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## **How Does Teaching In Outdoor Classrooms Impact Secondary Student Learning Of Environmental Science Concepts?**

Robert Cole

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HOW DOES TEACHING IN OUTDOOR CLASSROOMS IMPACT SECONDARY  
STUDENT LEARNING OF ENVIRONMENTAL SCIENCE CONCEPTS?

by

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A capstone project submitted in partial fulfillment of the requirements for the degree of Masters  
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## TABLE OF CONTENTS

CHAPTER ONE: Introduction.....	4
CHAPTER TWO: Literature Review.....	9
Secondary Student Learning Through Experiences.....	10
Environmental Science Education.....	13
Elements of an Outdoor Classroom.....	17
Effective Teaching Strategies.....	19
CHAPTER THREE: Project Description.....	25
Theoretical Framework.....	25
Standards.....	26
Methods.....	27
Project Description.....	31
Lesson Outline.....	31
Timeline.....	33
Critical Reflection.....	34
CHAPTER FOUR: Reflection & Conclusion.....	36
Literature Review Summary.....	36
Implications.....	37
Limitations.....	38
Opportunities for Further Research.....	39
Communicating Results.....	39
Benefits to the Profession.....	40
REFERENCES.....	41

APPENDIX A: Basic Habitat Terms Curriculum

APPENDIX B: Curriculum Materials

APPENDIX C: Curriculum References

## CHAPTER ONE

### Introduction

#### Overview

Learning in-context is a key and foundational educational strategy to help cement learning of new concepts. Experiential learning (EL) creates the opportunity to learn through doing. EL works through the ability of experiences to transform individual understanding. Jose, Patrick & Moseley (2017) explain that experiential learning is learning that happens when students use hands-on activities and relate to previous knowledge. Dewey (1963) also explained that “All education comes through experience” (p. 25). Environmental science is usually taught in the classroom, these educational experiences are often one-dimensional. Given the increasing importance of environmental awareness, it is imperative that educators find more impactful and effective methods to create better learning experiences. Keeping this in mind, the purpose of this research is to determine *how does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?* The first chapter will provide the evolution of the research question and capstone project through personal and professional experiences in my life. This chapter also provides the rationale for the research question and how utilizing experiential learning opportunities that outdoor classrooms can provide to aid student learning.

#### Context

##### *Early Experiences*

From a young age, I was fortunate to have a multitude of experiences in nature and the outdoors. Both of my grandfathers were nature enthusiasts and trips to the woods or the lake were often filled with many of my questions regarding the natural phenomena surrounding us as

we walked, canoed, or fished. Questions like “What kind of bird is that?” or “Why is that bird climbing down the tree?” Were answered patiently and at a level, I could understand. These early experiences created a firm foundation to build upon as I entered school.

I can clearly remember sitting in an early elementary school science class and listening to our science teacher talk about how leaves would start to bud out in the spring and how if we looked close enough we could sometimes see where rabbits and rodents had gnawed on the base of young trees during the winter for food. While she was talking about these things it had been the weekend before that my father had pointed out those very things on our walk through the woods. The experience of being in nature and seeing the real-life examples of what our teacher had discussed resonated with me differently than if I hadn’t seen it personally. Similarly, I was also able to connect with the earth day lessons about tree planting differently as I had participated in the planting and care of many trees in the same place. I understood these concepts and ideas because I have experienced how they play out in nature.

High school provided similar opportunities. I was fortunate in that I attended a high school that had an environmental learning center (ELC) that included different types of habitats that we, as students, were able to help manage. I attended multiple science classes where the ELC was just as much of a teacher as the teacher guiding the class. I can clearly remember experiences helping to restore the upland prairie and in the early spring, helping to burn off the prior year’s growth to help mimic what happened in a natural, pre-European settlement environment. I also remember identifying trees in all four of the seasons, utilizing the trees themselves and the clues from their surrounding habitat. The summer before my senior year of high school, I was able to spend five weeks with the Student Conservation Association (SCA) in the North Cascade mountains in Washington state working to improve backcountry hiking trails.

With this opportunity, I was immersed in nature and developed an appreciation I could only understand from being in the backcountry. These experiences profoundly shaped my thinking and helped to form my desire to become an agricultural educator, as I could help students connect what they have learned through experiences at home with conceptual science learned at school.

### *Professional Experiences*

Throughout college, I continued to notice how much better I understood a concept or theory if I had something to connect it to. While taking an industrial technology class, I struggled with reading wiring diagrams. It was only when I could connect the diagram with actual, physical wiring demonstrations did the content make sense. I needed context to connect theoretical concepts with the physical representation. While student teaching, I was fortunate to be placed at a school that had space for what they called a land lab. Here, the science teacher and my cooperating teacher were working together to manage the woods and were in the beginning stages of creating a prairie restoration. At this point, I had little to compare to from a teacher's perspective, but I did notice how students seemed significantly more engaged when working on projects in the land lab than in the classroom.

After completing student teaching and finding my own classroom, I was thrilled to join students on their educational journey. I have worked to find ways to involve students in their learning through creating engaging content and activities where I can. Much like my student teaching experience, I've noticed that students are significantly more engaged when their hands and body are involved compared to when more traditional passive learning activities are implemented. As I have matured and become more comfortable in my teaching, I began to wonder what the next step was. After a few years of thought, a master's program seemed like the

right choice, and Hamline's Natural Science and Environmental Education program seemed like a good fit to allow for further exploration of what I and my students enjoy and value. While direct and in-person classes were limited due to the COVID-19 pandemic, I was able to attend one in-person class. In the *Birds and Bugs* class, I was able to work on bird and insect identification and our instructor showed us how to incorporate these activities into the classroom. These activities provided additional opportunities for hands-on learning experiences. I also was able to take socially distanced *Spring Wildflowers* and *Minnesota Biomes* courses. These courses required site visits across the state and through experiencing and using the places I visited as a resource I was able to learn specific content through connecting the abstract with the concrete experiences through the places I visited.

### **Rationale**

Environmental science education is the study of the natural world around us, including but not limited to biotic and abiotic features and their interactions with each other. (Hungerford, 2009). Outdoor classrooms are, according to the Minnesota Department of Natural Resources (1970) "a place where students have an opportunity to learn and interact within their environment - they may be found on the school site or within reasonable proximity to the school." (p. 2). Outdoor classrooms, because of the experiential nature inherent in their use, lend themselves to a variety of instructional purposes (Price, 2009). My intention is to better understand how the experiential education opportunities outdoor classrooms offer can provide for better and more comprehensive student learning of environmental science topics. My goal is to establish this link and lay the groundwork for the establishment of outdoor classrooms to allow for better student learning. In doing so, I hope other teachers will be able to improve the effectiveness of their teaching through the use of outdoor classrooms.



Experiential learning is unique in its ability to create a context for the learning of concepts through connecting content with activity. Utilizing the outdoors as an aid to help teach can create a better understanding of environmental education concepts for both teachers and students (Alberth, 1996; Haines, 2006). Working to answer the question of *how does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?* will help to aid in student comprehension and appreciation of important ideas.

## **Conclusion**

Much of my understanding of environmental phenomena is derived from experiences I have had outside of the traditional classroom. These contextual learning experiences laid the groundwork for the understanding that I was able to further develop with additional education in the traditional classroom. It is from this background and my experiences as a classroom teacher that have framed my curiosity around the research question and the answers I hope to find.

With this context in mind, Chapter Two will investigate the role of experiential learning in the learning process in general and in environmental education in particular. This chapter will also define outdoor classrooms and also examine effective teaching techniques when utilizing outdoor classrooms. Chapter Three of this capstone will outline the project, theoretical framework for lessons, and discussion of techniques to be utilized. Chapter Four will reflect on the project and my learning as a whole.

## CHAPTER TWO

### Review of Literature

#### Overview

As I discussed in Chapter One, many of my deep-seated memories of learning have come from lessons learned while experiencing and connecting what I was learning when I was outside, rather than solely focusing on theory and content. To become more effective in the classroom and create better learning experiences, my goal is to discover the answer to my driving research question: *How does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?*

Environmental science and biology are largely taught inside the walls of a school and textbook driven. Outdoor classrooms offer the opportunity to learn through doing and learn through experiences. Environmental awareness is becoming a growing concern of ever-increasing importance as students have less knowledge of the natural world around them. (James, et al., 2017; Jose, et al., 2017).

Outdoor classrooms are uniquely poised to fill the gap between learning from the textbook and learning in and from nature itself. This paper aims to show that outdoor classrooms can help to provide opportunities to create real-life and contextual learning experiences that can help cement student comprehension of environmental science and biology curriculum. It will also highlight common elements that outdoor classrooms need to be successful in enhancing student learning. A review of research shows that outdoor classrooms are utilized across the world in educational settings yet are much less common in the United States. Limited work has been done to determine the value and effectiveness of outdoor education and its ability to help

close the achievement gap in science understanding (James & Williams, 2017), this study aims to address these concerns and help readers discover that experiential learning (EL) opportunities outdoor classrooms can provide and offer much-needed context. It will also investigate effective techniques when using outdoor classrooms.

### **Secondary Student Learning Through Experiences**

Student learning takes on many forms as Dewey, noted (1963) “All education comes through experience” (p. 25). Experiential learning is learning through exploration and doing. Experiences work to help make real ideas and concepts by taking the abstract and making it concrete. This section will discuss the role of contextual and experiential learning and how it aids student discovery, understanding, and learning. This section will also explore the role of outdoor classrooms in helping to facilitate experiential learning opportunities.

Kolb (1984) stated that experiential learning is “the process whereby knowledge is created through the transformation of experiences” (p. 38). Jose, Patrick & Moseley (2017), used Wenger’s, (2009) understanding of experiential learning and explained it as “the notion that learning occurs when students use hands-on, task-oriented activities and relate previous knowledge in a contextual way to real-life examples,” (p. 270). Kolb’s experiential learning cycle (1984), shown in figure one, highlights how a learner enters the learning process by thinking and organizing their thoughts through taking an active role and engaging in the learning process. The learner then participates in a concrete experience. The learner then thinks back on the process and finally reviews and identifies what they have learned and gained from the experience. As part of this process, the learner takes an active role in the discovery process and owns their learning through personally investing and experiencing the content to be learned.

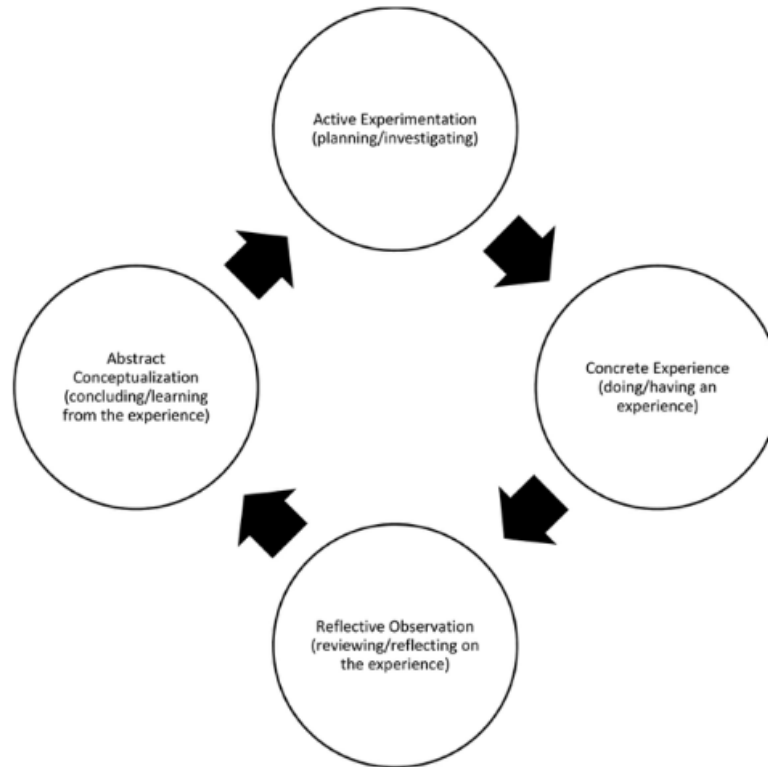


Figure 1. Kolb's Model of Experiential Learning

Vince (1998) elaborated on Kolb's work further and identified six key and foundational concepts of EL;

1. Learning is best conceived as a process
2. Learning is a continuous process grounded in experience
3. The process of learning requires the resolution of conflicts between directly opposed modes of adaptation to the world
4. Learning is a process of adaptation to the world
5. Learning involves transactions between the person and the environment
6. Learning is the process of creating knowledge (p. 305)

The essential component of Kolb's model is that experience is foundational and necessary for learning to occur through making connections between the learner and the environment around

them. In Kolb's model, the learner works to organize their thoughts based on what they have seen, felt, and observed, and develop conclusions on inconsistencies. Vince (1998), summarized that a learner is most engaged when allowed to make connections to the world around them based on their own experiences and their use of future experiences will help aid in solidifying their knowledge and understanding. The inherent value in experiential learning is clear if one considers that a person only remembers 20% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they see, hear, and discuss, and 90% of what they see, hear, discuss, and practice (Diem, 2001). The experiential learning theory works to take advantage of the importance of the component of practice in learning and combining experiences to solidify learning. Experiential learning also allows for students to recognize and determine what they are learning. Hamilton (1980) highlighted this,

Experiential learning elicits a wider range of learner responses than conventional classroom learning. Ethical and emotional reactions are called forth along with physical activity and social engagement. There is likely to be, therefore, greater investment in the situation and a more active role on the part of the learner in the classroom. (p. 183)

In-context learning allows the learner to be more engaged and results in more impactful learning (Hamilton & Williams, 2017). When a learner personally invests in their learning, they take more away from the experiences. Because of the in-context learning that occurs in outdoor classrooms, students are able to be more engaged in their lessons. Student engagement increases because the students were involved in first-hand data collection, in the elements, and exposed to a multisensory environment. Teachers also noted that students were able to increase their use of critical thinking skills and activate prior knowledge in useful and effective ways.

Since originally being published, Kolb's model has been adopted by fields beyond public education, including human resources, medicine, legal fields, and others (Morris, 2020). Although largely accepted, experiential learning is not without some criticism, much work remains in proving its efficacy. Criticism comes from the lack of a clear definition of 'concrete experience' (Morris, 2020), Bergsteiner et al., (2010); Morris (2020); Tomkins et al., (2016), noted that many think that experiential learning lacks significant and sound underlying evidence despite its widespread adoption. While these criticisms remain to be undisputedly answered to further prove experiential education efficacy, its widespread acceptance across many disciplines supports its validity as an educational method. Experiential education can work as an effective teaching method across many subjects. To effectively teach environmental science, experiential education must be inherent in the lessons to ensure better comprehension of content.

### **Environmental Science Education**

Environmental science education is the study of the natural world around us, including but not limited to biotic and abiotic features and their interactions with each other (Hungerford, 2009). This section will define environmental education and identify the guiding ethos of environmental education and the science it works to address and investigate. This section will also discuss how governmental agencies and non-governmental organizations define environmental education and the role of environmental education at present and in the future.

#### ***A Short History of Environmental Education***

On an informal basis, people have been learning about their surroundings since the beginning of time, as an in-depth understanding of the local environment, knowing the behavior of animals and knowing the characteristics of plants, (i.e. which ones were poisonous) was

essential for immediate survival (Graslund, 2005). Many indigenous peoples still highly value and respect this knowledge as a part of traditional culture. When resources became limited, early humans moved to where resources were less scarce. This pattern was followed to some degree in the United States during the early settlement era as lumber resources and soil fertility was exhausted. From an institutional standpoint, EE began as the United States began to urbanize and its citizen base became increasingly disconnected from the natural world (Stapp, 1969). As the population increased, natural resources became stressed and government agencies began educational outreach programs to inform and educate the public about wise use and proper stewardship of natural resources as an issue of importance to the overall well-being of the country (Disinger, 2001). Formal EE largely included outdoor and conservation education. A shift in focus began as the public became increasingly concerned about habitat loss, decreasing biodiversity, and excessive resource depletion (Hungerford, 2009). An effort to develop a collective ecological awareness was seen the world over and in 1977, the United Nations Educational Scientific and Cultural Organization (UNESCO) met at Tbilisi, Georgia, and developed these guiding principles and goals of environmental education

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

(Tbilisi Declaration, UNESCO, 1978).

As environmental educators have worked towards those goals, increasing awareness of the importance of EE was recognized. In 1990, the National Environmental Education Act (NEEA) was approved and this legislation is far-reaching. To date, the NEEA has provided over \$100 million in funding to increase environmental awareness and environmental action through EE efforts (Potter, 2009). These foundational actions have laid the groundwork for EE standards and guidelines today.

### ***Environmental Education Today***

Environmental education today is a dynamic and intricate part of modern K-12 education. The North American Association for Environmental Education (NAAEE, 2010) provide four underpinning guidelines as strands in their recommended framework for environmental education,

Strand 1: Questioning, Analysis and Interpretation Skills,

Strand 2: Knowledge of Environmental Processes and Systems,

Strand 3: Skills for Understanding and Addressing Environmental Issues,

Strand 4: Personal and Civic Responsibility (pp. 5-6)

While not explicitly stated, these guidelines correlate well with the 9th-12th grade life and earth science standards in the 2019 Minnesota Academic Standards in Science. Much of the NAAEE framework looks to encourage students to demonstrate responsible citizenship through stewardship and actions, emphasizes critical thinking and analysis skills through real-world problem solving, possess basic environmental knowledge, and have a thorough understanding of the complex nature of human interactions with the natural world (NAAEE, 2010). Likewise, the



Minnesota Academic Standards (2019) place emphasis and high priority on analytical and critical thinking and problem-solving skills while learning and possessing a high degree of scientific knowledge.

Modern environmental education provides students with the opportunity to develop a comprehensive understanding of science across chemistry, physics, and biology by learning through the context of the local components of the environment. Environmental Education can vary from trips to the park, to plant identification, to a case study of resource use, to water testing for nutrient loading after precipitation events (Disinger, 2001). Environmental Education varies across the country based on community resources, values, instructors' awareness, and knowledge base and there is some considerable tension between knowledge of the environment and its systems and calling students to action (Disinger, 2001; Fraser et al, 2015; Potter, 2009). More work needs to be done to investigate solutions to iron out differences in guiding philosophies.

The need for environmental education continues as complex and systemic problems still evade solutions and climate change poses a significant challenge and threat to all occupants of the planet with significant action still delayed. Because of the unique interdisciplinary nature of environmental education, subjects beyond science such as English, Mathematics, Social Studies, Physical Education, and others can have environmental education embedded in the curriculum as part of, not a stand-alone component of the curriculum. Environmental education provides an opportunity to breathe life into the academic work of our students, outdoor classrooms provide an additional avenue to allow for further contextual learning and connections to be made to the world beyond the walls of the classroom. Outdoor classrooms offer the opportunity to learn through doing and learn through experiences.

## **Elements of an Outdoor Classroom**

Every school has a variety of resources available to utilize in the creation of an outdoor classroom. These can vary from a rooftop garden in urban settings to land labs consisting of many acres in rural and suburban settings. Outdoor classrooms can vary in size, scope, and location depending on community resources, age and cognitive ability of students, and subjects being taught. (Wanger, 2006). This section will investigate the diversity in outdoor classrooms and will also compare and contrast differences in features when planning for age groups from preschool to college.

The Minnesota Department of Natural Resources [MN DNR] (1970) described outdoor classrooms as “a place where students have an opportunity to learn and interact within their environment - they may be found on the school site or within reasonable proximity to the school,” (p. 2). Haines (2006) noted that outdoor classrooms should look for features that could be transformed into a schoolyard habitat and take advantage of any existing natural features. These broad and wide perspectives are key in understanding what an outdoor classroom can ultimately be based on available resources and school needs. Large spaces can be preferable when looking to create the greatest diversity in learning opportunities, but schools do not have to have large or pristine undisturbed spaces available. Small spaces can be, as Haines (2006) also noted, “transformed into a valuable habitat for both plants and animals” (p. 45). Although many outdoor classrooms are located on school grounds, they do not have to be limited to school grounds. Nearby community parks and open space areas can be ideal spaces for outdoor classrooms as well (Haines, 2006; MN DNR, 1970).

When planning for the users of the outdoor classroom, organizers need to be cognizant of age, cognitive, and mental, and physical abilities. Seeking feedback from the users is a good

place to start. Administrators, teachers, and students are more likely to find success in using the outdoor classrooms when their input is sought (Haines, 2006; Wise, 2012; Woods; 2006).

Involving students in the decision-making process provides the opportunity to see plans come to fruition. Involving teachers provides an in-house 'peer review' and ensures the survival of the outdoor classroom if the organizing teacher leaves the district. Involving the administrators creates the chance for buy-in from the decision-makers in the district.

Along with these factors, it is important to design the outdoor classroom for its ultimate use in educating students. The goals for each outdoor classroom will be different.

Age-appropriate features are a key part of outdoor classrooms. Waldron et al., (2016) investigated an outdoor classroom created for geology students, its purpose was to provide field experiences without having to leave the college campus. The key feature of this space was to recreate geological features and rocks to mimic what would be seen in the field. Alberth (1996) highlighted how a local state park was utilized for a high school class whose students were interested in natural resources-based careers. These students were able to participate in park management activities such as maintenance of facilities and habitat restoration. Minnesota DNR (1970) described how learning stations for all seasons of the year can be designed for secondary students to investigate a multitude of natural phenomena and address many areas of biology and environmental science. Haines (2006); Wiese (2012); Wood (2006), all noted that simple investigations in small scale outdoor classrooms like rain or butterfly gardens can be effective when working to meet local and state science standards and work to create the sense of wonder and appreciation that outdoor classrooms can offer. The structures in the space can vary from more formal amphitheater spaces and wide paved trails to informal repurposed wire spools and

dirt trails (Wood, 2006). There is no one size fits all approach to outdoor classrooms, they can be tailored to a school's goals for space and be as elaborate as expertise, time, and budget allow.

Outdoor classrooms can be different in as many ways as there are instructional strategies. To best utilize outdoor classrooms effectively a diversity of approaches and activities can be used.

### **Effective Teaching Strategies**

Outdoor classrooms are uniquely poised to maximize the potential of experiential learning. Experiential learning is the process of learning through doing (Kolb, 1984). This section will analyze experiential learning in the outdoor classroom. Teachers utilizing outdoor classrooms can maximize the impact of the experiences by crafting a curriculum to allow students to explore the outdoors and take full advantage of using nature as a teacher. The first part of this section will examine the role of different instructional strategies such as formal and direct instruction, inquiry-based learning, and self-directed learning and exploration and reflection. This section will specifically examine the role of the teacher in creating an effective learning atmosphere. The second part of this section will work to discuss specific techniques, strategies, and the impact of technologies impact student learning and discovery

### ***Effective Learning Atmosphere***

Outdoor classrooms and environmental education are innately different from in-classroom settings. Outdoor classrooms and environmental education can be less formal and less defined but less formal does not mean less rigorous, rather it should indicate student-centered and self-directed (Meighan & Fuhrman, 2018). The nature of outdoor classrooms lends itself to a less formal educational environment. NAAEE (2010) suggested that,

Environmental education is learner-centered, providing students with opportunities to construct their own understandings through hands-on, minds-on investigations. Learners are engaged in direct experiences and are challenged to use higher-order thinking skills. Environmental education supports the development of an active learning community where learners share ideas and expertise, and prompt continued inquiry. Environmental education provides real-world contexts and issues from which concepts and skills can be learned. (p. 1)

Education is most effective when connections are made through the power of moments. Heath & Heath (2017) discussed how strong emotions allow for connections and memories to be made across many of life's situations. Due to the initial novelty, the outdoor classroom can offer these opportunities for connections to be formed. Meighan & Fuhrman (2018), described how learning outside provides "a visual aid and allows students to vividly contextualize the presented information." (p. 40). James & Williams (2017) concur,

while much science is learned in classrooms through teacher lectures, textbook reading, laboratory experiments, and interactive discussion. This is not enough to develop an in-depth conceptual understanding. Application of environmental science concepts in experiential, real-life field contexts is extremely valuable (p. 59)

In essence, learning in context and through experiences allows for significant connections to be made. Effective teaching strategies in the classroom are recognized as having a knowledge of the content, being able to manage the classroom environment, and having a broad set of instructional skills. The teacher also must be motivated, resourceful, caring, and responsible (Roberts et al. 2007).

Outdoor classrooms and environmental education together offer students the opportunity to learn in the context in less formal learning environments. Begum (2012) stated “a science teacher should teach environmental education in the science classroom by using the environment as a teaching-learning aid because environmental education helps to develop relational understanding.” (p. 12). These strategies also apply to environmental education and outdoor classrooms, Dillion et al. (2006) and Roblyer et al. (1997) as referenced by Kirschner et al. (2006), reported that teachers have found that discovery learning is successful only when students have the prerequisite knowledge and undergo some prior structured experiences.

### ***Instructional Strategies***

Just as there are many different types of outdoor classrooms, there are many different types of instructional strategies. Emerging technology, reflective thinking, and learning activities are all important instructional strategies.

#### ***Emerging Technology***

Emerging technology continues to impact our lives. It has found its way into every aspect of our lives and the classroom is no different. Bollinger et al. (2020) & Hills et al. (2020) described the role that technology can play in outdoor education and highlight the importance of using technology as a tool that can be appropriately utilized to boost student comprehension. They describe how most environmental education practitioners are hesitant to fully embrace technology but have identified using technology as a navigational tool, checking the weather, using it as a resource to investigate a natural phenomenon (i.e. plant identification, bird songs), and taking pictures. Throughout all of this discovery, it is important to take time to think about what has been discovered.

### *Reflective Thinking*

Reflective thinking is an important and key part of Kolb's experiential learning cycle (1984). Many in the environmental education field use this strategy to provide for deeper thinking and enhance student learning. Rea (2006) suggested that while some people are natural reflective thinkers, many need to be encouraged and even taught how to participate in an effective reflective thought process. Though more work needs to be done to better understand the link between formal reflective thinking as a part of utilizing outdoor classrooms.

### *Activities*

Much of the underlying basis for utilizing outdoor classrooms is founded on the experiential learning process or active learning through doing. Activities can include observation of natural phenomena (i.e. bird watching), plant identification, habitat restoration, water quality analysis, wildlife population surveys, and many others. This is an area of growing emergence, Dillon & Scott's (2002) analysis of trends suggested that over the last ten years there has been an increase in outdoor activities and projects especially at the pre-school and elementary levels. This trend strikes true to the heart of the experiential nature of outdoor classrooms and environmental education and fully utilizes the potential of what both can offer. Dillon et al. (2006) in their review of the literature found that "over structuring activities" with more formal types of activities worked against the nature of outdoor classrooms and were not effective in enhancing student learning. (p. 2)

This chapter reviewed the literature on the impact of experiential learning through outdoor classrooms on student learning. Based on the literature, this project addresses the current gap by analyzing how high school students can benefit from outdoor classrooms. Through a better understanding of the important role experiential learning plays in helping to cement

environmental science concepts, educators can create a more impactful curriculum to enhance student learning thereby answering the question *How does teaching in outdoors classrooms improve secondary student learning of environmental science concepts?*

## **Conclusion**

Learning in context or experiential learning is a widely recognized method of teaching students of all ages new content that allows for better comprehension of new concepts and ideas (Hamilton, 1980). In spite of this, many environmental science courses are taught in classrooms without utilizing nature as an additional aid to better student understanding. To allow for better understanding of environmental science concepts, teaching in outdoor classrooms where a student is surrounded by nature works well to help cement important and foundational environmental science understandings (Jose et al, 2017). Through the use of outdoor classrooms, students are able to see, smell, and feel many of the phenomena discussed in a classroom. These experiences have the possibility to create stronger memories and better learning experiences because of the multisensory learning that occurs, breathing life into otherwise theoretical academic material (Dillon, et al 2006). Outdoor classrooms are indeed unique in their ability to add another dimension to learning. Outdoor classrooms can look widely different depending on the age of the student, content to be taught, and community resources and availability (Wood, 2006). Simply being outside is only part of what makes outdoor classrooms effective. It is important to allow students the opportunity to utilize what they learn through practice and reflection all while helping students create connections between their prior, more structured learning experiences.

Chapter three will detail the curriculum project addressing the research question: *How does teaching in outdoor classrooms impact secondary student learning of environmental*



*science concepts?* This section will also provide an explanation of the setting, participants, and research theories the project utilizes.

## CHAPTER 3

### Project Description

#### Introduction

Outdoor classrooms, because of the experiential nature inherent in their use, lend themselves to a variety of instructional purposes (Price, 2009). This study works to determine the effectiveness of utilizing outdoor classrooms in teaching environmental science topics and works to answer the research question: *How does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?* Chapter One provided my rationale for choosing this topic and explained why outdoor classrooms are a necessary component in environmental education. Chapter two examined the literature on the value of outdoor classrooms and the importance of experiential learning in helping to cement student learning. The curriculum project that follows in this chapter was developed as a result of the findings from the literature review in Chapter Two. This chapter will also work to explain the scope of my research, the methods I utilized, the setting for my research, and how I collected and analyzed the data.

#### Theoretical Framework

The goal of my research is to determine the effectiveness of teaching in outdoor classrooms. I intend to evaluate the effectiveness through teacher-made tests. This method, as described by Mills (2018), is used as a method to adapt curriculum materials from a variety of sources into a summative assessment. The data collected will be in the form of a numerical score, quantitative in nature, and collected pre-treatment to create a baseline and post-treatment to establish the effectiveness of the treatment (p. 133). At the conclusion of the study, I will also

interview five predetermined students. Mills (2018) described key helpful characteristics to use in an interview to elicit useful information as,

- Using open-ended questions
- Using appropriate wait times
- Locating an appropriate place to conduct the interview
- Choosing interviewees carefully (pp. 120-122)

The *Lesson / Learning plan (Appendix A)* the unit recommended by Wiggins & McTighe (2011).

## **Standards**

The standards I will utilize are the Minnesota Agriculture Education Frameworks for Natural Resources. The standards that apply to this research are listed below. These standards lay the groundwork for a solid understanding of habitat and habitat management that is built upon throughout the remainder of the courses to which they apply.

MN.NRES.01.02. Apply ecological concepts and principles to atmospheric natural resource management

MN.RN.01.05. Apply ecological concepts and principles to living organisms in natural resource systems.

MN.NRES.02.02. Assess the impact of human activities on the availability of natural resources and or environmental service systems.

MN.NRES.02.03. Analyze how modern perceptions of environmental service systems and or natural resource management, protection, enhancement, and improvement change and develop over time.

MN.NRES.04.01. Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.

Available at <https://education.mn.gov/MDE/dse/cte/prog/Ag/>

## **Methods**

### **Participants**

The participants of this study will be 9-12 grade students enrolled in the Minnesota Wildlife and Woods and Water courses. There are twenty-four students in the Minnesota Wildlife course and twenty-eight in the Woods and Water class. Student background generally matches that of the entire district.

### **Setting**

This study will take place at a small high school in rural Minnesota. The district has an overall enrollment K-12 of 1545 students. The high school consists of 450 students across grades 9-12. The student population consists of 88.7% White, 10.2% Hispanic or Latino, 0.9%. The student population also consists of 26.4% Free or Reduced-Price Meals, 15.6% are receiving special education services and 1.5% are English Language Learners.

### **Classroom**

The classroom environment consists of one classroom teacher. There are twenty-four students in the Minnesota Wildlife course and there are twenty-eight students in the Woods and Water course. The student make-up is approximately 50% males and 50% females in both classes with 9-12 graders equally represented between both courses. Each course has eight to ten students on Individual Education Plans (IEPs) Both courses have a paraprofessional at all times.

### **Materials and Procedures**

DeVere Burton, L. (2001). *Fish & Wildlife: Principles of zoology & ecology* (2nd ed.). Florence, AL: Delmar Cengage Learning.

Minnesota Department of Natural Resources webpage

Environmental Science Lecture notes

LCD projector

1:1 instructional technology

Pre and Post survey

### **Design**

This study is an attempt to answer a question for my classroom to examine the reasons why outdoor classrooms are more effective than traditional classrooms. A review of research shows that outdoor classrooms are utilized across the world in educational settings but are much less common in the United States. First, I need to know what students know before any education. Then I need to know how much students gain from being educated in an outdoor classroom compared to how much students gain from being educated in an indoor classroom. To

determine this, I will need two groups of similar students. My intention is to teach one class as I would normally (control group) and the other group (experimental group) I would teach in an outdoor classroom. Both groups would be taught the same material. One would experience the lessons in the typical classroom. The other would experience their lessons through being in a more natural habitat and experience much of the basic terminology they are learning about first hand. I also plan on conducting interviews to capture an additional set of qualitative data not realized in the pre and post-review. Due to the quantitative nature of numeral data, it is difficult to add a human dimension through the qualitative data. The interviews will help add life and further dimension to how students felt about their learning, what they specifically thought was impactful, and what they would remember most about their learning experience. The *lesson learning plan* (Appendix A.) highlights the unit recommended by Wiggins and McTighe (2011). Students will be given the same pre and post-test to gauge their understanding of what was taught.

### ***Lesson / Learning Plan***

#### **Simple Stages for Basic Environmental Science Unit**

**Unit Topic:** Basic Environmental Science

**Subject:** Minnesota Wildlife/ Wildlife Management

**Grades:** 9-12

**Timeframe:** Two weeks

#### **Stage 1 Desired Results**

This unit introduces students to basic environmental science topics relating to habitat and habitat types. Students will learn about the five elements of habitat, biomes, and ecological succession.

### **Stage 2 Evidence**

Students will be assessed through a chapter review and will also be assessed with a basic habitat management plan and a unit review.

### **Stage 3 Learning Plan**

Major learning activities include

- Whole class lecture and discussion
- Biome Jigsaw Activity
- Read and answer chapter review questions from chapters 3 and 4 (Fish and Wildlife Textbook)
- Habitat analysis and improvement plan project
- Final Review

The data collected through the pre and post-review will be quantitative in nature. To add depth and dimension to this study five students will be interviewed and asked the following questions

*What was different about learning outside of the classroom vs. learning in the classroom?*

*What is one memory that you remember most? Why?*

*What makes it memorable?*

*What did you like the most/ least about outdoor learning?*

## **Project Description**

The curriculum designed for this project is created to be utilized in any high school course where the subject of habitats is taught. Every high school has different resources available to aid in the teaching of content. Keeping this in mind most of the content can be taught at every school using available resources. A key piece of the curriculum is an outdoor learning experience in a natural setting to allow students to make a personal connection to different habitat types. Understanding habitat is foundational to understanding wildlife biology as many of the issues related to wildlife management are tied to habitat loss and degradation (Potter, 2009). The goal of this curriculum is to help students develop that crucial understanding habitat in a way that cannot be replicated in the classroom.

## **Outline**

There are eight lessons that make up this curriculum. Each lesson is designed to be completed within one to two 50 minute class periods with the exception of the trip to a local park which would vary depending on the distance to and from the school. The lessons are developed to be taught in-sequence and will take two weeks to complete. Students will learn in and outside of the classroom.

## **Lesson One**

Lesson one focuses on basic habitat terms and providing background information. Students will first complete the pre-unit assessment, then students will learn about the elements of habitat. Students will also work on the discussion questions in chapter three out of the Fish and Wildlife Text.



**Lesson Two:**

Lesson two focuses on habitat. Students will review the elements of habitat through examining what is present and what is lacking in the area around the school in terms of wildlife habitat. Students will leave the classroom and walk around the school to find the elements of habitat.

**Lesson Three:**

Lesson three focuses on food webs and food chains. Students will learn about why the relationships between plants and animals in their habitat are important in wildlife and habitat management. Students will create their own food web and food chain that is representative of the local area to demonstrate their understanding.

**Lesson Four:**

Lesson four will take two class periods and will introduce students to biomes. Students will learn the definition of biome and then work with others to research one biome found in the state and present the information they find to class. By the end of the lesson students will learn about the four different biome types in the state. Students will take on the primary role of teacher and teach others. Students will also work on the discussion questions from chapter 4 out of the Fish and Wildlife textbook.

**Lesson Five:**

Lesson five focuses on biological succession. Students will learn about biological succession. Students will learn the basic terminology and utilize an internet search and discover how succession impacts habitat.

### **Lesson Six:**

Lesson six takes students on a field trip to a natural space near school. This experience will allow students experience in a natural setting to allow students to make a personal connection to different habitat types through looking for elements of habitat and the species that are present.

### **Lesson Seven:**

Lesson seven will take two class periods. During this lesson, students will show what they have learned by creating a plan to improve the school grounds for wildlife. Students will need to pick species they wish to attract to the school grounds and improve the habitat for those animals while keeping the school grounds usable for all users. Students will present their plan to the class for lesson eight.

### **Lesson Eight**

During lesson eight students will review their classmates' habitat plans and briefly offer suggestions. Students will also complete the final review.

### **Timeline**

The timeline for this capstone project was completed during spring and summer semester. The literature review and background for the capstone was completed during the spring semester

(February- May) of 2021. The curriculum and reflection was completed during the summer semester (June- August) of 2021.

### **Critical Reflection**

This project will be evaluated after the completion of the unit by students. Students will be asked the following questions:

*What was different about learning outside of the classroom vs. learning in the classroom?*

*What is one memory that you remember most? Why?*

*What makes it memorable?*

*What did you like the most/ least about outdoor learning?*

Questions I will be looking to answer:

*When comparing the two classes, is there a difference between the post-unit review?*

*Did the outside experiences for students help add context to the content? Could they be done differently?*

The lessons are designed to develop a better understanding of habitat and the role it plays in wildlife management. Through the different types of educational experiences students will be able to learn in context as much as possible about habitats, taking a largely theoretical based set of lessons and reframing the learning to concrete experiences.

### **Conclusion**

Chapter three outlined the research paradigm, identified the standards addressed, described the setting and participants, discussed the methods, and listed the materials needed. It also provided an outline of the curriculum that was created to answer the question: *How does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?* Chapter Four will revisit the literature review, discuss major findings and what aided in the development of the curriculum. Additionally, the chapter will identify broader implications and opportunities for further research. Finally, the chapter will discuss the benefits of this research to the profession and how results will be communicated.

## CHAPTER 4

### Reflection and Conclusions

#### Introduction

This curriculum project was developed to improve student's understanding of foundational habitat terminology necessary for further development of a solid understanding of wildlife management concepts through experiential learning. Experiential learning (EL) creates the opportunity to learn through doing. EL works through the ability of experiences to transform individual understanding. Jose, Patrick & Moseley (2017) explained that experiential learning is learning that happens when students use hands-on activities and relate to previous knowledge. Dewey (1963) also explained that "All education comes through experience" (p. 25). Because environmental science is usually taught in the classroom, these educational experiences often are lacking in depth. Given the increasing importance of environmental awareness, it is imperative that educators find more impactful and effective methods to create better learning experiences. Keeping this in mind, the purpose of this research was to determine *how does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?* Chapter Four will revisit the literature review and what aided in the development of the curriculum. Additionally, this chapter will identify broader implications and opportunities for further research. Finally, this chapter will discuss the benefits of this research to the profession and how results will be communicated.

#### Literature Review Summary

Most of the literature I reviewed relating to experiential learning usually began with foundational thinkers like Dewey and Kolb. Much of my understanding of experiential learning was developed by their work. Dewey noted (1963) “all education comes through experience” (p. 25). Kolb stated that experiential learning is “the process whereby knowledge is created through the transformation of experiences” (p. 38). Additionally, Jose, Patrick & Moseley (2017), used Wenger’s, (2009) understanding of experiential learning and explained it as “the notion that learning occurs when students use hands-on, task-oriented activities and relate previous knowledge in a contextual way to real-life examples,” (p. 270). Hamilton (1980), also noted that “Experiential learning elicits a wider range of learner responses than conventional classroom learning.” (p. 183) In using these understandings of experiential learning as a foundation I was able to determine that experiential learning opportunities create situations where learners invest themselves differently into their learning as compared to more traditional classroom experiences.

Experiential learning is inherent in outdoor education, James and Williams (2017), noted that “Application of environmental science concepts in experiential, real-life contexts is extremely valuable” (p. 59). Meighan & Fuhrman (2018), described how learning outside provides “a visual aid and allows students to vividly contextualize the presented information.” (p. 40). Outdoor classrooms and environmental education together offer students the opportunity to learn in the context. These experiences work together to create opportunities for deeper learning and more connections to occur. Begum (2012) stated “a science teacher should teach environmental education in the science classroom by using the environment as a teaching-learning aid because environmental education helps to develop relational understanding.” (p. 12).

## **Implications**

The key takeaway from the literature review and the capstone project is that learning in outdoor environments aids in student comprehension because of the experiential nature of learning in real life contexts. I will be actively examining my curriculum for opportunities to use the outdoors as a teacher. Beyond the environmental science classes I teach, I will be looking for opportunities to add additional experiential learning opportunities to create more contextual learning opportunities as the research on experiential learning reaches across all subject areas.

As an educator, it is important to utilize best practices to create the most effective learning environments for students. Moving forward, I intend to plan for an outdoor classroom space. I intend to do so by utilizing the best practices suggested by the Minnesota Department of Natural Resources and others. In creating the outdoor classroom, it will be designed so that all staff members looking to add an additional dimension to their learning environment could use the space. While this capstone project focused on environmental science directly, by reading through the related literature it seems as if there are an almost endless amount of opportunities to bring the learning outdoors and create deeper learning experiences regardless of the subject being taught.

### **Limitations**

The curriculum that I developed for this project uses outdoor spaces to help students better understand habitat terms, this is key for this curriculum because the habitat allows for contextual learning. Additionally, a trip to a local park that offers different habitat types is essential to also aid in student comprehension because of the learning in context experience. Some schools have limited outdoor spaces on their school grounds, making it difficult for students to develop the experience of analyzing habitats. Likewise, some schools lack the

financial resources to allow students to visit a local park. Additionally, there are logistical challenges with transportation and scheduling. Beyond the issues that may arise with the specifics of site issues or student travel, adoption of the curriculum by other teachers may be limited by teacher knowledge and interest in habitat and perceived difficulties in allowing students to discover the habitat independently.

### **Opportunities for Further Research**

This capstone project focused on high school students and increasing their comprehension of basic habitat terms through using outdoor spaces for experiential learning. I feel this is only the beginning of how we can improve student learning experiences through the use of outdoor classrooms. In developing the literature review, I was particularly struck by the observation of the value of outdoor classrooms for the multi-sensory experience of sights, smells, feel, and movement of being outdoors (Dillon, et al 2006). Examining additional dimensions beyond content and location of the learning was intriguing and seems worth considering. With more development of this research I feel this is an area that all educators could benefit from and could incorporate into their classrooms. Through the creation of classroom spaces, in and outdoors, which work to create contextual, experiential, and multisensory learning opportunities.

### **Communicating Results**

As I worked to create this curriculum, my goal was also to help other educators in their teaching of the basics of habitat. My intention is to share my findings with other educators who teach high school environmental science through a shared Google drive folder. I also hope that other teachers who are looking for information about the benefits of outdoor classrooms will be able to utilize this information.



## **Benefits to the Profession**

As an educator, there have been many times I have wished for ways to add additional depth to the lessons being taught. This capstone project affirmed the observations I have made over my career, that experiential learning creates more engaging experiences and better learning opportunities. Many times educators wish for spaces outside their classroom to add another dimension to the learning experience but lack the knowledge and resources to begin the process. The goal of this capstone project was to discover the benefits of adding outdoor classrooms. The curriculum unit was developed with this in mind to aid in student understanding of the basics of wildlife habitat. Beyond the curriculum unit, the literature review provides a solid footing from which educators can advocate for the development of outdoor classroom space.

## **Conclusion**

The goal of this capstone project was to answer the question *how does teaching in outdoor classrooms impact secondary student learning of environmental science concepts?* Through reviewing the significant literature, discussing the importance of experiential learning, and reviewing current literature on outdoor classrooms, I developed a curriculum that revised my current unit and added additional dimension to further student engagement and understanding. The research in these areas reaffirmed my understanding of student learning- that unique experiences work to develop understanding and cement memories better than standard classroom activities. I look forward to my plans of creating an outdoor classroom based on my findings from this capstone project.

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