

Hamline University

DigitalCommons@Hamline

School of Education Student Capstone Projects

School of Education

Summer 2020

HOW CAN INCORPORATING GAMES AND ACTIVITIES ENHANCE LEARNING IN ENVIRONMENTAL EDUCATION?

Joan Fasanella

Follow this and additional works at: https://digitalcommons.hamline.edu/hse_cp



Part of the [Education Commons](#)

HOW CAN INCORPORATING GAMES AND ACTIVITIES ENHANCE LEARNING
IN ENVIRONMENTAL EDUCATION?

by

Joan Fasanella

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

Hamline University

Saint Paul, Minnesota

May 2020

Capstone Project Facilitator: Patty Born-Selly

Content reviewer: Diane Gurnea, Jessica Prince-Sharrar, Jamie Viebach

Peer reviewers: Erica Hall, Nicholas Koerbitz, Henry Whitehead

TABLE OF CONTENTS

| | |
|---|----|
| CHAPTER ONE: INTRODUCTION..... | 4 |
| Foreword..... | 4 |
| Background..... | 5 |
| Motivation..... | 6 |
| Professional growth..... | 8 |
| Rationale..... | 11 |
| Summary..... | 13 |
| CHAPTER TWO: LITERATURE..... | 15 |
| Introduction..... | 15 |
| Using games and activities versus traditional teaching methods..... | 16 |
| Summary..... | 21 |
| Benefits of games and activities..... | 21 |
| Summary..... | 27 |
| Obstacles against game and activity based learning..... | 27 |
| Summary..... | 32 |
| Implementation and assessment of game and activity learning..... | 33 |
| Summary..... | 38 |
| CHAPTER THREE: METHODS..... | 40 |

| | |
|------------------------------------|----|
| Introduction..... | 40 |
| Project overview..... | 41 |
| Project description..... | 42 |
| Setting..... | 44 |
| Audience..... | 45 |
| Curriculum development theory..... | 46 |
| Learning assessment..... | 46 |
| Summary..... | 47 |
| CHAPTER FOUR: CONCLUSION..... | 49 |
| Introduction..... | 49 |
| Literature review..... | 50 |
| Developing the project..... | 51 |
| Limitations..... | 54 |
| Future use..... | 55 |
| REFERENCES..... | 56 |

CHAPTER ONE

Introduction

Introduction

In my work as an environmental educator at a nature center, I have often incorporated games and activities as learning tools to enhance the learning experience and reinforce lesson objectives. Environmental education has become vital as global concerns such as climate change, water conservation, waste management and food production loom over our future. According to the Environmental Protection Agency (2018), environmental education is “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.” (What is Environmental Education? section, para. 1). By introducing children to environmental education, they are given a background that prepares them to make better decisions that affect the future of the environment (Aydede-Yalcin, 2016; Dresner & Gill, 1994; Volk & Cheak, 2003). Environmentally themed games and activities can bridge the gap between traditional and informal learning. I began to use games and activities while I was a scout leader to make work on various scout badges fun for the scouts after spending all day behind a desk at school. I observed that when a game or activity is used, the students

grasped the concept of the lesson quickly, are able to articulate what they have learned and they were excited about it. Drawing on my nature experiences as a child, I seek to bring forth self learning and discovery for the scouts and for the students who visit the nature center where I work. While conducting research for this capstone, I uncovered research that confirms that young people who are literate in environmental/ecological concepts, demonstrate proactive behavior toward conservation and have better test scores on standardized tests (Aydede-Yalcin, 2011; Leung, Tam, Wu Lung & Spengler, 2019).

The purpose of this study is to further explore *how can incorporating games and activities enhance learning in environmental education* beyond the lesson at hand.

Students who have the opportunity to participate in activity based learning in environmental education are more aware and are likely to take an active part in stewardship projects (Volk & Cheak, 2003).

Background

I often reminisce about growing up in what was then a small, outlying suburb of Chicago. Cornfields and farms were within walking distance and empty wooded lots beckoned me to explore. Far-sighted urban planners had established county forest preserve districts throughout the state to preserve open spaces for future generations. I was fortunate to live near many of these preserves managed by the county and was able to visit them often. I spent as much time as I could outside in my neighborhood, capturing butterflies, collecting flowers and bird watching. Given a gift of a butterfly net, I spent hours in the field capturing, admiring and releasing butterflies. I watched the seasons

change by the color of flowers. In the spring, white and pink flowers are dominant, and gradually these colors gave way to yellow and purple. Flowers are just darn pretty and are so important to the food chain. From childhood, bird watching was something that was inspired by a bird feeder outside the window that was always well stocked with seed. On days where the weather was unfavorable, I would spend time in front of the window watching avian visitors. Those days were precious, for soon the cornfields and farms would disappear, to be replaced by fields of new houses and roads lined with strip malls.

With it came a change in family dynamics where both parents now work to pay for the new house and other living expenses, leaving the children to take charge of their afterschool time (Belle, 1997; Patten, 2015). Out of this new family dynamic, many children who once played outside all day, now spend more time indoors with the TV or favorite device (Belle, 1997; A Kaiser Family Foundation, 2010; Jiang, 2018). Gradually, the common knowledge learned from spending time outdoors faded. Sadly, it seems that this loss has spanned more than one generation. If the parents have lost the connection to nature, how can they inspire it in their children? Some time needs to be reserved to spend time outside without an agenda to just “chill”. I believe that families should be encouraged to spend some time in nature without pressure and just take it in.

Motivation

When I had my own children, I tried to recreate some of the experiences I had growing up. I took them to the woods and pointed out the different species of trees and we looked for birds and animals that lived there. My children loved our nature junkets and when they got a bit older, their friends were included. I would scan the newspapers

and was on every mailing list for nature centers and park districts looking for interesting and fun places to go. The children were only an excuse for me to relive my childhood. They were willing to go anywhere, do anything and were pretty good company. With the car full, we would head out to see what we could find.

My love of nature met its match when I became involved with scouts. Boy Scouts of America (BSA) has fundamental ties with environmental education. Founded in 1910, the BSA is a leader in youth programs focusing on character and leadership development leading to a lifelong ability to make ethical and moral choices (Boy Scouts of America [BSA], 2020). Most of their programs are based on developing understanding and sustainable outlook with nature. As I spent time developing lessons for the boys that adhered to BSA guidelines, I began to understand how important it is to share these values. A sort of metamorphosis occurred and my passion shifted from a love of nature to a love of teaching about nature. I began to think about what was the best way to get lessons about nature, community, personal health and technology to a group of boys who had already spent a full day sitting at a desk. Why, to incorporate a lesson with a game or activity, of course! I began to research topics and looked for anything that would have hands-on experience. Anywhere I went became a source of information to translate into an activity laden lesson plan for the scouts with plenty of hands on learning. To bolster my background, I became a volunteer for the forest preserve district so that I would have access to more information and gain enough knowledge to be an effective teacher. Here I was able to gain valuable experience as a volunteer interpreter by facilitating public and school programs. The staff and volunteers at the forest preserve proved to be a great

training resource by sponsoring me for professional certifications, such as herbicide applicator, prescribed burn crew member and natural resource technician. Through their environmental education programs, they encouraged me to create my own lesson plans and implement them. I brought my experiences home, for the benefit of my scout group and replayed the lessons I had learned. For some field work, I arranged for the scouts to participate on a restoration workday with forest preserve volunteers, using loppers to clear out invasive species. Although it was a cold day with snow on the ground, the bonfire and snacks made everything right. At the end of the workday, the boys did not want to leave because they were having so much fun. By the next meeting, they were able to identify the main species that were cleared and understood what invasive species were and why they are a problem.

Here was the beginning of my quest to make learning about nature and ecological practices as simple and painless as possible. Now was the time to take a real leap of faith and return to school to pursue my new found passion of *how can incorporating games and activities enhance environmental education.*

Professional growth

While working as a volunteer, I was hired as a part-time naturalist at a nature center in nearby Indiana. With the coordinator's approval, I was able to research and create my own programs for public and special interest groups. Remembering past work with my scouts, the programs included some activity based learning. The programs were successful but did not reflect the excitement of learning something new that I was looking for. It was not until I was hired by a nearby park district with an environmental education

(EE) and team building department that I saw how the difference adding a game could make to the participant's understanding of the lesson. I watched the participants having fun and becoming excited while playing games, all the while learning the basic components of a lesson. The fact that I was learning basic EE lesson concepts through the games we created was not lost on me. This EE facility had games for every program offered. When I took the summer camp director position, I made sure that plenty of games would be included to fill out lesson plans and to keep the campers engaged in learning about nature. By tapping the team building department for activities and games designed to break down social barriers and incorporating them into the day's plan, shyness began to fade away, paving the way to group learning.

The 17-acre park is heavily wooded with a creek and a wetland. Deer, beavers, coyotes, raccoons were only a small sampling of the wildlife that call the park home. The possibilities to create environmental education programs were endless. A tracking game could easily be improvised, searching for and comparing animal tracks. The kids loved nature lessons like this. It was something new and different from anything they could get in a classroom. It is such a pleasure to see them get excited about learning something about nature.

I continued my work at the Indiana nature center and began offering scout programs. Boy Scout merit badges have strict requirements to complete the work and do not allow for much variance. It was my job to make the requirements come to life and make them memorable. Again, I researched to find games that supported the lessons and activities that gave hands-on experience. By the time I was finished, we offered a dozen merit

badge workshops and became known in the local Boy Scouts of America (BSA) council as an environmental education hub. The BSA council invited me to facilitate a breakout session at their Leader's Day training to show leaders how to conduct scout meetings with an environmental theme. During the session, I introduced environmental education games for the leaders to play so they would understand the lesson and gave out resources so they could duplicate it with their scouts. I assured the leaders that it is OK not to know every answer. Finding the answer is the fun part.

Riding on the success of the BSA workshops, I began to offer citizen science training for adults which are offered nationwide as part of a conservation effort. In my opinion, adults have a different expectation of learning that falls in the traditional format of teacher led learning. But when a water monitoring training was offered, they stepped up to the challenge and began scooping up water samples, making chemical tests, looking for, identifying and comparing specimens with other participants. By the end of the session, they were ready to go out and collect water samples at their monitoring site. The hands-on time they had was invaluable practice for learning the sampling techniques and reporting protocol used for the monitoring program. Did I mention that the adults were having a great time while learning how to conduct tests and take samples?

Now, I never have an EE program without incorporating a game or activity with it. It could be something as simple as a demonstration that everyone gets a chance to try or just some time out exploring the grounds. I have observed that presenting lessons at a nature center is a unique teaching experience, and there are some problems that come with it. First, as facilitators outside their classroom, we have no history with the students.

We do not know what kind of background instruction they have had. We do not know if they will fully understand what we are presenting or what our facility has to offer. The students do not know us and may have a tendency to “hang back” and rob themselves of the full potential of the program (Hewitt, 1997). The second problem is time. With only 60 or 90 minutes to get an EE concept across, I have observed that a game or activity can offer a perfect fit. The students have been brought to the center to learn in a way that is difficult to replicate in a classroom. Games and activities help to focus the group on a main topic and are beneficial to students who have a hard time learning in a classroom setting (Hewitt, 1997; Sung & Hwang, 2013). Lesson plans can be tweaked to highlight any interest in any setting using a few basic games and activities.

Rationale

Just because they are fun, does not mean that games do not have specific learning goals and it is fueling the need to use games as an education tool (Branco et al., 2015; Klein, 2015; Mese & Dursen, 2019). A shift in teaching techniques has led to a more active approach to learning with the introduction of entertainment learning games in the 1980’s (Gerber, 2014). An astute teacher can take the challenges of a game to inspire students to learn valuable lessons (Klein, 2015). Strategically placed games in a lesson plan can reap the full benefits of increased attention, critical thinking, problem solving and making a connection with past knowledge and experiences (Klein, 2015). A game can be a great motivator for participants, particularly when combined with a reward system (Mese & Dursen, 2019). The introduction of competition can further motivate participants to do well (Mese & Duran, 2019). Games inspire critical thinking, improve

problem-solving skills, and invite cooperation between participants to put into practice skills that are needed in modern education (Kuo, Barnes & Jordan, 2019). Games with an environmental theme should incorporate real-life questions into a learning experience that is instructive and fun (Pollanen & Vartiainen, 2013). These games can be presented in a question-and-answer format, a memory challenge or functional task where the player works to complete a goal (Pollanen & Vartiainen, 2013). Students who partake in educational games are consistently more motivated to learn as they are now in charge of what they take in (Hewitt, 1997). When developing an environmental education learning game or activity, some things to be considered are readiness of the group and time allowed to complete the lesson.. The facilitator should choose an objective that is age appropriate for the group, taking into consideration what normal educational background and maturity would be at a certain age or grade level (Oltman, 2002). Any game or activity should reflect what is appropriate for that age group. Young (ages 4-10) children have a fascination with nature and are best served when lessons revolve around discovery (Peace Corps, 2015; Sophian & Wood, 1997). For example, when taking groups of small children on a hike into the woods, look for things that they are familiar with, such as colors. When a color has been identified, examine the object on which it was found. Together, discover the connection between the color and the object, whether it be a leaf or a bird. An activity such as this can begin to build a knowledge base for future inquiry.

Older children have a developed sense of logic and prefer to work out solutions on their own and/or want to feel that they can be part of a positive change (Peace Corps, 2015). When working with older (ages 11-14) children and teens (ages 14-18), giving

them an objective with basic information and allowing them to work out their own conclusions allows them the chance to develop their understanding (Hewitt, 1997: Peace Corps, 2017).

When hosting a group from another facility, contacting the groups' instructor for guidance ahead of time can be helpful. Background information such as what the class has been studying can make it easier for the nature center facilitator to make a connection to what has already been learned to what they will experience. Facilitators must look at the mechanics of the activity, such as what materials will be needed, how many players a game can have at one time, how much area game or activity needs, where the game or activity should be facilitated (outdoors or indoors), how much time will be needed to complete the game or activity and safety factors (Prince-Sharrar, 2014). Users of games and activities in a learning situation can be formal or informal. In either situation, the facilitator will need instructions clear enough to follow (Carillo, Garcia, Laguna, Magan & Moreno, 2019) . Facilitators need to conduct research to include several different types of modes for the game. They should also implement a challenge to the students by creating a lesson using multidisciplinary techniques, such as vocabulary, art work, critical thinking and physical game skills (Kingsley & Grabner-Hagan, 2015; Oltman, 2002).

Summary. *How can incorporating games and activities enhance learning in environmental education* offers a different approach to a lesson. A well planned and written game or activity can bring an EE lesson to life. Both are essential in a non-formal learning setting. A game can quickly teach a concept to students and reinforce a classic lesson plan. The activity allows for hands on learning experience. Studies have shown

that playing educational games can motivate students and result in increased learning performance (Yang, Lin & Liu, 2016). Studies have also shown that by exposing students to environmental issues they display an awareness and environmentally responsible behavior (Hewitt, 1997; Kuo et al., 2019; Volk & Cheak, 2003).

For many, traditional learning paths are a challenge. A large percent of students learn best by doing or creating (Kuo et al., 2019; Szczytko, Carrier & Stevenson, 2018). Games and activities open the door for them so that they have the same chance to grasp the lesson. In a sense, games and activities level the playing field by using multidisciplinary techniques to give these students a better chance to excel (Hewitt, 1997). Science taught with hands-on experience may be especially beneficial for students with disabilities (Szczytko et al., 2018).

Chapter 2 will draw on literature and studies to support how games and activities enhance environmental education. The purpose is to make a connection between environmentally themed games and activities to the participant's understanding of his/her living environment, inspire critical thinking and to be able to put this knowledge into practice. Chapter 3 will outline the capstone which includes a pedagogy to assist educators in creating effective games and activities to enhance EE learning with lesson plans that include several games and activities that introduce learning about social and environmental issues along the southern tip of Lake Michigan. The purpose is to inspire teacher/facilitators to create meaningful lesson plans about the Calumet area using games and activities for inquiry-led learning. Chapter 4 will reflect on the lessons learned and obstacles encountered while researching materials to create the capstone project.

CHAPTER TWO

Literature Review

Introduction

To build on what was covered in Chapter 1, I will continue to rethink and redesign traditional environmental education (EE) lesson plans. The object is to create an easy system to convert a one-dimensional lesson into a game or activity that will quickly and painlessly teach the basic concept of the lesson. Games are revolutionizing how subjects are taught through simulation that fosters critical thinking and engaging and retaining attention of the player(s) (Branco et al., 2015; Gerber, 2014). There are many online games which are appropriate for any age that introduce eco-friendly concepts that can be applied in real world situations (Branco et al., 2015). This method works especially well for EE, where the study of ecology requires critical thinking, problem solving and goal setting. Without these steps, a lesson can fall flat, leaving only facts to be memorized (Klein, 2015). A well-placed game or activity can bring the lesson to life and allow the student to take an active part in the outcome. Using the “backwards design” described by Wiggins & McTighe (2011), meaningful learning goals are outlined with established clear, detailed learning objectives created before fleshing out the plan. Backwards design lends itself well to EE by breaking down “big picture” issues into smaller, digestible parts

that can be understood. Main skills and knowledge to be developed are identified using this process. Once the learning goals are established, learning components, such as games or activities, can be introduced to support objectives and learning assessments can be selected (Wiggins & McTighe, 2011). The results indicate that participants in this type of pedagogy exhibit a measurable concern for the environment and a desire to help protect it (Aydede-Yacin, 2016).

What constitutes a game or activity? Although similar, games and activities differ slightly. A game is played over a specified time with rules with a definite end result (Gerber, 2014). An activity is a hands-on undertaking that is done as a project for a specific learning goal where participants are constantly engaged (Panko et al, 2007, as cited by Anwer, 2019). Both are exceptional learning tools.

Chapter 2 will use literature to support the quest to discover *how can incorporating games and activities enhance learning in environmental education*. Four main themes will be explored: the advantage of using games and activities in a lesson plan compared to traditional teaching methods; benefits of participating in learning games and activities beyond the lesson itself; obstacles encountered using non-traditional teaching methods and implementing the games and activities into a viable lesson plan. These themes will help establish the importance and value that games and activities bring to a student's understanding of the environment (Klein, 2015) and confirm that students retain learning concepts better when they are actively involved (McLean, 1973).

Using games and activities as compared to traditional teaching methods

Incorporating games and activities to enhance learning in environmental education is an alternative approach to learning as compared to traditional lesson plans. A traditional lesson plan usually follows the formulated method of reading, writing and arithmetic to teach students. Traditional lessons are presented in a sequential learning order, following a graduated succession of information (Knapp, 1996). Using games and activities as educational tools can make learning a fun and easy way to grasp the fundamental point of a lesson (Klein, 2015; Kuo et al., 2019). Lessons using games and activities as educational tools tend to make the learning more interpretive and informal (Knapp, 1996). Engaging students in a practical simulation gives hands-on experience that can be applied in real world situations (Branco et al., 2015; McLean, 1973). Studies of students who participate in these have shown better understanding of environmental concepts (Aydede-Yalcin, 2016; Birinci Konur, Seyihoglu, Sezen & Tekbiyik, 2011; Dresnier & Gill, 1994). These students also express a concern for the environment and a desire to preserve nature (Aydede-Yalcin, 2016; Birinci Konur et al., 2011; Dresner & Gill, 1994).

The general premise of using environmental themed games and activities with a lesson plan is that the students take an active role in learning, while the instructor steps back into a facilitator role. Play is an important part of learning development as it can be directed to have a specific outcome. While participants are involved in play, they are using critical thinking to analyze the structure of the game and are able to follow through to an end result (Klein, 2015; Sung & Hwang, 2013). Participation in a game or activity often requires students to work together cooperatively in order to achieve results. The

flow of information from one student to the next reinforces learning and builds self-confidence. Engaged students have a vested interest in learning and when the game or activity has an environmental theme, it increases environmental awareness. A study at a summer camp by Dresner and Gill (1994), found that once campers adjusted to their new surroundings and free from pressures at home, they were able to open up to new ideas and learning, ultimately changing their attitudes toward the environment. In an indoor garden based learning study by Schneller, Schofield, Frank, Hollister and Mamuszka (2015), a student commented: “I definitely like it a lot more than a lecture. It’s fun to move instead of sitting in the same spot. It’s a different way of doing it that doesn’t always feel like learning” (p. 263). Facilitating opportunities for students to explore and work out their own solutions allows for the learning to take on a much deeper meaning and understanding about the environment and is more enjoyable for them (Schneller et al., 2015; Wiggins & McTighe, 2011).

The purpose of incorporating games and activities to enhance learning in environmental education is to give students an alternate way of learning while raising awareness of environmental issues, develop an interest in environmental issues/ecology and foster a connection with the natural world (Dresner & Gill, 1994). In a study by Volk & Cheak, students who do participate in environmental based activities appeared to be more knowledgeable, by applying the knowledge learned and demonstrated a desire for stewardship (2019).

Environmental education is best served by a multidisciplinary approach to develop an understanding of environmental issues that will require knowledge from many subjects (McLean, 1973). Students will need to understand and connect the social aspects of environmental issues as well as the science behind it and possess the academic skills to back up any statistics obtained from experiments and field studies (McLean, 1973). Social science taught with environmental science will help students understand the impact of humans on the environment (Miller, 2011). Students who are exposed to other learning disciplines will develop a better, deeper understanding of the environment (Miller, 2011). Introducing a game or activity can bridge the gap between subjects.

Traditional learning focuses on instructional teaching where the student's role is limited to absorbing knowledge. This kind of passive learning can fall short of the engagement value that a game or activity can provide (McLean, 1973). Environmental education and ecology are disciplines that require critical thinking and engagement by the student in order to understand concepts being presented. Applying Gardner's theory of multiple intelligences of art, interpersonal and scholastic talents provides for a multidisciplinary format that allows students to absorb and reflect information in several ways (Gardner, 2011). Not every student is academically inclined (Kou et al., 2019). Some struggle with reading, some are unmotivated or bored and others are easily distracted by other students (Coyle, 2010; Kou et al., 2019). By using a kaleidoscope of learning opportunities that games and activities bring to the lesson, broaden that chance that these students who might typically fall through the cracks, will be reached. Incorporating games and activities into lesson plans may be effective for reaching

students with Attention Deficit Hyperactivity Disorder (ADHD), behavioral disorders and other learning disabilities to comprehend environmental concepts (Collini, 2019; Coyle, 2010; Schneller, Schofield, Frank, Hollister & Mamuszka, 2015; Szczytko et al., 2018). Using games and activities in a lesson can be beneficial for English as a Second Language (ESL) learners (Gerber, 2019). By adding games and activities, these students may gain a new perspective and success that they could not achieve in the past (Haney, 2007). With success, some students will increase confidence and increased self-esteem. Dresner and Gill wrote that positive self-image contributes to a positive attitude about the environment (1994). In a study by Birinci Konur, students engaging in games and activities through a nature camp displayed increased self-confidence that later translated to a positive attitude toward classroom lessons, including those subjects that were previously disliked (2011). Students become motivated, active learners when engaged in performance based learning.

Increased self-confidence also benefits the environment. In the 37 studies and articles concerning the use of game and activities cited for this research, participants demonstrated an increased awareness of environmental issues when they were used as educational tools. Many of these students went on to become actively involved in stewardship programs and ecology clubs. Some of the students declared that they would like to take an even more active role by pursuing a career in an environmental field. The parents of some of the campers observed by Dresner and Gill (1994) stated that they had noticed changes in their child after the summer camp had ended. These former campers had been involved in environmentally based activities during their time at nature camp.

The parents reported that their child showed a marked interest in the natural world. Some examples were wanting the family to go on a camping trip, talking about environmental concerns, recycling at home, and riding their bike instead of asking for a ride (Dresner & Gill, 1994). Positive changes in behavior can be a result of the knowledge gained from participating in environmentally themed activities. Each student chooses to apply what they have learned from the activities they participated in. The lessons learned from the activities participated gave them the foundation to become environmentally aware.

Summary. When learning games and activities are incorporated into traditional learning, the teaching mode shifts from instructional based to discovery learning. Students are able to take an active role in how they learn. This participation can help the students to develop a deeper understanding of topics. Game playing allows for students who normally do not do well in a classroom to excel, bolstering self esteem (Coyle, 2010; Kuo et al., 2019). Games can be an important tool for students with autism, ADHD and behavior problems by allowing the students to learn in their own terms and abilities (Carrier et al., 2018; Collini, 2019; Coyle, 2010; Schneller et al., 2015; Szczytko et al., 2018). ESL students may also benefit from games and activities (Gerber, 2019).

When partnered with environmental education, students exhibit self-confidence and are better adjusted (Dresner & Gill, 1994). Students who participate in environmentally themed games and activities exhibit critical thinking and a concern for the environment (Volk & Cheak, 2003). Taking a multidisciplinary approach contributes to critical thinking and problem solving (Branco et al., 2015).

Benefits of Games and Activities

Students who participate in environmentally themed games and activities have shown positive behaviors. Many are team or group based, so playing the game requires collaboration with others. This type of structure encourages cooperative learning, so that everyone participates and has a chance to give input. One of the best outcomes is that students who tend to hang back in the classroom are given a chance to showcase their knowledge and talents. Successful interaction with peers bolsters self confidence (Dresner & Gill, 1994; Hewitt, 1997). Interactive environmental education has the ability to reach beyond the lesson. Those who participate in environmentally themed games and activities exhibit a deeper understanding of the concepts of the lesson and demonstrate concern for the environment (Carrier, Tugurian & Thompson, 2014; Dresner & Gill, 1994). Participating in environmental themed activities has the ability to reach even further. Since most environmental activities involve group work, in the field or in the classroom, participants must learn to work together cooperatively (Volk & Cheak, 2003). This life skill is essential not only in the classroom, but also in the workforce where cooperation between employees is necessary for production and workflow (Coyle, 2010; Kuo et al., 2019).

Students having contact with green space in a schoolyard, can produce better grades, higher test scores, enhanced knowledge and improved outcomes in science, math and language arts (Leung et al., 2019; Williams & Dixon, 2013). Improved academics are one of the benefits of spending time in nature. Behavior issues showed a decline in a 2005 study conducted of 10 middle schools in South Carolina where an Environment as an Integrating Context (EIC) program was initiated. EIC uses the community and school

surroundings to implement a student led learning guided by proven educational practices. EIC is based on State Education and Environment Roundtable (SEER) research which indicates that students who participate in environmental programs score higher on standardized tests (State Education and Environment Roundtable, 2018). After the first year, the study found that the students who participated in EIC programs had fewer absenteeism, suspensions and significantly fewer discipline referrals than non EIC students (as cited in Coyle, 2010, p.14).

School and community gardens can provide an introduction to EE. By integrating ownership through participation in planning a garden plot requires more than the dedication from the students. To create a successful garden, critical thinking and research are factors. In a study by Sulsberger (2018), when asking a group of first grade students what they would like to plant in a garden, the students replied with species of flowers and vegetables that they were familiar with. An interesting observation was that some of their choices reflected the student's social-economic background. One student suggested ideas for future fundraising to support the garden, exhibiting critical thinking skills. Teachers often dictate which activities and what course the student's participation will take and decide what value it brings to a lesson. These subtle discriminations can transfer to the child and shape their perception of the environment (Sulsberger, 2018). At a community children's garden in Illinois, adults are there to supervise, but not allowed to help (Sullivan, 1992). Participants are freely allowed opportunity for self expression. At both garden locations described by Sulsburger and Sullivan, the children were enthusiastic about creating a special place which they had designed. The children who participate

learn valuable, transferable life skills such as problem-solving by deciding the best layout for a garden, how to implement it, delegation of work duties by prioritizing and dividing up chores, forecast planning so that plants mature at different times and the ability to accept disappointments when things do not work out as expected.

In a study by SEER in California found that English as a Second Language (ESL) students list benefits from environmental education as an: “increase cooperation, increase leadership, improve relationships with peers, motivation to learn increased, increase in confidence, increase in opportunity to ‘shine’” (as cited in Coyle, 2010). In a study at an elementary school in Milwaukee, Wisconsin, where 71% of the students qualify for free or reduced rate lunches and the student body is comprised of African-American, Asian-American, Hispanic, Caucasian and “other”. These students showed a significant improvement of scores in reading comprehension and math proficiency when environmental education was added to its curriculum (Glenn, 2000; Leung et al., 2019). In a study by Schneller et al. (2015), a middle school teacher in New York is quoted:

I have students with a variety of learning styles and learning abilities. The hands-on aspect was an equalizer. The kids who have trouble learning, and for the kids who are super advanced, they’re all having the same discussions. There’s more collaboration and engagement and it contextualizes what they’re learning (pp. 263-264).

Homeschooled children who have environmental and outdoor education, also reap the same physical and emotional benefits as children in a classroom (Coyle, 2010). Students with autism or hypersensitivity stand to benefit by exposure to nature by merely touching

or examining. Sensory experiences can refocus the child's attention and reduce stress (Collini, 2019; Szczytko et al., 2018).

Students who participate in environmental projects have reported that hands-on learning has helped them more than traditional, lectured instruction (Schneller et al., 2015). McLean (1973) noted that students have shown a higher level of retention of environmental lessons. Game playing can help organize concepts making them easier to remember as rules of the game. Students can then be directed to a specific concept that may be reworked in a future lesson (Klein, 2015). At a science camp, students who expected to be bored, were pleasantly surprised and participated in more activities. They found camp activities to be engaging and felt that the programs more than met their expectations (Birinci Konur et al., 2011).

Students who have become engaged in their learning with participation in environmental games and activities, are less likely to drop out of school (Coyle, 2010; Szczytko et al., 2018). Blacks and Latinos traditionally have a higher percent of students who do not finish high school and stand to benefit the most from the engagement that environmental education offers. Some students who dropout, do so because they are unable to meet the academic challenges, however, a larger percent of the dropouts left school because they were not challenged in a way that honed in on their learning style (Bridgeland, Dilulio & Morison, 2006; Rumberger & Lim, 2008). Those without a diploma can expect to earn less than a high school graduate over a lifetime.

The hands-on learning that EE provides may be able to encourage these high risk students to challenge themselves in ways that motivate and build self esteem. Effective

EE is multidisciplinary, allowing for these students to learn based on their strengths. Environmental education has a proven track record of engaging and motivating students with real world application (Kou et al., 2019). The connection between real world application and making better grades may be a motivator for students to stay in school (Kou et al., 2019; Lueng et al., 2019; Williams & Dixon, 2013). Some studies have pointed to a connection between dropping out and delinquency (Rumberger & Lim, 2008). Bringing environmental education and creating more green space to depressed neighborhoods has shown a reduction in crime (Kuo & Sullivan, 2001; Kou et al., 2019).

Simulation games have been shown to inspire innovation. These games break down complex issues into smaller parts that are easier to understand for learning or training purposes (Branco et al., 2015; McLean, 1973). These positive results have found their way into industry. Simulation training has become standard in industries such as energy, aviation and bioengineering with excellent results. Games have also been created to simulate environmental problems that are currently being worked on by scientists (Branco et al., 2015).

Teachers can also appreciate the movement toward students taking an active part in their education. It is extremely gratifying to work with students who are engaged in learning. Many teachers have reported a marked decrease in aggressive behavior and increase in cooperative learning (Collini, 2019; Coyle, 2010; Kuo et al., 2019; Szczytko et al., 2018). Students who are engaged in an activity based lesson, have no time to be disruptive, making a class easier for the teacher to manage (Lieberman & Hoody, 1998, as cited by Haney, 2007).

A change in education direction came in 2001 with the “No Child Left Behind Act” which caused a shift toward increased visibility and accountability by putting more emphasis on standardized tests (Coyle, 2010). Now working under pressure to produce high scores in core subjects such as math and language arts, outdoor and environmental education has suffered (Carrier et al., 2014; Coyle, 2010). By 2010, education trends began to reverse to modes of education that encompass multidisciplinary approach. (Education Week 2010, as cited by Coyle, 2010, p.12). This includes environmental education which is now beginning to take a bigger role in academics (Kuo et al, 2019).

Summary. The benefits from participating in inquiry-led environmental activities are far reaching. Life skills such as cooperation, deductive reasoning skills, self confidence and acceptance of disappointment are well documented and supported by studies. Teachers who have embraced inquiry-led learning have reported that students who have difficulty in a traditional classroom setting are better able to grasp the concept of the lesson. Incorporating games and activities to enhance learning in environmental education is a multidisciplinary approach that is starting to become adopted.

Obstacles against game and activity based learning

The early days of environmental education had obstacles to overcome. The obstacles came from educators, parents and politicians who had their own ideas on how environmental education should be taught in schools (Bruker, 1973, Gough, 2013). In September 1999, Letter to the Editor, the Acting Executive Director of the North American Association for Environmental Education (NAAEE) fired back at special interest groups and individuals who selectively pushed forth half-truths to undermine

progress made for environmental education and champion their own agenda. In this letter, the goals and guidelines of environmental education were restated emphasizing the value of hands-on learning (Wall Street Journal, 1999). At the beginning of environmental education, “many EE programs were considered to be discretionary and even thought of as possibly interfering with higher scores on the statewide tests. These tests have very little actual environment or nature-based content” (Coyle, 2010, p.22).

As another example, a Chicago district education council demanded return of the money spent to fund the ecology program, 4 months after its initiation, following an evaluation report, on the grounds that the program was not effective. The request was made in spite of the fact that teachers who were partakers in the program responded positively, asking for an expansion of the ecology program. One parent commented that there was no hard evidence that the program was not working (Chicago Tribune, 1971). Debunking the notion that environmental education interferes with standardized test scores is a study by Osanka Bartosh in 2003. Bartosh (2003) studied 77 pairs of similar schools; selecting half without an environmental education program as the control group. She found that 73 of the 77 schools with an environmental education program tested significantly higher on standardized tests than the control group.

Politics have found their way into how environmental education should be taught. Unlike core subjects such as language arts and math, environmental science requires active involvement from students. Often this involvement becomes a movement to make changes in policy or laws (Cushman, 1997). Some critics of EE protest that students are fed a diet of “doom and gloom” from environmental classes that contributes to the stress

of the students (North American Association for Environmental Education [NAAEE], 2017). Other critics argue that environmental education is founded on biased information (Cushman, 1997; Holsman, 2010). In Arizona, an environmental education law was overturned in favor of the personal agenda of a political scientist/author (Cushman, 1997). To counter actions like this, the EPA stresses a non-partisan viewpoint when applying for an environmental education grant. The EPA stands by their guideline that advocacy is not a part of environmental education (Cushman, 1997). A commission in 2000, created by George C. Marshall Institute, Arlington, VA, reviewed EE materials that received criticism. Some of the materials reviewed substantiated the criticism, but many more were found to be exemplary examples of EE materials (Holsman, 2010). Selecting educational materials with accompanying games and activities is important to make sure that they are not biased or favor any special interest group. Guidelines to assist teachers in evaluating materials for environmental education are available on the North American Association for Environmental Education website (NAAEE, 2010). Choosing the right materials is the key for a lesson. A poorly designed game or activity can omit several important learning points leaving the student short on developing an understanding of the lesson (Gerber, 2014; McLean, 1973). It is important to review the game or activity ahead of the class to make sure that it does enhance understanding of the concepts presented and the value of what they have learned (Gerber, 2014; Hewitt, 1997). Game design should include choices and options in order for students to reap the full benefits (Kingsley & Grabner-Hagen, 2017).

Teachers are influential in the success of EE programs. The teacher often shapes the direction of the lesson by personal tastes and interests. While some are enthusiastic, others are unfamiliar with environmental concepts and hesitant to teach the subject (Carrier et al., 2013). Most teachers view teaching science under two methods: traditional teaching where the teacher transfers knowledge in a lecture-based format or as a facilitator, where the teacher coaches students to discover answers to questions on their own. Many teachers opt for the instruction based learning because they feel unprepared to teach environmental education in a facilitator's role (Carrier et al., 2013; Haney et al., 2007). Assuring the teacher that it is acceptable to admit that they do not know the answer to a question will open the door to a group investigation to find the answer. This type of self learning fuels a sense of self achievement essential to environmental education (Birinci Koncur et al., 2011; Sung & Hwang, 2013; Volk & Cheak, 2003). After a two year study using inquiry methods in environmental education in Ohio, teachers reported feeling more confident about teaching (Haney et al., 2007). In another study in Hawaii, a teacher said "it makes my instruction easier" (Volk & Cheak, 2003).

Making time for the activities needed to facilitate an environmental lesson is often a difficult obstacle to overcome. Teachers often feel unprepared to teach science and prefer the use of familiar, traditional methods that are easier to implement over unstructured, inquiry-based methods (Carrier et al., 2013). Typical complaints from teachers include: the amount of time needed to complete a lesson, in an already overcrowded curriculum as more demands are placed on teachers, and potential problems managing a group in a large, open area (Carrier et al., 2013). Discovery learning takes

more time for students to figure out solutions to a problem than it takes for them to be told the answer, therefore time must be sacrificed elsewhere. Students are also frustrated by time constraints (Carrier, et al., 2013). Many have expressed a desire to spend more time outdoors (Carrier et al., 2013; Dresnier & Gill, 1994).

Pressure to obtain higher scores on standardized tests that emphasize math and literacy has infringed on time that could be spent outdoors and learning (Carrier et al., 2013; Wiggins & McTighe, 2011). Test scores are important to schools because they dictate how much money a school can receive from federal funding (Thompson, 2018). A reduction in these funds would mean a reduction in resources, affecting all academic and enrichment subjects (Thompson, 2018). Reinforcing the need for environmental education, a study in Massachusetts found a positive correlation between test standards in math and English to opportunities in outdoor experiences regardless of socioeconomic standing (Leung et al., 2019).

One of the biggest concerns are state budget cuts, which are affecting schools nationwide (Litvonov & Flannery, 2018). With so many cutbacks in education and supporting educational programs, funding for environmental education can find itself on the chopping block. Lack of equipment and materials are an additional obstacle for schools to overcome (Peace Corps, 2017). Much of the funding to purchase equipment and materials is directly tied to school performance on standardized tests (Thompson, 2018). In contrast, environmental education does not have to depend on the use of expensive equipment (Sobel, 2016). Taking time outdoors with simple activities such as observation and journaling are cost effective, low tech learning tools.

In Europe, “Forest Kindergartens” where young children spend time outdoors exploring nature on a daily basis, without lesson plans, regardless of the weather, is an example of making outdoor time a priority (Sobel, 2016). Schools like the “Forest Kindergartens” use time outdoors so young children can explore and learn about nature on their own terms. Focusing on a young child’s imagination and not expensive equipment, the discovery time is child-led, with adults giving gentle guidance. Outdoor schools like this are just beginning to catch on in the USA, with 182 schools listed nation-wide in 2019 (mamookids, 2020). Nature schools and forest kindergartens are appreciated by those who have good memories of playing outside from their childhood. Parents who are worried that by attending a forest kindergarten their child will not be prepared for entering first grade need not worry (Sobel, 2016). In a study in Germany, children who attend nature based learning school are more socially adjusted and excelled in reading and mathematics along with creativity and oral expression (Sobel, 2016). Children who partake in unstructured play with natural items such as sticks and stones, are more social, active and creative (Kuo et al., 2018; Sobel, 2016).

Summary. Overcoming obstacles has been a part of environmental education since its beginning. There will always be nay-sayers who do not believe in the evolution of environmental education. But the evidence is overwhelming that environmental education works. Studies show a correlation between outdoor time and improved standardized test scores. Environmentally themed games and activities simulate problems and situations that are of current interest on a global basis. Funding for environmental education programs may prove to be pivotal for creating a sustainable future. The world

is facing problems such as climate change, water and air pollution and food production. Allowing children to play outside and explore nature is the start of cultivating a love of nature. A child who loves nature is more apt to become involved in conservation (Sobel, 2016). By incorporating games and activities into environmental education, students will have enough understanding to make responsible choices and future policies.

Implementation and assessment of game and activity learning

Incorporating games and activities into lesson plans is a practical way to teach environmental science. Few can argue against the benefits of hands-on learning. In a study by Aydede-Yalcin, second grade students were asked questions about the environment before playing environmentally based games and activities. After playing, the students were asked the same questions. The students showed a significant improvement in their understanding of the lesson (2016). This study is supporting research that students who have been involved in EE games and activities show an enhanced interest in the environment and express an interest in preserving it (Peace Corps, 2011; Slusberger, 2018).

Choosing a topic for a lesson requires consideration of many facets: age of participants; lesson goal; practicality of implementing the lesson; enjoyment factors and if teaching in a culturally diverse society, to respect traditional norms (Oltman, 2002; Peace Corps, 2017). Making sure that the lesson is age-appropriate is an important factor. Most younger children have not yet developed a sense of thinking beyond what they can see and touch (Oltman, 2002; Peace Corps, 2017). Therefore, when choosing a subject, make sure that the themes are simple. Introducing global issues to younger children can

cause stress to the child as they may feel helpless to correct the situation (Peace Corps, 2017). Using lessons about the natural world around them work the best with this age group (Hewitt, 1997). The concepts are easy to grasp and form the base for future lessons when the child is older. Games that convey a general understanding of environmental concepts help a younger child quickly learn the basic fundamentals of a lesson. Activities for this age group would draw heavily on exploration and discovery. A child with a sketchbook or journal can record their observations and thoughts. The journal should never be judged critically. Instead, it should be used to reinforce ideas and feelings about the environment (Petranek et al., 1992).

Older children and teens are able to understand more abstract issues. Lesson plans with activities that have goals that are stewardship oriented challenge this group to apply critical thinking to the task. The group is more likely to want to work out problems on their own, needing only occasional guidance (Peace Corps, 2017). Games for this age group should be goal oriented scenarios for the group to work through solutions.

Some children with behavior problems or autism may need extra time to make a connection to nature (Collini, 2019). These special participants need to be given the opportunity to adjust and desensitize to being in an outdoor environment. Introducing a holistic approach to the environment helps to soothe anxieties, moving the participant to a calmer state (Collini, 2019; Szczytko et al., 2018).

The facilitator will need to assess the skills of the group to determine the appropriateness of the activity or game. Younger children may lack the fine motor skills that older children have developed. As discussed earlier, younger children have not yet

developed sophisticated reasoning skills, and need more information with instructions to be direct (Oltman, 2002; Peace Corps, 2017; Sophian & Wood, 1997). Older children and teens appreciate a challenging problem. Special needs children need to be assessed on a case by case basis.

Selecting an activity can be a proactive response to a need in the community. Starting with identifying a problem and then brainstorming what can be done to address it. Things that should be considered are: How important is the need? Have others tried to address the need? What was the outcome? Will there be any positive or negative repercussions from addressing the need? Are there enough resources to fulfill the desired goal? (Peace Corps, 2017). Using environmental education to shape future behavior has fundamental beginnings from recognizing a problem and what action was taken to address it.

Making time for a game or activity is at the heart of every lesson. Teachers complain that there is not enough time to allow for a game or activity extension of a lesson plan and students complain that game time is too short (Carrier et al., 2013). By restructuring the teaching schedule, additional time can often be found hiding in teacher-led lessons. Enough time must be allowed to complete the activity in order for students to experience the full benefit. By conducting a dry run before the students arrive, the facilitator will gain insight for time and space needed to conduct the game or activity. Any safety factors should be exposed at this time and addressed or the activity should be moved to another area and a dry run repeated. Flexibility should be built into the lesson to allow for any unplanned occurrences (Prince-Sharrar, 2014).

Measuring results of environmentally themed lesson plans are categorized by short or long term outcome measurements. A short term measurement can be taken during a lesson and up to a year after the initial program. The advantage of this type of assessment is that the lesson learned is still fresh in memory. Questions can be asked while the activity is taking place, immediately afterwards or a follow-up weeks or months later to see if any actions have been taken up by the participant. Care should be taken not to distract the participants from enjoying the lesson, as the learning momentum may be lost. Verbal questioning is sufficient if the results are informal. Questions during or shortly after an activity or game can be as simple as “Did you like what we did today?” or “What did you like the best and why?” If formal results are needed for record, a written questionnaire/response is preferred (Russ, 2014). Long term outcome measurements occur one year after the program and can occur throughout the participant’s lifetime. The obvious problem with conducting this type of measurement comes from difficulty in keeping contact with participants over a period of years. If contact can be kept, long term measurements bring valuable information that can affect direction and/or funding of a study. Long term measurements can have far reaching effects that may change attitudes and public policies. Disadvantages stem from the participants inability to clearly recall details or inability to locate enough former participants to make a valid conclusion of results (Russ, 2014).

Collection of data for an environmental lesson can be assessed by qualitative or quantitative methods. Using a qualitative method, participants describe how they feel about the experience while quantitative measures the intensity of the experience or

statement by assigning it a number value (Russ, 2014). Both methods are effective modes of measuring results and can be used together in the form of a questionnaire with a comment section. The educator needs to determine which method will supply the information desired.

Due to the self-discovery nature of an environmental education program, there is opportunity to make assessments while the game or activity is being played out or shortly afterwards. Observation of the participants during a lesson will tell the facilitator many things. By monitoring the participants while applying a skill is a way to judge if the skill is being mastered (Peace Corps, 2017). The study by Aydede-Yalcin (2016), used a short questionnaire before the lesson (the baseline) and asked the same questions after the lesson to compare results at their nature camp. The results revealed an impressive increase in knowledge of the campers (2016). Dresner and Gill also used the pre and post questionnaire for nature campers. The questionnaire found an increase of environmental concerns and piqued interest in nature at the end of camp. The campers were observed in a daily assessment by the staff, looking for improvements in confidence and self-esteem. A follow up after the camp with the parents revealed that the camper's behavior had changed and become more environmentally aware (1994). This information would not have been available in detail without assessment measurements.

Measuring learning is essential for any environmental program. Because the lessons are participant driven, there is a constant need to monitor learning progress. Environmental games and activities need to constantly be tweaked in order to keep up

with the interests of the group and with changing environmental conditions, policies and actions.

Summary. *How can incorporating games and activities into environmental education enhance learning in environmental education* effects the participants with measurable results. By taking an active involvement in learning through problem-solving scenarios and simulations, students are more likely to display changes in behavior that support stewardship and environmentally responsible decisions. By embracing a student-driven learning program, participants develop a deeper understanding of the subject(s) as they work to find solutions. The lessons learned by participating in games and activities extend beyond the lesson and intertwine with life skills. Participants in activity-based learning are better able to enter the workforce, demonstrate ability to handle disappointments, and learn cooperation with others. Involvement in activity-based learning encourages students with difficulty performing in a traditional learning setting an equal chance of expression.

Environmental education has encountered obstacles from persons looking to advance their own personal agenda to claims that environmental education lowered scores on standardized tests. Budget is the biggest challenge, as most school funding comes from results from standardized tests (Thompson, 2019). Following the European example of “Forest Kindergarten”, American schools are allowing young children to spend time outdoors on a daily basis to explore on their own without the use of expensive learning materials. The results from children spending informal time outdoors have shown an increase in math and literacy (Sobel, 2016).

Matching the right game or activity to the lesson to maximize learning takes age, ability and community needs into consideration (Peace Corps, 2017; Sophian & Wood, 1997). Measuring the results can be short or long term, qualitative or quantitative, depending on the need of the facilitator or sponsoring institute. The data is to ensure that learning is taking place and to be able to make adjustments to reflect changing needs.

Chapter 3 outlines an environmental education project that uses games and activities to highlight learning points with student-led investigation. Lessons will include both natural and social environmental topics for participants to develop an appreciation of this widely diverse area.

Chapter 4 will describe the challenges encountered while developing this project. Some of the challenges were overcome, while others called for a new strategy and resourcefulness.

CHAPTER THREE

Project Description

Introduction

Environmental education encompasses the world in which we live. It is what influences how we live, how we think and how it shapes our future. Olson (1958) stated, “Everyone has a listening-point somewhere. It does not have to be in the north or close to the wilderness, but some place of quiet where the universe can be contemplated with awe” (p. 8). In spite of Olsen’s words, I am often amazed by the disconnection that children have with nature. As a part-time environmental educator, I noticed that even with limited exposure to the outdoors, children are still intensely curious and accepting of something new. This chapter describes how I will use games and activities to enhance learning in environmental education. My project introduces urban, suburban and rural students, grades 6-8, to the diversity of the southern tip of Lake Michigan, known as “The Calumet Heritage Area”. The purpose is to raise awareness and cultivate an appreciation for a region that is home to unique geological features, plants and wildlife, which are side-by-side with heavy industry. An introduction to environmental issues is included to heighten the student’s awareness of the importance of sustainability and stewardship.

Lessons will be presented in a non-traditional format to allow students to take an active part in their learning.

Project Overview

My capstone includes a collection of games and activities that can support curriculum lesson plans or that can stand on their own as student-led learning. This collection supports the literature cited in Chapter 2, concerning the benefits of incorporating games and activities to enhance learning in environmental education. By using games for a quick lesson and activities to deepen learning, the topics in my capstone cover: local wildlife, geology, social anthropology, impact of industry and environmental issues and the arts. A short pedagogy is included for educators to assist in developing games or activities to enhance their lesson plans. I will be using backward design theory proposed by Wiggins and McTighe (2005), to format each game and activity. In this format, larger topics are broken down so that the student has the opportunity to learn the underlying basic concepts. Backward design is an effective lesson structure for long-term learning as it outlines connections from the lesson to real life applications that the student carries for a lifetime. Games or activities with environmental themes are keys for the understanding of EE program lessons where stewardship is passed from one generation to the next. Incorporating activities and projects works well in an EE setting where the learning platform is less formal and may have to be assessed on the fly. Games and activities often include other subjects such as language arts and math that widen the learning base. The lesson design guides the student through the learning process by establishing learning goals that can be reinforced and

assessed by activities and projects. Using this method, teacher/facilitators first foster learning by determining what markers constitute learning before creating a lesson plan that reflects upon expected performance (Wiggins & McTighe, 2005). Quizzes, tests, projects and reflective written assignments are additional tools that can be used to gauge learning when time allows. The completed curriculum unit will be offered to the Calumet Heritage Partnership and Lake County Parks as a PDF file to be downloaded from their websites.

Project Description

I developed a collection of twelve games and activities for use by formal and non-formal educators that reinforces an environmental concept and makes learning fun. These lesson plans as presented will take at least a half school day to complete in school. Some lessons will require a field study or extended project time. These lessons can be used as a two-week long unit, or broken up to be used individually as enrichment lessons that support an established learning unit. A portion of each lesson plan can be completed indoors in case of inclement weather. Details concerning time, setting and any materials needed for each section of a topic can be found in the individual lesson plan. Inspired by the National Park Service's Junior Ranger program that gives young visitors an overview of the highlights and history of each park, lessons are points of interest and structured in a format comparable to Project WILD and Project WET learning activity guides (Project Wild, 2009; Project Wet, 2011). The curriculum project focuses on some of the many aspects of the Calumet Heritage Area to raise awareness concerning points of interest that

may be missed by the casual visitor and are things that residents of the area should know, but often are not familiar.

Each lesson bridges the widening gap between the student who has disconnected from nature and lost a sense of history to an understanding of the environment in which we live. The goal is to instill an appreciation of the natural and social history of the region, raise an awareness of environmental issues and cultivate a sense of pride for those who reside within the area. These games and activities draw on several sets of skills to broaden the scope of learning (Adydede-Yalcin, 2016). *Following Frames of Mind: The Theory of Multiple Intelligences* (Gardner, 2011), each lesson will encompass a part of the eight intelligences outlined in the book. Loosely described as: Linguistic, Logical, Naturalistic, Interpersonal, Intrapersonal, Visual, Musical and Kinesthetic, these intelligences will work together to appeal to the students on many levels for deeper understanding of the topic. The games and activities can be used in part for science and social science lessons, with math and language arts as supporting disciplines. Music and art disciplines are included to a lesser degree. Lessons adhere to Illinois, Indiana and Michigan learning standards for science, social science, math and language arts.

Making a strong connection to an environmental concept without a textbook is the basis of incorporating games and activities to enhance an environmental education project. Using a Socratic method, questions will be asked and an argumentative dialog is encouraged with “pro” and “con” points to promote critical thinking in a review of the game or activity’s methods and outcome. The overall objective is to create positive memories of learning while “doing”.

The games and activities are written with lesson plans for a middle school audience and can be modified for other grade levels by removing a component or adding an extension. The curriculum unit has topics that can be covered over one week of study or may be split up to be implemented over a span of weeks. Games/activities can be included as part of an established, required curriculum or can stand alone as an enrichment lesson. Each plan includes an objective, approximate time frame to complete, space or setting needed to perform, topical background information, a list of materials needed and instructions for the accompanying game and/or activity. Teacher/facilitators are encouraged to assess learning using rubric outlined in the lesson plan. Students who engage in the games and activities will quickly learn basic concepts (Klein, 2015). I have found that a game is especially effective when introducing a new concept or when time for a full lesson is short, as when a group visits an offsite facility. Activities generally take more time to complete and require critical thinking from the participants to develop ideas and concepts. Gauging the learning comes from observation of the students and reflection review (Petranek et al., 1992). As with games, observing participant's involvement, reflective review and journaling are effective measuring tools and reinforcements of learning.

Setting

The Calumet Heritage Area (CHA) spans Illinois and Indiana, from Chicago's southeast side, east to Michigan City, Indiana, covering portions of four counties that border Lake Michigan. Once prosperous from the steel industry, the area fell on hard economic times when the industries that supported so many families declined. The loss

caused a ripple effect in the surrounding communities, especially in the city of Gary, IN, where many of the schools have closed. In their place, corporate charter schools have begun to spring up. These corporate-sponsored schools are breathing new life into an economically depressed municipality.

The Dunes Learning Center, owned and operated by the Indiana Dunes National Park, has helped reintroduce children and adults to the outdoors. The students who take part in these programs, have shown an increased interest in stewardship and have lasting memories of their experience (Russell, 2017). My project expands on the environmental education foundation from the Dunes Learning Center to bring hands-on experience to students in schools, nature centers and special interest groups.

Audience

Middle school students are the target age group for this set of lessons. Students of this age are capable of independent thinking and are able to enter into discussions about a topic or issue (Peace Corps, 2017). The lessons are open to any teacher, formal or non-formal, group leaders and individuals who desire to learn more about this unique area. Home school and outreach programmers can use these lessons to highlight some of the important components of CHA. The topics introduced do not have fixed conclusions, leaving room for critical thinking and discussion from students. Students are encouraged to explore solutions and voice opinions as they work through the lesson. Some of the games and activities may be conducted indoors, although most require outdoor field study. Settings will vary according to each topic and may best be planned when

conditions are optimal. Teachers and facilitators should plan accordingly for seasonal weather conditions.

Curriculum Development Theory

When creating student-led activities, I first considered what audience would be addressed and what stage their learning development might be and what prior experience with the topics they might have (Oltman, 2002; Peace Corps, 2017). Afterward, I selected which learning goals I wanted to achieve. Using the backward design theory described by Wiggins and McTighe (2005), an objective statement was written with specific learning goals. Components to make up the lesson were then selected based on the ability to focus the lesson and practicality of executing it effectively. Researching material that lent itself well to become a game or activity, proved to be challenging and engaging. The result is a series which can be used as a supporting part of an existing lesson or can stand on its own with a little background instruction. The overall objective is to cross out any prejudices, disabilities and/or reluctances so that all students may have the same opportunity to begin learning on a level plane (Schneller, 2005). Support is given while the game or activity is in progress, but the learning comes from the student as they make their own discoveries. Learning in this fashion has been proven to bolster self confidence and reinforce the lesson (McLean, 1973; Schneller et al., 2015).

Learning assessment

Assessment of learning can be judged from the level of student participation, oral feedback and when required, level of completion of a project. A rubric with learning markers is included with each plan. A pre-lesson assessment is suggested to establish a

baseline of understanding. These can be very informal, using a question and answer format before and after to establish what the students know and what areas of the lesson needs to be focused on. During transitions from one game or activity to another, discussions are initiated to reinforce and gauge learning. Such dialogs provide a bridge to the next step. At the conclusion of the lesson, a review of main points with open ended questions, help instill the value of the lesson. Journaling is a quiet reflection activity that allows the student time to absorb what has been learned (Patranek et al, 1992).

Summary. In researching the question: *How can incorporating games and activities enhance learning in environmental education?* I looked at supporting literature and other opinions that do not support activity driven learning as well as budget concerns and the focus on standardized test results. Overwhelmingly, evidence from the literature points to supporting hands-on learning over traditional methods to enhance learning. Students who take part in activity based learning reap other benefits such as improved self confidence, learn to work cooperatively and are less likely to drop out of school. Students also tend to develop an interest in stewardship and sustainability. Learning by games and activities has proven so successful, that several major industries use these methods for their training programs.

I chose a curriculum to implement games and activities for a unit overview of a historically and geologically significant area. The ultimate goal is to instill value to a region that has seen hard economic times and invoke a sense of pride for the residents, many who have lost the connection to their environment, both natural and social.

In Chapter 4, I will reflect on what I have learned in the process of creating this project. I will investigate ways to promote my capstone curriculum so that it can be used as intended.

CHAPTER FOUR

Conclusions

Introduction

In creating this project, my purpose was to engage students in a way that learning became a natural component of having fun. I thought about sharing experiences while introducing new ideas and information as a gentle way to coax self discovery out where it can flourish. Communal learning as presented in an environmentally themed game or activity leads to equal opportunities for all learners to develop an understanding of the lesson at hand. Over the years, I have become fascinated by how many ways the mind can absorb information. I began to wonder *how can incorporating games and activities enhance learning in environmental education?*

On a personal note, I watched my son struggle in elementary school. A bright child, who you could ask anything about everything and expect to receive a detailed, accurate answer, he could not step in line with traditional teaching methods. Subsequently, both he and his teachers were flustered because they were confined to certain grading standards. If my son was not learning in school, where was his learning coming from and how can I, as his parent, better capitalize on it so he receives the education that he deserves? The secret was to guide him on his own learning experiences

by providing access to as many subjects as he desired in a way that did not echo the repetitiveness of school. In creating this project, I drew upon the struggles we had, how we overcame them and had fun in the process.

Literature review

While conducting research for Chapter 2, I stumbled upon a previously overlooked article by Howard Gardner that broke down and described multiple intelligences (Gardner, 2011). Upon reading it, I knew that this would be the foundation of my project. Environmental education and education in general draw from many learning experiences that the student has acquired. While I agree that some subjects have to be taught in a traditional setting that is instructor led, it is the application of these subjects in real world situations where the learning connection takes place (Gerber, 2014). Using games and activities help to bridge this gap and foster self discovery learning.

Review of literature to support alternative learning that environmental education games and activities provides, revealed many positive results. Due to critical thinking that is necessary when a student is fully immersed while participating in games and activities, it provides an excellent venue to enhance learning and understanding in environmental education. Comparing traditional, teacher-led instruction to student-led discovery learning reveals a marked improvement of understanding the lesson when the student is in charge of their learning. Students who are able to participate in student led-discovery have shown to become more environmentally aware by demonstrating an interest in stewardship and are able to apply knowledge to real life situations. Benefits include

improved self confidence with a deeper understanding of the environment and sustainability.

It would seem that everyone would welcome the positive benefits of incorporating games and activities into established, environmental lessons. This is not always true. Some teachers feel unqualified to teach science and prefer to teach using traditional methods in order to stay in their comfort zone (Carrier et al, 2013). I kept this objection in mind when developing my project so that when the learning process shifted to the student, the learning experience was expanded to benefit all, including the facilitator.. Other resistance usually comes from an already overwhelmed instructor, who must make sure that students perform well on standardized tests. These tests are directly tied to school funding, making good scores essential. This makes budget the biggest obstacle. Schools, parks and nature centers depend on public funding. Often, there is very little money left over after purchasing necessary supplies. The activities and games in my project can be implemented on a tight budget.

Developing the Project.

In the fall of 2019, I attended the annual conference for the Calumet Heritage Area. The conference highlights the Calumet region with descriptions of people, places and things that make up the character of the area. In past years, conference themes have included tours and a marketing project where ideas for the proposed “Calumet Heritage Corridor” was brainstormed. This year’s theme was about the musical heritage of the Calumet region. Presenters described the contributions of local musicians to world music culture.

Excited about what I had learned at the conference, it was only natural that I would start my project with music, which is one of Gardner's intelligences that shows evidence at an earlier stage, before any of the other mentioned intelligences (Gardner, 2011).. Researching this topic was a lot of fun. Following up on some of the highlights from the conference, I began to work backward from the objective, breaking down the information into smaller components. I then looked at each component to create a lesson that would lend itself well to an activity interpretation. The result was a series of short activities that provide a wide base of understanding for the completion of a final assignment. Each topic encompasses various combinations of Gardner's intelligences: Linguistic, Logical, Naturalistic, Interpersonal, Intrapersonal, Visual, Musical and Kinesthetic (Gardner, 2011). This was planned with the purpose of engaging students on different levels so that some part of a lesson will appeal to a student's learning strength. Students who use the lessons in the project will be asked to investigate, reflect and share their personal stories as they relate to the topic, as the conference attendees did.

Choosing the next topics required more innovation. There are so many aspects of *the Calumet*, it was hard to decide. For inspiration, I looked around as a new visitor might take in the sights. The huge sand dunes, the glacial geology and Lake Michigan truly define this as "dunes county". Building an understanding of how the local geology came to be with demonstrations, games and activities required a lot of research. Many learning points were considered and rejected as being too difficult to translate into an activity. Considering that time, space and budget were all possible constraints, I looked for quick and easy projects that were budget friendly. The next step was to link the activities and

games together to create a logical storyline that could be followed as a lesson plan. This proved to be very difficult as each learning point needed some type of background understanding before the lesson could begin. I found myself continually adding pre-lessons to establish a base. At some point, I realized that a line had to be drawn for what was going to be included in the project. I restructured each topic so that it would only be an introduction to that particular aspect.

Inventing learning games for the project was more difficult. I created a crime scene investigation from an actual incident on the grounds of the nature center where I work. Originally designed to be an interactive display, it was modified into a game that can be played anywhere. When working from scratch, I found that creating a game with an objective, rules and outcome takes a considerable amount of time, research and creativity. At the end, the game also has to be enjoyable for the participants otherwise, the learning results will be disappointing (Gerber, 2014). I quickly realized that I lacked enough imagination to be an effective game writer and focused instead on developing meaningful activities with extension opportunities to explore the Calumet area on a self learning journey.

There are hundreds of books, articles, studies and lesson plans about the Great Lakes. I knew from past research that many of the area residents had never been to Lake Michigan. Yet, this great body of water affects them everyday by creating a microclimate. Making a connection to the lake from the phrase, “cooler by the lake”, uttered by every local weatherman, became a simple demonstration using glass or Pyrex containers filled

with water to illustrate heat transference and how it is directly related to the temperature of the lake water and the land surrounding it.

Big industry built this area and its influence is still viable in the railroads, steel mills and refineries. Including this aspect was a “must” for the project. During these lesson topics, students can take some time to learn the history of these industries and have the opportunity to make a personal connection.

Sometimes, a picture is worth a thousand words. I knew of three great media resources and found a fourth by accident. Trying to avoid having to obtain written permission to use these media resources, I thought if I used a website link with citations would be good enough. I was reminded that it was not and that I would have to track down the owners of the media I wanted to use and gain permission. I feared the worst—that I would not be able to find the person(s) who could grant permission or that I would never hear back from them. I got lucky on this and obtained permission for all four resources in a record time.

Limitations

The lessons created for this project are very region specific and may be hard to translate in another area that is not geographic or economically similar. The games and activities are designed to encourage learning by providing an introduction to a topic. Further, deeper instruction is at the discretion of the teacher. A significant portion of the activities are for the student to complete on their own or with a group. A possible limitation may stem from an inability for the student to travel to a location to complete the assignment. To overcome this, I have offered alternative assignments that can be

completed in school or at home. I do want to emphasize that the main objective of this project was for students to learn and appreciate features that characterize the Calumet area, but are often overlooked. The lessons should be considered an interactive, learning travel log of the region.

Future Use

I cannot begin to contemplate a use for my project without mentioning the COVID19 pandemic during the spring of 2020, that caused schools, businesses and government offices to close. One by one, states issued social distancing and stay-at-home orders. I believe that we are now entering into an unknown country, where the rules and what we know will change permanently. I predict that going forward, online learning will become mainstream and brick & mortar schools will exist only when necessary. As this happens, the need for lesson plans with activities that are student-led will be in demand as parents take over more responsibility for their child's education from a professional teacher. This type of transition favors projects like mine. The lessons are laid out in a "cookbook" format that is easy enough for a novice educator to use with a rubric to measure the student's understanding of the lesson. I have always thought that I would like my project to be posted online from a website for anyone to use. The opportunity presented itself while I was contacting media resources for permission to use their artifact. To my delight, one of the agencies expressed an interest in my project. We have a tentative agreement to meet this summer to discuss use of my project.

REFERENCES

.A Kaiser Family Foundation Study - ERIC. (2010, January 20). Retrieved March 15,

2020, from <https://files.eric.ed.gov/fulltext/ED527859.pdf>

Anwar, F. (2019). Activity-Based Teaching, Student Motivation and Academic Achievement. *Journal of Education and Educational Development*, 6(1), 154–170. doi: 10.22555/joeed.v6i1.1782

Aydede-Yalcin, M., N. (2016). The effect of active learning based science camp activities on primary school students' opinions toward scientific knowledge and scientific process skills. *International Electronic Journal of Environmental Education*, 6(2), 108-125. Retrieved from <https://files.eric.ed.gov/fulltext/EJ1220168.pdf>

Bartosh, O. (2003). *Environmental Education: Improving Student Achievement* (Master's thesis). Retrieved from <http://www.seer.org/pages/research/Bartosh2003.pdf>

Belle, D. (1997). Varieties of Self-Care: A Qualitative Look at Children's Experiences in the After-School Hours. *Merrill-Palmer Quarterly*, 43(3), 478-496. Retrieved March 10, 2020, from www.jstor.org/stable/23093334

Birinci Konur, K., Seyihoglu, A., Tekbiyik, A. and Sezen, G. (Summer 2011) Evaluation of a science camp: Enjoyable discovery of mysterious world. *Educational Sciences: Theory & Practice*. Retrieved November 1, 2019 from

[https://pdfs.semanticscholar.org/32fe/d82242e6a58fe8f05c27948f2b4cca54bf71.p](https://pdfs.semanticscholar.org/32fe/d82242e6a58fe8f05c27948f2b4cca54bf71.pdf)

[df](#)

Boy Scouts of America (2020) Prepared. For Life.™. Retrieved from

<http://www.scouting.org/>

Branco, M., Weyermüller, A., Müller, E., Schneider, G., Hupffer, H., Delgado, J., ...

Mendes, T. (2015). Games in the environmental context and their strategic use for environmental education. *Brazilian Journal of Biology*, 75(2 suppl), 114–121. doi: 10.1590/1519-6984.0413.

Bridgeland, J. M., Dilulio Jr., J. J., & Morison, K. B. (2006). *The Silent Epidemic*

Perspectives of High School Dropouts . Washington, D.C.: Civic Enterprises,

LLC. Retrieved from <https://files.eric.ed.gov/fulltext/ED513444.pdf>

Bruker, R. (1973). An Historical Approach to Environmental Education. *The Clearing*

House, 48(3), 135-137. Retrieved May 2, 2020, from

www.jstor.org/stable/30180856

Carrier, S. J., Tugurian, L. P., & Thomson, M. M. (2013). Elementary Science Indoors

and Out: Teachers, Time, and Testing. *Research in Science Education*, 43(5),

2059–2083. doi: 10.1007/s11165-012-9347-5

Carrillo, D. L., Garcia, A. C., Laguna, T. R., Magan, G. R., & Moreno, J. A. L. (2019).

Using Gamification in a Teaching Innovation Project at the University of Alcalá:

A New Approach to Experimental Science Practices. *The Electronic Journal of*

e-Learning, 17(2-June 2019), 93–106. doi: 10.34190/jel.17.2.03

- Collini, S. (2019, October 13). 6 ways Autistic children can benefit from woodlands.
Retrieved December 7, 2019, from
<https://www.outdoortribe.co.uk/6-ways-autistic-children-can-benefit-from-woodlands/>.
- Coyle, K. J. (2010). *National Wildlife Federation Report: Back to School: Back Outside*.
National Wildlife Federation. Retrieved from
[https://www.nwf.org/~media/PDFs/Be Out There/Back to School full report.ashx](https://www.nwf.org/~media/PDFs/Be%20Out%20There/Back%20to%20School%20full%20report.ashx)
- Cushman, J. H. (1997, April 22). Critics Rise Up Against Environmental Education.
Retrieved November 2, 2019, from
<https://www.nytimes.com/1997/04/22/us/critics-rise-up-against-environmental-education.html>.
- Dresner, M., & Gill, M. (1994). Environmental education at summer nature camp.
Journal of Environmental Education, 25(3), 35.
<https://doi.org/10.1080/00958964.1994.9941956>
- Gardner, H. (2011). *Frames of mind: the theory of multiple intelligence*. New York: Basic Books.
- Gerber, H. R. (2014). Problems and Possibilities of Gamifying Learning: A Conceptual Review. *Internet Learning*. doi: 10.18278/il.3.2.4
- Glenn, J. L. (2000). *Environment-Based Education: Creating High Performance Schools and Students*. Washington, D.C.: National Environmental Education and Training Foundation. Retrieved from <https://eric.ed.gov/?id=ED451033>

- Gough, A. (2013). The Emergence of Environmental Education: a 'history' of the field. In R. Stevenson (Ed.), *International Handbook of Research on Environmental Education* (pp.13-23). New York: Routledge.
- Haney, J. J., Wang, J., Keil, C., & Zoffel, J. (2007). Enhancing Teachers Beliefs and Practices Through Problem-Based Learning Focused on Pertinent Issues of Environmental Health Science. *The Journal of Environmental Education*, 38(4), 25–33. doi: 10.3200/joee.38.4.25-33
- Hewitt, P. (1997). Games in Instruction Leading to Environmentally Responsible Behavior. *The Journal of Environmental Education*, 28(3), 35–37. doi: 10.1080/00958964.1997.9942827
- Holsman, R. (2001) VIEWPOINT: The Politics of Environmental Education, *The Journal of Environmental Education*, 32:2, 4-7, DOI: [10.1080/00958960109599131](https://doi.org/10.1080/00958960109599131)
- Jiang, J. (August 2018). How Teens and Parents Navigate Screen Time and Device Distractions. Pew Research Center. Retrieved from <https://www.pewresearch.org/internet/2018/08/22/how-teens-and-parents-navigate-screen-time-and-device-distractions/>
- Kingsley, T. L., & Grabner-Hagen, M. M. (2015). Gamification. *Journal of Adolescent & Adult Literacy*, 59(1), 51–61. doi: 10.1002/jaal.426
- Klein, V. (2015). Let's play that again! Engaging students in ecology by using instructional games. *Science Scope*, 38(7), 72-77. Retrieved October 2, 2019, from www.jstor.org/stable/43691255

- Knapp, D. (1996, November 30). The Relationship between Environmental Interpretation and Environmental Education. Retrieved October 2, 2019, from <https://eric.ed.gov/?id=EJ548152>
- Kuo, M., Barnes, M., & Jordan, C., (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*, 10. doi: <http://dx.doi/10.3389/fpsyg.2019.00305>
- Kuo, F. E., & Sullivan, W. C. (2001). Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment & Behavior*, 33(3), 343–367. doi: 10.1177/00139160121973025
- Letters to the editor: Environmental guidelines' goals. (1999, Sep 29). *Wall Street Journal*. Retrieved from <https://search.proquest.com/docview/398673277?accountid=37103>
- Litvinov, A., & Flannery, M. E. (2018, July 19). The High Cost of Education Budget Cuts. Retrieved December 1, 2019, from <http://neatoday.org/2018/07/16/the-high-cost-of-education-budget-cuts/> .
- Leung, W. T. V., Tam, T. Y. T., Pan, W.-C., Wu, C.-D., Lung, S.-C. C., & Spengler, J. D. (2019). How is environmental greenness related to students academic performance in English and Mathematics? *Landscape and Urban Planning*, 181, 118–124. doi: 10.1016/j.landurbplan.2018.09.021
- McLean, H. (1973). Simulation Games: Tools for Environmental Education. *The Elementary School Journal*, 73(7), 374-380. Retrieved from <http://www.jstor.org.ezproxy.hamline.edu:2048/stable/1000186>

- Mese, C., & Dursun, O. O. (2019). Effectiveness of Gamification Elements in Blended Learning Environments. *Turkish Online Journal of Distance Education*, 119–142. doi: 10.17718/tojde.601914
- Miller, S. (2011). Nature as a Learning Tool. *The Science Teacher*, 78(5), 70-71. Retrieved from www.jstor.org/stable/24148134
- North American Association for Environmental Education. (2017, August 23) Beyond Doom and Gloom: A Resource to Empower High School and College Students. Retrieved from <https://naaee.org/eepro/resources/beyond-doom-and-gloom-resource-empower>.
- North American Association for Environmental Education. (2010). Guidelines for excellence preparation. Retrieved November 2, 2019, from https://naaee.org/sites/default/files/gl_preservice_complete.pdf
- Olson, S. F. (1997). *Listening point*. Minneapolis: University of Minnesota Press.
- Oltman, M. (2002). *Natural Wonders A Guide to Early Childhood for Environmental Educators*. Place of publication not identified: Distributed by ERIC Clearinghouse.
- Patten, E. (November 2015). How American parents balance work and family life when both work. *Pew Research Center*. Retrieved from <https://www.pewresearch.org/fact-tank/2015/11/04/how-american-parents-balance-work-and-family-life-when-both-work/>

Peacecorps.gov. (2017, March). Retrieved from

https://files.peacecorps.gov/documents/PC_Environmental_Activities_508_mNd3UVx.pdf.

Petranek, C. F., Corey, S., & Black, R. (1992). Three Levels of Learning in Simulations: Participating, Debriefing, and Journal Writing. *Simulation & Gaming*, 23(2), 174–185. doi: 10.1177/1046878192232005

Pollanen, S. & Vartiainen, L. (2013). Forest-themed learning games as a context for learning via collaborative designing of crafts. *Techne Series A*, 20(3), pp.33–49

Prince-Sharrar, J. (2014, October). Learning with loppers. *Green Teacher*, 30–31. Project WET Foundation. (2011). *Project Wet: curriculum and activity guide 2.0*. Bozeman, MT.

Project WILD. (2009). *Project Wild: K-12 curriculum & activity guide*. Houston, TX.

Rumberger, R. W., & Lim, S. A. (2008). *Why Students Drop Out of School: A Review of 25 Years of Research* (Vol. 15). Santa Barbara, CA: University of California. Retrieved from https://www.researchgate.net/publication/268424401_Why_Students_Drop_Out_of_School_A_Review_of_25_Years_of_Research

Russ A. (Ed.). (2014). Measuring environmental education outcomes. Ithaca, NY and Washington, DC: EE Capacity project, Cornell University Civic Ecology Lab, and NAAEE.

Russell, J. (2017, December 17). Dunes Learning Center has educated youngsters for 20 years. *NW Indiana Times*.

- Schneller, A. J., Schofield, C. A., Frank, J., Hollister, E., & Mamuszka, L. (2015). A Case Study of Indoor Garden-Based Learning With Hydroponics and Aquaponics: Evaluating Pro-Environmental Knowledge, Perception, and Behavior Change. *Applied Environmental Education & Communication, 14*(4), 256–265. doi: 10.1080/1533015x.2015.1109487
- Seeks refunding of ecology class. (1971, May 20). *Chicago Tribune*. p. 129. Retrieved from <https://www.newspapers.com/search/#lnd=1&query=seeks+refunding+of+ecology+class&t=4351>
- Sobel, D. (2016). *Nature preschools and forest kindergartens: the handbook for outdoor learning*. St. Paul, MN: Redleaf Press.
- Sophian, C., & Wood, A. (1997). Proportional reasoning in young children: The parts and the whole of it. *Journal of Educational Psychology, 89*(2), 309–317. doi: 10.1037/0022-0663.89.2.309
- State Education and Environment Roundtable. (n.d.). Retrieved from <http://www.seer.org/>.
- Sullivan, C. (1992, Oct 25). Tots' plot: Garden encourages children's nurturing nature. *Chicago Tribune* (1963-1996) Retrieved October 30, 2019 from <https://search.proquest.com/docview/1703962456?accountid=37103>
- Sulsberger, M. J. (2018, June 18). Gathering, interpreting, and positioning children's narratives in environmental education research. Retrieved October 30, 2019, from <https://link.springer.com/article/10.1007/s11422-018-9867-z>.

- Sung, H.-Y., & Hwang, G.-J. (2013). A collaborative game-based learning approach to improving students learning performance in science courses. *Computers & Education, 63*, 43–51. doi: 10.1016/j.compedu.2012.11.019
- Szczytko, R., Carrier, S. J., & Stevenson, K. T. (2018). Impacts of Outdoor Environmental Education on Teacher Reports of Attention, Behavior, and Learning Outcomes for Students With Emotional, Cognitive, and Behavioral Disabilities. *Frontiers in Education, 3*. doi: 10.3389/educ.2018.00046
- Thompson, V. (2019, January 10). Do Standardized Test Scores Factor into How Much Money a School Will Receive? Retrieved November 1, 2019, from <https://www.theclassroom.com/standardized-test-scores-factor-much-money-school-receive-25534.html>.
- Volk, T. L., & Cheak, M. J. (2003). The Effects of an Environmental Education Program on Students, Parents, and Community. *The Journal of Environmental Education, 34*(4), 12–25. doi: 10.1080/00958960309603483
- What is Environmental Education? (2018, November 5). Retrieved from <https://www.epa.gov/education/what-environmental-education>
- Wiggins, G. P., & McTighe, J. (2011). *The understanding by design guide to creating high-quality units*. Alexandria, VA: ASCD.

Williams, D. R., & Dixon, P. S. (2013). Impact of Garden-Based Learning on Academic Outcomes in Schools. *Review of Educational Research*, 83(2), 211–235. doi: 10.3102/0034654313475824

Yang, J. C., Lin, Y. L., & Liu, Y.-C. (2016). Effects of locus of control on behavioral intention and learning performance of energy knowledge in game-based learning. *Environmental Education Research*, 23(6), 886–899. doi: 10.1080/13504622.2016.1214865

(2020). Retrieved from

<https://mamookids.com/blogs/journal/the-ultimate-guide-to-forest-nature-schools-in-the-us>

