potential for brain isolation by brain damage.** One intelligence can be dissociated from the others, *e.g.,* stroke patients can be left with some forms of intelligence intact despite damage to other cognitive abilities such as speech (Gardner, 1999, p.36)
2. **Place in evolutionary history.** It has to have played a role in the survival of our species and our ability to adapt to the surrounding environment.
3. **Presence of a core set of operations.** For example, the core operations of the musical intelligence are pitch, rhythm, timbre, and harmony.
4. **Susceptibility to encoding (symbolic expression).** Symbols related to the intelligence can be developed in order to accurately and systematically express culturally-relevant information (*e.g.,* language characters, musical notes, mathematical and artistic symbols, etc.)
5. **Distinct developmental progression.** The ability of an individual to advance their intelligence to an expert state, through studying or practicing.
6. **Existence of savants, prodigies, and other exceptional people.** Individuals who naturally excel at a particular intelligence, far superior to the abilities of an average individual (*i.e.,* musical or artistic prodigies).
7. **Support from experimental psychology,** and
8. **Support from psychometric findings.** Asking someone to perform two tasks from the same intelligence area simultaneously causes interference because they rely on the same mental capacities (Gardner, 1999; Gilman, 2001).

When Gardener's book *Frames of Mind* was released, he used these eight criteria to describe seven distinct intelligences:

1. **Verbal-linguistic (words):** Learn best through written and spoken languages and interpretation and explanation of information through language. Typical roles include writers, journalists, lawyers, English teachers, PR consultants, and TV and radio presenters.
2. **Musical-rhythmic (music, sound and rhythm):** Learn best through the use of sound, and recognizing tonal and rhythmic patterns; can create a rhythm to express a mood. Often individuals with this MI demonstrate "perfect pitch." Typical roles include musicians, singers, composers, acoustic engineers, and voice coaches.
3. **Logical-mathematical (numbers or logic):** Learn best through reasoning and deduction, detecting patterns, performing calculations, and understanding cause-and-effect relationships. Typical roles include scientists, engineers, accountants, statisticians, negotiators, and researchers.
4. **Visual-spatial (Pictures):** Learn best through interpretation and creation of visual images; easily understand the relationship between images and meanings, and space and effect. Typical roles include artists, graphic designers, architects, photographers, inventors, and urban planners.
5. **Bodily-kinesthetic (Physical):** Learn best through manual dexterity, physical tasks, or demonstrating techniques; often have physical agility and balance, and exceptional eye and body coordination. Typical roles include dancers, actors, athletes, soldiers, craftspeople, and chefs.
6. **Interpersonal (Social):** Learn best through relating to other people's feelings and emotional health; demonstrate high empathic proficiencies. Typical roles include

therapists, psychologists, HR professionals, politicians, educators, clergy, doctors, and coaches.

7. **Intrapersonal (Self):** Learn best through self-reflection and understanding oneself and one's relationship to others and the world. This intelligence has no clear roles or professions, but instead can be applied to any who is self-aware and actively working to change their thoughts, beliefs, or behavior in relation to their situation and/or other people. (Gardner, 1983). There is a strong relationship between the Intrapersonal intelligence and what is now referred to as "Emotional Intelligence" (aka EQ); some have referred to this as being "emotionally mature" (similar to Abraham Maslow's level of self-actualization) ("Howard Gardner's multiple intelligences", n.d.).

Added and Suggested Intelligences

Since *Frames of Mind* was first released, other intelligences have been suggested based on Gardner's original eight criteria. In 1995, Gardner proposed an eighth intelligence related to the natural world:

> If I were to rewrite *Frames of Mind* today, I would probably add an eighth intelligence—the intelligence of the naturalists. It seems to me that the individual who is able readily to recognize flora and fauna, to make other consequential distinctions in the natural word, and to use this ability productively (in hunting, in farming, in biological sciences) is exercising an important intelligence and one that is not adequately encompassed in the current list. (Gardner, 1995, p.205)

Typical roles of the naturalist intelligence include botanists, biologists, zookeepers, aquarists, hunters, fisher people, and farmers.

While he did not include it in the original book, Gardner suggested he considered a spiritual (or existential) intelligence, which he described as "capturing and pondering the fundamental questions of existence" and asking who we are and what is our purpose (Gardner, 1999, p.22). This intelligence meets all the basic criteria except support of its existence from psychometric studies (eighth criteria), arguing that the desire to understand the basic questions of life is inherent to human nature.

Additional intelligences that have been suggested, but currently not substantiated, include teaching-pedagogical, moral-ethical, humor, cooking, and sexual intelligence (Gardner, 2016).

Scientific and Educational Implications of MI

According to the Official Authoritative Site of Multiple Intelligences (OASIS), there are two principal scientific implications of the Theory of Multiple Intelligences:

1. The intelligences constitute the human intellectual tool kit. All able individuals possess the capacity to develop several intelligences to create a unique "intelligence profile".
2. Each individual has a unique and distinct intellectual profile; while two humans may have similar profiles, no two profiles will be identical. This also specifically mentions that even humans with similar genetic identities (i.e., identical twins) will have different intelligence profiles due to environmental, psychological, and cultural influences. (MI OASIS, n.d., para.5-6)

There are also two principal educational implications of the MI theory:

1. Each human has his or her own unique intelligence profile, so assessments should allow them to show what they have learned in situations that require their preferred type of intelligence.
2. Material and subjects should be taught and presented in several different ways. This allows the educator to reach more students, and also helps the educator themselves more fully understand the subject, since they too have a unique intellectual profile (MI OASIS, n.d.).

While people rarely have only one type of intelligence, they tend to be stronger (*i.e.*, more intelligent) in one or two areas rather than all of them.

How MI theory applies to informal environmental education is the central focus of this capstone project. Just as formal educators must design classroom lessons that reach multiple types of intelligences, outdoor environmental lessons also need to incorporate activities that engage students through their preferred intelligence style. While a standard nature hike may inherently appeal to the naturalist intelligence, it is just as important to create opportunities for logical, linguistic, or interpersonal individuals to connect with nature.

Criticisms

The theory of MI has been subject to criticism from other professionals in the psychology field. The most cited argument points to a lack of empirical evidence to support the idea that multiple intelligences are separate from the prevalent idea of the single dominant intelligence (IQ or g-factor) and that MI are just a combination of the already established abilities of IQ. Dr. Linda Gottfredson argued that there is overwhelming support for the testable concept of an overarching single intelligence, but

virtually no support for the idea of eight autonomous intelligences, saying "they argue that there are multiple independent intelligences, suggesting that everyone can be smart in some way. This is, understandably, a very attractive idea in democratic societies" (Gottfredson, 2006, p.4). MI supporters agree that the *g*-factor exists, but argued that *g* is not superior to other forms of human cognition and instead is primarily expressed as the logical-mathematical intelligence alongside the other intelligences. Gardner did admit that he intended to be provocative in calling the areas "intelligences" rather than "talents," and that he wanted to "challenge the sacrosanct nature of 'intelligence' as a singular phenomenon and get people to think more deeply about what it means to be intelligent" (Armstrong, 2009, p.192).

Critics also suggest that there is no solid research support that MI exists in an educational classroom setting and that it has no practical application in schools. James Collins wrote that "evidence for the specific of Gardner's theory is weak, and there is no firm research showing that its practical applications have been effective" (Collins, 1998, p.95). The counter-argument points out that in the current education system, "the idea of 'valid research' has been severely limited to highly controlled studies using standardized tests and quantitative tools based on correlation coefficients and levels of statistical significance" (Armstrong, 2009, p.193) —testing methods that inefficiently measure a variety of learning styles. Supporters provide a number of examples of how MI theory has been successfully implemented into educational programs in both the United States and internationally, including Project Zero, Practical Intelligences for School (Williams et al., 2002), and Project Spectrum (Gardner, Feldman, & Krechevsky, 1998). In 1999, the American Educational Research Association formed a special interest group (MI-

SIG) to research MI theory; the group has since amassed over 200 doctoral dissertations providing validation of MI in numerous educational contexts (Armstrong, 2009).

MI in Non-Formal Environmental and Outdoor Education

How can the theory of MI be utilized in the fields of environmental and outdoor education? There are a number of educational institutions that create a learning environment outside a classroom-based setting led by trained teachers (defined as formal education); these types of learning environments are defined as *informal education*. Examples of informal education include after-school program, community-based organizations, museums, zoos, aquaria, libraries, or at home (Corporation for Public Broadcasting, 2002). Much of the discussion surrounding MI is the application of the theory in a formal classroom setting. So, is environmental and outdoor education considered *formal* or *informal* education, and how does that impact implementing MI?

Because EE is defined as the *process* of helping individuals understand the environment and its components, it can be performed in both informal and formal settings. Implemented as a part of a school program, EE would fall within the general guidelines of a formal education (*i.e.*, taking place in a classroom, led by a trained educator), while in a museum or national park, it would be designated as informal. Vance and Schroeder, researchers at the University of Wisconsin- Milwaukee, explored the implications for learning in informal settings by matching visitor learning style with museum exhibits; their research was based on the learning styles defined by the Myers-Briggs test, a widely-used personality test. While similar to the theory of MI, the idea of learning styles is a slight variation on the theory; learning style refers to the manner in which an individual learns. While Gardner adamantly opposed the idea that "multiple

intelligences" were the same as "learning styles" (arguing that how a person learns does not dictate strength of intelligence) (Strauss, 2013), Vance and Schroeder's study demonstrates how a non-formal learning environment (like a museum), can appeal to different types of visitors. Their research indicated that matching visitor's learning styles with the informational qualities of exhibits has a positive impact on learning (Vance & Schroeder, 1992).

Teaching in the outdoors, like a museum, can provide a number of unique challenges as well as benefits. This includes finding opportunities to engage multiple intelligences in a learning environment that can often be more unstructured and distracting than a formal classroom setting. Students and teachers may see going outdoors as a break from formal teaching, but with the right direction and preparation, nature can be an excellent opportunity for educators to use this "change of scenery" to engage students in a memorable learning experience. Nature, like other non-formal educational situations, can "serve as an ideal learning environment for inviting inquiry, questioning, and constructive practice in investigatory behaviors" (Vance & Schroeder, 1992, p.7).

Here are some examples of K-12 environmental-focused activities that could be used for each of the eight current MI, along with notable environmental and outdoor figures that demonstrate qualities personifying each type of intelligence:

1. **Verbal-linguistic (words):** Listen to a story or book involving nature, create a poem related to nature, write a short story about an animal or plant from the area, write a letter to a state representative about local environmental issues or to the editor in response to nature-related current events, or participate in a debate. People that represent verbal intelligence include Rachel Carson, David

Attenborough, Aldo Leopold, Ralph Waldo Emerson, John Muir, Terry Tempest Williams, and Jad Abumrad and Robert Krulwich (hosts of NPR's science program Radiolab).

2. **Musical-rhythmic (music, sound and rhythm):** Write a song or create music about the outdoors, set an existing poem to music, use rhythm to memorize environmental facts and concepts, analyze a song with an environmental message, or identify animals by their sounds or calls. Notable people who have create music related to the environment and outdoors include John Denver, Joni Mitchell, and Neil Young.
3. **Logical-mathematical (numbers or logic):** Search for patterns in the outdoors, create a chart to record phenology (signs of seasonal change) and/or observations of animals and plants in the area, conduct experiments to demonstrate environmental science concepts (*e.g.*, water sample testing, wildlife population dynamics), or develop analogies to help describe unfamiliar or complex natural processes. People that represent the logical-mathematical intelligence include marine biologist Sylvia Earle, ecologist Rolf Peterson, and Bill Nye.
4. **Visual-spatial (pictures and images):** Use natural materials to make sculptures, create a visual chart of food chains, use puppets to act out animal behaviors, draw or sketch natural scenery, create a field guide, or take photographs for a photo essay. People who represent the visual-spatial intelligence include John James Audubon, Ansel Adams, and Roger Tory Peterson (Peterson Field Guides).
5. **Bodily-kinesthetic (physical movement):** Create animal-inspired costumes for role-playing or skits, act out scenes that describe environmental concepts, use

charades to describe animals or plants, go on a nature hike, or participate in nature-based scavenger hunts. Individuals who demonstrate kinesthetic learning include outdoorsman Tom Brown Jr., Edward Michael "Bear" Grylls, and Mark Collard (founder of Project Adventure).

6. **Interpersonal (social):** Work together with others to design and complete projects related to environmental issues, interview people with knowledge about content-areas (*e.g.*, DNR and conservation officers, park guides), or teach environmental concepts to younger students or classmates. Notable outdoor and environmental-related interpersonal figures include Robert Baden-Powell (founder of Scouting), Jane Goodall, and Ernest Thompson Seaton (founder of Woodcraft Indians).
7. **Intrapersonal (self):** Write a reflective paper on their experiences with nature, keep a journal or personal log describing their interactions with the outdoors, set goals related to the environment (*e.g.*, spent more time outside, learn three different bird calls) and plan ways to achieve them, or write essays or stories from the perspective of animals, plants, or environmental-significant figures. Important intrapersonal icons include reflective nature writers such as Ralph Waldo Emerson or Aldo Leopold.
8. **Naturalist (nature):** Care for classroom pets and/or plants, sort and classify natural objects, organize clean-ups or recycling drives, or lead a nature hike for classmates or younger students. Notable naturalist intelligence icons include activist Julia Butterfly Hill, John Muir, Steve Irwin, and politician Gaylord Nelson.

Recognizing the importance of developmental theories like MI can better prepare environmental and outdoor educators to use the proper equipment, setting, activities, and examples when teaching; they also help understand *how* a person learns and what barriers might be inhibiting progress in a lesson or course (Gilbertson et al., 2006).

Summary

The review of literature provides evidence to support the importance of the research question ***How can we use the theory of multiple intelligences to connect 4th-8th grade students to nature?*** including the physical, emotional, mental, and educational benefits of exposure to nature and how the multiple intelligences theory can help educators provide a more personalized educational experience for students to connect with the environment in both formal and non-formal settings.

Chapter three provides an overview of the capstone project curriculum, including: the intended target audience using the curriculum, the setting where the curriculum will primarily be used, how each of the different intelligences are utilized in the activities, and suggestions for how it could be modified for other environments and time constraints.

CHAPTER THREE

Project Description

This chapter, the project description, outlines the methods that will be used to answer the research question, ***How can we use the theory of multiple intelligences to connect 4th-8th grade students to nature?*** This chapter will provide a detailed explanation of the project, including: the goals of the project, the curriculum design, the target audience, the setting and environments where the teaching will take place, and how the curriculum will be implemented and evaluated.

Overview

This capstone is the creation of a curriculum for an instructor-guided nature hike for students in grades 4-8. The hike is planned for three hours in length (but adaptable to longer or shorter time frames) and takes place at a residential environmental learning center in Minnesota. The primary audience are students in grades 4-8 (estimated ages of 9-14 years old) from a variety of backgrounds, communities, and school types in the upper Midwest (MN/WI/IA/IL). While the curriculum will primarily be used at a non-formal environmental education center, it can be modified to apply to a variety of environments and time constraints.

The curriculum is based on the eight multiple intelligences defined by Gardner, and discussed in depth in chapter two. There are a number of activities available for instructors to use with students, with each of the activities placing emphasis on a different intelligence (some activities may utilize more than one intelligence) and are designed for the suggested learning styles of this age group. The curriculum activities meet a number

of current Minnesota state academic standards in art, language arts, physical education, science, and social studies, as defined by the Minnesota Department of Education. It will also include any pertinent Common Core State Standards, as established by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO); the standards met will be listed in the lesson plan for reference. Academic standards will be updated in the curriculum as they are revised on a state and national level and curriculum activities will be updated to meet new standards as needed.

The goals of this project are to create an experience that engages each student with nature on an individual level, based on their preferred intelligence style. Because people often demonstrate affinities for more than one type of intelligence, the variety of activities provides the best chances of finding at least one experience that connects with each person on a personal level.

Setting

The curriculum will be used in programming at a private, non-profit 501(c)(3) residential environmental learning center (RELC) in Minnesota that provides accredited environmental education and outdoor adventure programs. An RELC is a professionally staffed, full-time, year-round facility that provides participants with in-depth, multi-day experiences to engage with and learn about the outdoors. Programs are typically two to five days, but may be longer depending on season and/or group; on-site lodging and meals are usually provided for participants ("What is a Nature Center," 2005). This particular center has a privately-owned 127-acre campus, surrounded by 800 acres of state forest land that is accessible to classes and the public. The campus is located in a

region of the state known as the "Driftless Area", an area of the upper Midwest that was not glaciated during the most recent major ice age (the Wisconsinian glaciation); the region is named after the lack of glacial-deposited debris known as *drift*. The campus contains a number of different features and ecosystems, including karst geography (a limestone topography characterized by exposed limestone bluffs, sinkholes, and cave systems), tallgrass prairie, maple-basswood broadleaf and floodplain hardwood forests, burr oak savanna, eutrophic retention ponds, ephemeral spring pools, and a spring-fed river.

The center records an average of 22,000 visitors annually. The primary audience are 4^{th}-8^{th} grade students from public and private schools in the tristate area (Minnesota/Wisconsin/Iowa) and Illinois. The average length of a school trip is three days (Monday to Wednesday, or Wednesday to Friday), during which students attend four three-hour classes from one of three focus areas: (1) Adventure (*e.g.,* high ropes challenge courses, group team-building, canoeing, winter survival, orienteering), (2) Cultural (*e.g.*, Native American studies, 1850's pioneer life, or ice age studies), or (3) Science (*e.g.,* wildlife ecology, fungus, stream lab, pond ecology, natural history studies). These classes all begin and end in a traditional indoor classroom space but spend a majority of the three hours outside, learning through on-trail activities and lessons; sheltered teaching spaces are available and lesson plans may be modified in case of inclement weather. Students also attend two, one-hour naturalist programs focused on a natural science topic (*e.g.* astronomy, reptiles, birds of prey) and participate in evening programs such as night hike, campfire, team-building games, or STEM-based activities (*e.g.*, egg drop, simple machines).

Classes are led by trained instructors with a minimum of an undergraduate college degree; science background and teaching experience vary from instructor-to-instructor. As part of the program, first-year instructors attend weekly educational seminars on Natural History, Interpretation and Instructional Techniques, with material designed to work towards an optional Certificate in Environmental Education through Hamline University. The goal of the seminars is for participants to grow and use the techniques to become a more informed and effective instructor.

Intended Audience

The primary audience of this curriculum will be 4th-8th grade students from schools in Minnesota, Wisconsin, Iowa, and Illinois. Tables 1 displays a breakdown of the different grades that have attended the RELC program during the past five years, including those that are scheduled to attend during the current 2017-2018 academic school year (September to June).

Table 1

Grades attending the RELC program each academic year.

Grade(s)	2017-18	2016-17	2015-16	2014-15	2013-14	Average
K-3	3	3	3	2	2	**3**
4	18	15	14	13	13	**15**
5	50	44	48	43	45	**46**
6	48	51	52	48	49	**50**
7	27	26	30	32	25	**28**
8	30	27	31	29	27	**29**
9-12	8	5	6	5	5	**6**

** Discrepancies between the number of total grades and total schools due to some schools bringing multiple grades.*

Since K-3 and post-secondary education participant groups are not the primary audience and make up a small percentage (6 percent in 2017-18) of the participants using this curriculum, there are no activities designed specifically for these groups. However, some of the activities could be used with high school students, based on how the instructor adapts the material to the older students' learning style and attitudes. While the center's primary audience is 4th-8th grade students, other groups include K-3rd grade, high school (9th-12th grade), college and adult groups.

Table 2 displays the designation of the communities where the schools are located. Communities are categorized as urban (population greater than 50,000), urban cluster (population ≤ 2500-50,000), or rural (all populations, housing, and territories not included within an urban area) as classified by the United States Census Bureau in 2010.

Table 2

Location of schools attending the RELC program each academic year.

School Location	2017-18	2016-17	2015-16	2014-15	2013-14	Average
Urban	39	32	35	32	26	**33**
Urban Cluster	53	45	52	41	42	**47**
Rural	47	49	50	49	51	**49**

Table 3 designated the type of schools attending the RELC program, designated at either public or private; private schools are further designated as religious or secular (non-religiously affiliated).

Table 3

Types of schools attending the RELC program each academic year.

School Type	2017-18	2016-17	2015-16	2014-15	2013-14	Average
Public	78	72	80	66	66	**72**
Private (Religious)	27	31	29	30	30	**29**
Private (Secular)	34	24	28	26	24	**27**

Curriculum Framework

The curriculum was developed using an original internal template created by the RELC. This template includes: time outside, weather considerations, intended grade levels, universal concepts, Minnesota Academic Standards met, STEM (Science, Technology, Engineering & Mathematical) components, and International Baccalaureate (IB) Learner Profiles. The IB Learner Profile is based on the International Baccalaureate mission to "develop active, compassionate, and lifelong learners" and incorporates a distinction set of attributes and qualities that "prepare IB students to make exceptional contributions on campus" ("IB learner profile", n.d., para.1). Since a number of schools that utilize the IB framework attend the program, it was important to include this information in the lesson plans.

Each three-hour class is designed around a framework with a central topic and theme supported by three to five universal concepts and accompanying theme statements. Additionally, each class has up to five listed outcomes for students, which are met through activities, questioning, and discussions facilitated by the instructor. Every class

has an accompanying "class kit" which includes all materials for the activities described in the curriculum; class materials are maintained and restocked by the center's staff. There are pre- and post-activities available online for visiting teachers to use in their classroom in preparation for the trip, and as a follow-up assessment and debrief of their student's experience after their visit.

Lesson plans are designed around Minnesota State Academic Standards. These standards are developed through a process that "involves several advisory panels with members who represent subject and grade level expertise, gender balance, ethnic diversity, and statewide geographic representation" ("Frequently asked questions", 2014, p.4). They are revised on a schedule approved by the state legislature, and class activities are updated as needed, based on new or changing standards; standards for arts and physical education (both of which are used in class activities) are the next areas scheduled to be revised before 2020. Out-of-state schools that attend the program may utilize the material taught in classes to fulfill their own state's academic standards if the standards are closely aligned, or if they add supplemental material back in their home classroom.

Minnesota has developed its own assessments aligned to the standards, and is therefore not considered a full Common Core state (with the exception of Common Core English language arts standards, which the state adopted in 2010) ("Frequently asked questions", 2014, p.6).

Summary

Chapter three provides an overview of the curriculum that will be developed for use in our RELC program, and more details on how it will help answer the original

capstone question. The specifics of the chapter include an overview of the project design, more details on the RELC setting where the curriculum will be used, intended audience of 4-8 grade students and their community and school type, research theories and curriculum framework used, state academic standards fulfilled by the activities, and why this specific format was chosen for the project.

CHAPTER FOUR

Reflection

This intent of this capstone project was to answer the question ***How can we use the theory of multiple intelligences to connect 4th-8th grade students to nature?*** The question stemmed from my own personal and professional experiences, combined with the researched benefits of exposure to nature and outdoors on children. The ultimate goal of the project was to design curriculum for a nature hike that could be modified to meet the needs of as many individual students as possible. In order to do this, the curriculum activities were based on the Multiple Intelligences theory introduced by Dr. Howard Gardner in 1983.

This final section will reflect on the development of this curriculum, including what I learned during the process, significant literature sources, possible implications and limitations, future related projects, and how this project could be a benefit for environmental and outdoor education.

What I Learned

Before starting this capstone, I had been on both the receiving and instructing end of education. While writing chapter one, I reflected on my experiences attending the public education system through all three levels of primary, secondary, and higher ed. institutions. I felt that the system served my personality well since I enjoyed listening and absorbing facts through lecture-style lessons. After college, I returned to education as a teacher. However, since I was working through private, informal educational organizations, I was never required to hold a formal teaching certificate. As a result,

everything I learned about teaching came from a combination of emulating what I had seen my former teachers do, observations and feedback from program staff, and a lot of boots-on-the-ground, experiential learning in the moment. I have a strong background in science and nature (both from my college major and personal passion), but the instruction techniques like class management and learning cycles were brand new to me.

Chapter two was a great opportunity for me to explore various areas of the teaching theory that were unfamiliar to me. I had heard references to the theory of multiple intelligences in passing, but I did not have a full grasp of its background or importance in education. Studying the various learning preferences during this project helped me better understand students who struggle in school because lecture-based teaching may not be in-line with their personal intelligence. Gardner's definition of the eight criteria used to identify intelligence areas was a great window into the process behind choosing what qualifies as a true intelligence. In addition to Gardner's book *Frames of Mind*, other important resources included Gardner's many related interviews and continuing research, and Armstrong's *Multiple Intelligences in the Classroom (3rd ed.)*.

The literature review also supported how exposure to nature is important for human development and wellness. It reinforced my reasons for picking this capstone project. There was an enormous amount of research on the benefits of nature exposure and it was a challenge to decide which information to include; it was also important to separate the anecdotal stories from the scientifically-based findings. Some of the most influential resources were the numerous studies and published papers, specifically research on the physical, emotional, and educational benefits of nature exposure

performed by Taylor, Kuo & Sullivan (2001), Tennesen and Cimprich (1995), Wells (2000), Kim et al. (2010), and Mao et al. (2012).

The curriculum was developed using an internal template created by our organization. This template includes: time outside, weather considerations, intended grade levels, universal concepts, Minnesota Academic Standards met, STEM (Science, Technology, Engineering & Mathematical) components, and International Baccalaureate (IB) Learner Profiles. The IB Learner Profile is based on the International Baccalaureate mission to "develop active, compassionate, and lifelong learners" and incorporates a distinction set of attributes and qualities that "prepare IB students to make exceptional contributions on campus" ("IB learner profile", n.d., para.1). Since we have a number of schools attending our program who utilize the IB framework, we felt it was important to include this information in our lesson plans.

Each three-hour class is designed around a framework with a central topic and theme supported by three to five universal concepts and accompanying theme statements. Additionally, each class has up to five listed outcomes for students, which are met through activities, questioning, and discussions facilitated by the instructor. There are pre- and post-activities available online for visiting teachers to use in their classroom in preparation for the trip, and as a follow-up assessment and debrief of the student's experience after their visit.

The original idea for the project was to create a curriculum that would meet standards for students in grades K-12; however, after starting to design the project, I decided that there was far too much information and standards to try and meet for such a wide age range of students. As a result, I ultimately limited the curriculum to grades 4-8.

This is the primary age group for the students attending our residential environmental learning center, so I felt that would be the most relevant and useful. Creating a K-3 and 9-12 specific curriculum will be a related research project for an undetermined future date.

Designing the capstone activities provided me with an opportunity to become more familiar with the Minnesota State Academic Standards. In addition to using them for the design of this curriculum, it was beneficial to update any standards I felt were applicable, but not included, in our center's other classes.

Project Implementation and Limitations

This curriculum will be integrated into our center's programming starting in April 2018. Part of the process will include training our instructors on the new activities and how to facilitate them with students. Depending on time and staff availability, this will be done either through a mock class, with staff acting as students while I facilitate the activities as the instructor, or as a shorter in-staff training where each activity is described in detail, but not performed. Each staff will have immediate access to the lesson plan to review and study before teaching their first class. As part of our program's evaluation process, all lead teachers/coordinators from visiting schools complete a final interview with a full-time staff member. This is an opportunity for them to provide input on the classes their students attended. This feedback will be a great assessment of how students and teachers are receiving the hike material, and any changes that need to be made to make it more student-friendly.

This project has some potential limitations. The curriculum was designed with a specific teaching site and environment in mind; as such, it was based on a set amount of class time (three hours) for the hike, and a set type of environments (deciduous hardwood

forests, river) that students would be visiting. This may cause some challenges if teachers choose to use this curriculum in their own classroom. First, any teachers outside of our RELC site may not have the exact same environments available to them. They could be confined to school grounds, urban areas, or different ecosystems such as a coniferous forest, mountains, or desert. Second, the time available to commit to the lessons may be limited based on school schedules.

The curriculum was designed to account for these limiting factors. Not every activity needs to be completed in order for the experience to be successful for students; teachers may pick-and-choose the class activities based on the time, environment, and specific goals. For example, the *Greatest (Tiny) Adventure* and *Visual Scavenger Hunt* are not tied to one type of environment and could even be modified to a small city park. Others activities, like *Meet an Outdoor Enthusiast*, can be done inside a classroom.

My background is in the field of biology and environmental science; however not all teachers will have that experience from which to draw. It may be difficult for a teacher without that background to know much about the material in the activities, therefore the directions for each activity are explained in a way that even someone without experience will feel comfortable teaching them to a class of 4^{th}-8^{th} grade students.

Another limitation is that the curriculum is based on Minnesota State Academic Standards. Since each state is allowed to design its own standards, these may not smoothly translate over to other states. Some may be similar in concept, but differ in wording or classification. State standards are also revised on a schedule approved by the Minnesota Legislature. Some of the current standards are in the process of being revised,

and the curriculum will need to be reviewed periodically as new standards are introduced or old standards are modified and/or removed. Schools from other states (Wisconsin, Iowa & Illinois) do attend our program; since our curriculum is based on Minnesota's state academic standards, how they incorporate the material into their own curriculum differs from school-to-school. For some the focus of the trip is purely community-building among their students, and is less focused on the academic aspect. Other teachers use the material and skills introduced in our center's classes as a starting point for material covered back at their school that will fulfil their state's specific academic standards.

One final limitation is the grade levels reached by this curriculum. Because our center's primary audience is students in grades 4-8, that was the intended audience for the project. Most of the standards met are focused on that age group (with the exception of a few grades 9-12 standards). Teacher may need to adapt their lessons to an older or younger age group.

Communicating Results & Related Projects

This lesson plan is scheduled to be used with students in the spring of 2018. Prior to teaching it, all of the center's instructors will receive a hands-on, experiential training to familiarize themselves with the material, activities and hike route; they will receive their own personal copy of the lesson plan to take notes and review. I will be receiving regular feedback from the staff who teach the class, letting me know which activities work well and which ones might need major or minor changes. Teachers will immediately have access to our curriculum resources online through our center's website,

and the curriculum will be available online through the Hamline University capstone archives.

As I mentioned in the project limitations, this curriculum's intended audience is students in grades 4-8. As our center continues to expand its programming outside of that current audience, it opens the door for a future nature hike that incorporates MI theory, but is focused on K-3, high school (9-12) students, and/or higher education students and even adults. I also want to continually develop new activities that can be rotated in and out of the curriculum, perhaps even on a seasonal basis.

Benefits to the Profession

With the limited material on MI theory use in environmental and outdoor education, any new applications of it into this field is more material for future educator to use; a curriculum that demonstrates how MI (and the activities designed around it) can be applied to a nature hike it may influence other EE/OE educators to utilize it in their own teaching, and adapt it to a variety of different informal learning environments such as museums, zoos, or aquariums.

This style of curriculum could also be useful at places like State or National Parks or at day-use nature centers. Visitors could check-out a daypack containing self-guided activities to use on a nature hike, helping make their experience more personalized and memorable. The activities could also potentially be adapted to an online or downloadable platform, so visitors can access them from their personal mobile devices. This would eliminate the need for physical materials, increasing access to more people and reducing maintenance costs.

Conclusion

In the process of researching this topic, I was surprised to find relatively little material in how multiple intelligences are represented in the fields of environmental (EE) and outdoor education (OE). One of the goals of this project is that reviewing this curriculum will provide material to help other EE and OE instructors incorporate MI theory into their own lessons and trips. Hopefully this will further help students relate to the environment and outdoors around them, therefore creating a stronger connection to the natural world. Our environment and natural resources are under many stresses, including climate change, destructive recreational activities, and overpopulation. Providing opportunities for new generations to make personal connections with the environment and outdoors will hopefully ignite a passion to protect those natural resources.

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