Summer 2018

The Benefits of a Therapeutic Nature Education Intervention for Children with ADHD

Madeline Dineen
Western Washington University, dineenm@wwu.edu

The Benefits of a Therapeutic Nature Education Intervention for Children with ADHD

By

Madeline Dineen

Accepted in Partial Completion of the
Requirements for the Degree
Master of Education

ADVISORY COMMITTEE

Dr. Gene Myers, Chair

Dr. Nick Stanger

Mr. Richard Hanson

GRADUATE SCHOOL

Dr. Guatam Pillay, Dean

Master's Thesis

In presenting this thesis in partial fulfillment of the requirements for a master's degree at Western Washington University, I grant to Western Washington University the non-exclusive royalty-free right to archive, reproduce, distribute, and display the thesis in any and all forms, including electronic format, via any digital library mechanisms maintained by WWU.

I represent and warrant this is my original work, and does not infringe or violate any rights of others. I warrant that I have obtained written permissions from the owner of any third party copyrighted material included in these files.

I acknowledge that I retain ownership rights to the copyright of this work, including but not limited to the right to use all or part of this work in future works, such as articles or books.

Library users are granted permission for individual, research and non-commercial reproduction of this work for educational purposes only. Any further digital posting of this document requires specific permission from the author.

Any copying or publication of this thesis for commercial purposes, or for financial gain, is not allowed without my written permission.

Madeline Dineen

08/06/2018

The Benefits of a Therapeutic Nature Education Intervention for Children with ADHD

A Thesis
Presented to
The Faculty of
Western Washington University

In Partial Fulfillment
Of the Requirements for the Degree
Master of Education

by
Madeline Dineen
August 2018

Abstract

ADHD (Attention Deficit Hyperactivity Disorder) diagnoses have been on the rise in children in the United States for the last twenty years due to multiple possible reasons (NIMH, 2016). Recent work on the subject, however, notes a positive correlation between exposure of children to experience-based nature therapy and the reduction of ADHD symptoms (Taylor & Kuo 2011). I hypothesized that implementing an intervention that is in an outdoor nature environment, that is experience-based and contains a learning objective would be correlated with a reduction of ADHD behaviors in elementary aged children. This study is a probe into the possibility of utilizing nature therapy and education lessons as a method to reduce ADHD symptoms in elementary aged children. I followed Keith Russell's (2012) theoretical framework on nature therapy, and used adapted lesson plans from Project Learning Tree's Environmental Education Activity Guide that have shown promise in raising subsequent engagement in the classroom, to create an intervention model that is comprised of four 30 - 45 minute lessons (Russell, 2012; Kuo et al 2018; plt.org, 2017). The program was delivered to two entire class groups in each of grades kindergarten through third grade in a northwest Washington State public elementary school I tested the intervention model on nine elementary aged students who were members of these classes. The program was completed in the span of two to four weeks. Participants had existing ADHD diagnoses, with individually-specific typical behaviors identified by school staff, and approval to participate. Counts of these ADHD behaviors pre- and post-lesson interventions were made during the 15 minutes directly before and after the 30 - 45 minute outdoor intervention. Four different lessons were offered, allowing a maximum of four pre- and post- counts per child. Three student participants engaged in the program all four times,

five students participated in three of the four lessons, and one student participated in two days of the program. For eight of the nine students, I used the before and after comparison design. I used an anecdotal method of data collection based on applied behavior analysis for the ninth student.

This student's behaviors are recorded verbally by the researchers. The results of this pilot study indicate that outdoor lesson interventions (based on a therapeutic nature framework) can reduce ADHD related behaviors in elementary students in grades kindergarten through third grade. It is recommended that a larger sample be studied next to statistically test the effects detected here.

Acknowledgements

This work is dedicated to Madeline Dineen Sr. (June, 4, 1922 – Sept. 15, 2014). You inspired me to be confident in my efforts and stubborn in my convictions. I miss you every day.

First and foremost to my advisor Gene Myers, thank your unyielding confidence in me.

To Nick Stanger, thank you for always pushing me to do better.

To Rich Hanson, thank you for taking a chance on me and this research.

To Samish Elementary School and Principal Mischelle Darraugh, thank you from the bottom of my heart for letting me invade your school.

To the Science, Mathematics, and Technology Education (SMATE) Center at Western Washington University, thank you for the tools necessary to complete this education research.

To the Samish Indian Nation, thank you for allowing these lessons to happen on your traditional lands.

To Becky Moore, thank you for absolutely everything. This project would not have been possible. Thank you for volunteering your time to help out a friend. Thank you for making me laugh. Thank you for listening and supporting me. Thank you for your unwavering friendship.

To Lindsay Pilon, thank you for dropping everything to assist this project, you were integral to its success.

To Jayme Gordon, thank you for keeping me sane, and reassuring me when I had minor freak outs

To Adam Jones, thank you for your love, and for cleaning the litter box and the kitchen when I was in over my head.

To my cohort – you made this journey not only bearable, but incredibly enjoyable.
Mark Bryant, thank you for being my adventure buddy.
Rosalie Motsumoto, thank you for always sparing time to listen when I was having a hard time.
Ciera Mead, thank you for your immense patience with me and guidance in completing the project.
Maeve Pickus, thank you for always being there whenever anyone needed you.
Sahar Arbab, thank you for adding much needed perspective to my two year journey. Lindsay Shepard, thank you for the most wonderful of hugs.

To the faculty I learned from,
Dr. Aquila Flower, Dr. Nabil Kamel, Dr. Kate Darby, Dr. Nini Hayes, and Dr. Ruth Sofield, thank you for the lessons.

To all others in my massive support system including: Melissa Biggs, Anna Hartzell, Sean Barry, Sarina Pekovic, Yalanda Russell, my parents, my grandparents, my sisters, and my extended family.

Finally to Project Learning Tree, of whose Environmental Education lessons informed the curriculum, thank you for your incredible resources for educators. You make our jobs easier.

Table of Contents

List of Tables and Figures

Introduction

The purpose of this pilot study is to investigate the possibility of using a therapeutic nature lesson as an intervention for elementary aged children (ages 5- 10) with ADHD or ADHD related symptoms as a method to reduce those symptoms. ADHD is an acronym for Attention Deficit Hyperactive Disorder and will be referred to as ADHD from this point forward in the paper. Increasing percentages of children are being diagnosed with ADHD in the U.S. (Visser et al, 2014). While the reasons for the increase in ADHD diagnoses vary - increased awareness of symptoms in girls, over-use of screen and video time, reduction of recess time to focus on STEM (Science, Technology, Engineering, and Mathematics) classes, reduction of access to outdoor programs, art, and music classes due to budget restraints, etc. - children with the disorder may struggle and have learning difficulties in and out of the classroom (Boyle et al, 2011). Some are greatly impacted by the symptoms of ADHD and wind up with learning delays, or in the special education room at school. The pilot study investigates the outcome of an outdoor lesson intervention that contains experiential outdoor engagement with nature as an alternative treatment for students with ADHD and measure the outcome with a before and after comparison test.

In recent years researchers have found that children with behavior and deficit disorders benefit from interaction with nature, and by extension natural environments, which may reduce some of the symptoms of those disorders (Dadvand et al, 2015; Jackson, Tester & Henderson, 2009). For example, merely taking a walk in a park or an outdoor place with elements of a natural environment can be enough to reduce ADHD symptoms in children (Taylor & Kuo 2004). Other research indicated that applying lessons in an outdoor setting, and encouraging student involvement is needed for more complex childhood development (Doyle, 2004; Malone 2003, Taylor & Kuo 2009,). Furthermore, utilizing methods of engaging children in nature therapy and outdoor programs can reduce stress and increase resiliency (Russell 2012, Kuo et al 2018).

The context lies within an analysis of the literature on environmental education benefits for children with ADHD, as well understanding the natural therapeutic structure of an outdoor education experience, to create a working intervention. A viable hypothesis can be formed on the outcomes of a pilot study by synthesizing various components of existing studies on the potential benefits of environmental education programming for children with ADHD. A 2004 study revealed that environmental education programming can be beneficial for all children with social, behavioral, or emotional disorders (Doyle 2004). A more recent study has indicated that inclassroom attention increased after the class spent time learning about various nature properties in a natural setting (outside) (Kuo et al 2018). Therefore, submersing children in an outdoor setting, and presenting information about the surrounding environment could be therapeutic, as well as effective, in reducing symptoms of ADHD in elementary aged children.

In this study, I attempted to determine if an outdoor lesson, applied to a nature therapy framework, would be effective at reducing the rate of ADHD related behaviors in elementary students from kindergarten through third grade. I tried to answer the questions: Will using an experience based outdoor engagement lessons developed with a nature therapy framework as an intervention cause a reduction of ADHD behaviors in elementary aged children? If so can changes be attributed solely to the outdoor intervention, and is there enough evidence to find conclusive proof?

Background

Childhood ADHD diagnoses have been on the rise in the US for the last few years (Boyle et al, 2011). For example, the prevalence of the disorder rose 22% from 2003 to 2007 among school aged youth in the US (Visser et al, 2014). Only about 5-6 % of all children in the US had a diagnosis of the disorder in 2000 (APA, 2000). In a study that spanned from 2003-2012, the Center for Disease Control and Prevention estimated that 11% of children in the US ages 5 – 17 were diagnosed with ADHD (Vissar et al, 2011). In 1991, U.S Congress added ADHD to the disorders protected under the Individuals with Disabilities Education Act. In 1995, the US Department of Education added a reapproved addendum to the Act, and current information can be found on the US Government's IDEA website (US Department of Education, 1995). These policy changes validated ADHD as a disability and the diagnosis rate began to climb, so too, did the prescribing of medications to children. Because these rates are on the rise, it is important to investigate broader treatment potential, rather than merely relying on the effectiveness of medication interventions (Bergey & Conrad, 2018).

Relevant to childhood ADHD research, research exist indicating nature and outdoor environments as reducers of symptoms of ADHD in children (Kuo & Taylor, 2009). In 2004, Kuo and Taylor tested non-ADHD persons with ADHD tendencies in nature and saw a reduced rate in those tendencies. When the processes were repeated on children with ADHD, they observed that nature access appeared to reduce symptoms associated with ADHD in those participants as well (Kuo & Taylor, 2004). They also noted that "the advantage of green outdoor activities over other activities was consistent for children across a wide range of individual, residential, and case characteristics" (2004, p. 1584). These findings show a clear link between natural settings and their ability to reduce the symptoms of ADHD in children.

The current research indicates that outdoor programming with an environmental learning component benefits children with cognitive and attention deficit disorders (Strife & Downey, 2009; Jackson et al, 2009; Kuo and Taylor 2011; Kuo et al 2018). A potential avenue for these deficits

and other negative childhood experiences could be found by directing and focusing attention of the participant to natural sources. Natural environments are generally rich in attention directing resources (Wells & Evans, 2003). As stated by Steven Kaplan, a researcher at University of Michigan specializing in environmental psychology, "[directed attention] is essential to a coherent life and to the identification and carrying out of worthwhile purposes" (Kaplan, 1995 p. 180). Such activities help children stay engaged in learning and the multiple distracters keep them focused.

Children are spending less time outdoors than their parents or grandparents. However, it has been well researched that time outdoors leads to better health in children (Myers 2012). It is even possible there are negative health ramifications to children spending less time outdoors, but there is little in-depth research on the matter. There is a need for research that can provide a quantitative analysis of outdoor education programs that benefit children and promote their health. A recent study done by Ming Kuo and her associates indicates that children perform better in school after spending time outdoors engaging with the natural environment, in a hands on way, with a knowledgeable instructor (Kuo et al 2018). Anecdotal accounts are readily available of the healing aspects of outdoor education in camps and other wilderness programs that have pointed to a positive relationship between children and the environment (Russell, 2012). Yet, there isn't a concrete method of measuring success of a program on changing or influencing a child's behavior currently in place. The pilot study is used as a probe to determine if continued research on the matter could create solid evidence of the benefits of a therapeutic nature therapy as an intervention for children with ADHD.

Environmental education programming as well as nature therapies could help children foster a deeper sense of, and appreciation for, natural places through the study of ecological processes, systems, and their place in it (Jackson, Tester, & Henderson, 2008). Researcher Keith Russell has published works that outline adventure therapy programs (Russell 2012). The

framework for such programs was created by an assessment of multiple outdoor facilities that use various nature aspects to create wilderness therapy programs for youth with behavioral disorders (Gass, Gillis, & Russell 2012). I used Russell's work to bring a therapeutic component to the lesson.

The framework consists of four components necessary to organize an outdoor-interactive therapy for youth. The first component is "nature" (an outdoor setting). The second is the "active self", which indicates the child's active engagement in a natural setting. The third is the "social group", which is comprised of the child's peers. The fourth and final component is the "activity reflection", which asks the students to think critically about the lessons they learn (Russell 2012). I use this model to build the outdoor education lessons that act as therapeutic interventions for the study. I use a fifth component of a trained environmental educator as well which is not included in Russell's original framework.

Nature can be defined in many ways, and is by many different people. For the purpose of the pilot study, I will be using the definition provided by Gene Myers in his 2012 work "Children and Nature" (Myers, 2012). He defines nature as, "nonhuman environment – encompassing (potentially) all biomes, landscapes, the waters, atmosphere, and heavens surrounding the earth, as well as all the orders of nonhuman living occupants" (2012, p. 113). The setting of the program must be in an outdoor natural environment containing those factors, which satisfies the nature component of the framework (Russell, 2012).

The second piece of the framework encourages the child to actively participate in and engage with nature. There must be an element of individual learning and engagement with surrounding nature (Russell, 2012). Here is a chance to introduce an environmental learning objective into curriculum and lesson plan. The outcome of each lesson is student and learner oriented with the environmental educator acting as more of a facilitator than a lecturer. These proponents meld with the third element of the framework which involves an active group of peers. Russell defines this as, "small-group environments where each individual is personally responsible

for the success of the group" (2012, p. 435). Each lesson in the pilot study contains a group activity to meet this requirement.

The final component of the framework is the "activity reflection" where the students reflect on the various outdoor activities they took part in. In doing so students receive "physical, emotional, and psychological benefits" (2012, p. 436). Students can use these reflections to apply the activity to their everyday life (Russell, 2012). The program lessons end with time to think and reflect in their journals. This portion takes place in the last 15 minutes of the lesson, after individual learning and the group activity.

I incorporated the framework provided by Russell into lessons from the Project Learning Tree Environmental Education Activity Guide to create the 30 - 45 minute lesson intervention program for children with and without behavioral disorders in elementary school. I have chosen Russell's work because it incorporates the therapeutic properties of nature in programming (Russell, 2012). The Project Learning Tree curriculum was used because over 380 environmental educators, researchers, and professionals collaborated to develop the lessons and over 20,000 environmental educators attend the annual workshop to update the curriculum and activity guides (Project Learning Tree, 2017). The PLT curriculum was also used in a study that measured classroom engagement for third graders in Illinois. The study found that children were more engaged in classroom learning directly after an outdoor lesson from the Project Learning Tree curriculum (Kuo et al, 2018). The curriculum works to connect children to the natural world.

Children with ADHD are more eager to engage in an outdoor setting if they feel involved and connected to the outdoor community (Hacking, Barratt, & Scott, 2007). Those children that struggle from social, emotional, and behavior issues responded positively to environmental education programs (Doyle, 2004; Stevenson, R. B. 2007; Norton et al 2014). Because of this, environmental education programming with a therapeutic component could prove to be more effective at reducing the symptoms of ADHD than a simple walk in the park. By assessing themes in Russell's "Therapeutic Uses of Nature" and lessons in Project Learning Tree I can create an

intervention plan for elementary aged children with ADHD, and measure the possibility of creating a viable intervention plan out of the program.

There are a few interventions in existence for childhood ADHD, and most of them include medication. While there are a number of medications that effectively treat the disorder, most have moderate to severe side-effects. Medications were initially given to children after they had shown progress in adults, however, children and adults' body chemistries are incredibly different and testing was not completed on children. Furthermore, there is relatively little known about the longterm implications of these medications on developing bodies. It is still unclear whether the benefits outweigh the risks, and most parents agree that they do not. Parents generally prefer alternative therapies, if they are available, to medications with potentially harsh side-effects

(Rosenberg D. &

Gershon S., 2012). This is not to say medications have not been useful in treating the disorder, but exploring other avenues of less invasive treatment could add necessary evidence to the debate between medication and more holistic treatments.

Environmental education programming as an intervention does not include the potentially harmful and damaging side-effects of many ADHD medications, and therefore should be considered for further research to prove effectiveness. Though, going outside for lessons can be hazardous in its own way. For example, some bugs sting, some plants are poisonous, rain and ice are slick, and water causes many problems by itself. It is important for outdoor educators to be wary of all the potential hazards.

Applied behavior analysis (ABA) could be used to quantify the benefits of outdoor learning and nature therapy as an intervention as they impact children's behavior. ABA, as defined by Applied Behavior Analysis for Teachers – the current (9^{th}) edition, is a "systematic application of behavioral principles to change socially significant behavior to a meaningful degree" (Alberto & Troutman, 2012). ABA is a way to measure the functionality of any given intervention on a target

behavior. The analysis is done without using a control individual or group, but rather by measuring the behavior around an intervention on a single individual and potentially repeating the intervention multiple times.

Due to time and resource constraint, as well as sample size, this study is merely a probe and *does not* use ABA as a method of analysis. I am discussing it here because research into using the behavior analysis system, could determine if an outdoor intervention creates a change in the child's behavior to a significant degree, using a larger population of students. I use the element of the single subject design in that each child acted as his or her own control. Stronger designs would use more data collection points and/or a control group.

Applied behavior analysis is actively used to determine if an intervention is working on a child with ADHD in classrooms across the United States. More investigation into measuring ADHD behavior in this manner could prove significant to students across the country, by providing alternate relief options. Single subject intervention methods are used to determine if a given intervention on children with ADHD is effective. Since there are multiple behaviors associated with ADHD, educators may use a multiple comparison design as an experimental design to further indicate if the intervention is viable. This method would allow for the educator to test a single intervention against multiple children (Alberto & Troutman, 2012).

Educators often record the data (child's behavior(s)) by using event recording, which is when "the observer makes a notation every time the student engages in target behavior[s]" (2012, p. 77) over a period of time to determine frequency or amount of that behavior. Baseline event recording is taken before the intervention, the intervention is implemented, and then frequency of the behavior is counted in this example. If the frequency of the behavior decreases after an intervention, than the intervention could have functionality (Alberto & Troutman, 2012). For the pilot study, I used event recording to measure behavior before and after the outdoor lesson.

With this pilot study, I propose to test the potential effectiveness of using nature therapy and education as an intervention for students with ADHD in elementary school. Based on provided

context, I hypothesized that using an experienced based nature therapy centered around a learning objective, as an intervention will cause a reduction of ADHD behaviors in children aged 5 - 10 years, as measured by repeated before and after comparison tests of ADHD related behavior. I will test this hypothesis by collecting data (behavior counts on students that exhibit ADHD related behaviors before and after the environmental education program intervention.

Methods

Location and Subjects

The study took place on the grounds of an elementary school located in Sedro-Woolley, WA. Criteria for participants in the study were as follow; the student had a diagnosis of ADHD and the homeroom teacher was aware of the diagnosis, OR the teacher had identified a child that exhibited ADHD related behaviors and wanted to see the student participate in the study. Just over 100 students engaged in the EE program (including classmates who were not part of the study), as social group is an important part of the framework methodology. Having peers or a social group interaction is important because "research has shown that wilderness experiences conducted in small group settings… allow[s] youth to experience a unique and intense feeling of community and belongingness." (Russell, 2012, p. 433).

For the study, recruitment emails were sent to the homeroom teachers once I had made contact with and received approval from the elementary school principal and her board of advisors. I received responses from the kindergarten, first grade, second grade, and third grade homeroom teachers asking to participate in the program. The kindergarten class had 29 students participate in the outdoor lesson portion of the study. The first grade class had 23 students, the second grade class had 28 students, and the third grade class had 21 students for a total of 101 students experiencing the lessons.

Nine students returned consent forms and participated in the study proper. Their behaviors were observed and examined before and after each lesson they partook in. Three of the student participants were in kindergarten, two were in second grade, and four were in third grade. Of the participants, six presented as male and three as female. The first grade class participated in the program, but no individual students returned consent forms and therefore data on the class could not be collected or used.

In the early days of the project, I contacted the principal of the elementary school and her administrators, and presented my proposed research. I inquired if her elementary school, and the

students that attend, would be interested in participating in the study. They agreed to the proposal, and I completed an application to the Internal Review Board (IRB) at Western Washington University for permission to study children with symptoms of a medical disorder to minimize potential risk to the student and maximize confidentiality. Once the IRB application was approved, the student participants were given anonymized identifying numbers to maintain confidentiality. I instructed the elementary school's faculty to send a recruitment packet that included a recruitment flyer, the parental consent form, and the child assent form to the parents/guardians of selected students. Program flyers were also sent home for students in kindergarten through third grade that would be merely participating in the outdoor program.

At that point, the parents decided if their child could participate in the study part of the program and if so, sent back the signed consent forms by the end of the week the packets were sent out. If the parent or guardian had any questions, I listed my contact information on the recruitment form. They were able to get a hold of me if they needed to clear up any confusion or ask questions. Teachers were recruited by an invitation from both the principal and me; they also saw the recruitment flyer being sent home with the students. They were sent consent forms with the study information and decided if they would like their class to participate. I collected their consent forms before the beginning of data collection in the classrooms.

The researcher and the environmental educator were two separate people under most circumstances, and I was the primary investigator and researcher. These lessons were added to the overall elementary curriculum as an addition to normal lessons and took place during normal school hours. Due to the high demands of working with elementary students, the program design shifted to meet the needs of the classroom teachers. This resulted in starting early or late for some lessons, not having the lessons fall at the same time in the afternoon each day, or missed/rescheduled lessons. These all could be compounding factors that skew the data collection and results.

The pilot study design had four lesson interventions to be deployed on four separate days.

It was the teacher's discretion when the lessons took place, depending on the classroom schedule (i.e. two 45 minute sessions a week for two weeks, or one 45 minute session a week for four weeks). Though the dates and times of the lessons varied, each lesson was facilitated in an outdoor setting, and contained a learning objective of increasing children's understanding of the complexities of their outdoor environment, and student behavior was measured in the 15 minutes directly before and after the intervention (Project Learning Tree, 2017). (See section on Intervention below, and Appendix C.)

I aimed to optimize the outcome potential and the validity of the results by utilizing multiple methods to collect and analyze qualitative and quantitative data sets. In doing so, I was able to indicate that, a therapeutic nature lesson should be studied more in depth to determine an effective intervention in lowering the average of ADHD related behaviors in elementary aged students.

Observational Measures

The homeroom teachers first identified students in their classes that either had known ADHD diagnoses or the teacher suspected that the student had ADHD because of related observations of the student's behavior. The teacher then sent home a recruitment packet with the students who were identified. I scheduled start dates with each class while I waited for the consent forms to be returned. I did not know the identity of the children until I was given their parental consent form with the child assent form if needed (for students over six years of age). Flyers were also sent home with the rest of the students participating only in the lesson portion, but not in the study.

I identified exact ADHD related behaviors each child was most likely to exhibit through interviews with the teacher before the start of the program. The educators were provided a list of the 17 main ADHD related behaviors that have been identified by NIMH (National Institute for Mental Health) in their 2016 report, as part of the initial interviews. The teacher chose which ADHD

behavior(s) to be isolated for each child based on the given list. Two or three ADHD related behaviors were pinpointed and acutely defined in each individual student participating in the study.

Each lesson also met the components of the nature therapy framework provided by Russell (2012). Students in the program received an outdoor education lesson in an outdoor setting with an experienced environmental educator. I had a few assistants in the duration of this study. They hold either an M.Ed in Environmental Education or were an undergraduate intern with outdoor education and assessment experience. The classes' homeroom teachers and the researcher were present during the outdoor intervention as non-active observers, and as facilitators, to minimize risk with increased supervision. It was my intention that the environmental educator had a separate role from the person watching behavior and conducting the research. Usually during the lessons, only the environmental educators were interacting with the children, but due to lack of time and help, occasionally the investigator had to be the observer and the educator. This might have created a confounding variable, or the possibility that that influences from outside the study may have influenced the results.

Student participants were coded to keep the study confidential and minimize risk for the participants. The code was a simple four digit design. The first two digits correspond to the grade and the next two digits refer to the student participant number. For example, third grade student number one was coded as G3–S1. Each student also had ADHD related behaviors identified by the homeroom teacher being measured and observed. We asked the teachers to identify the most commonly observed ADHD related behaviors in each student to pinpoint specific behaviors we would be measuring in each child (see Table 1).

Grade 3 – Student 1 (G3-S1): the homeroom teacher identified two ADHD behaviors in this student that we counted for in the study: easily distracted by unrelated thoughts or stimuli; and talks nonstop.

Grade 3 – Student 2 (G3-S2): the homeroom teacher identified two ADHD behaviors in this student that we counted for in the study: Overlooks or misses details, makes careless mistakes in

schoolwork, or during other activities; and is easily distracted by unrelated thoughts or stimuli.

Grade 3 – Student 3 (G3-S3): the homeroom teacher identified two ADHD behaviors in this student that we counted for in the study: Fidgets and squirms in seats; and blurts out an answer before a question has been completed, finishes other people's sentences, or speaks without waiting for a turn in conversation.

Grade 3 – Student 4 (GS-S4) the homeroom teacher identified three ADHD behaviors in this student that we counted for in the study: Has problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading; Avoids or dislikes tasks that require sustained mental effort, such as schoolwork or homework; and blurts out an answer before a question has been completed.

Grade 2 – Student 1 (G2-S1): the homeroom teacher identified three ADHD behaviors in this student that we counted for in the study: Has problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading; Fidgets and squirms in seat; and is easily distracted by unrelated thoughts or stimuli.

Grade 2 – Student 2 (G2-S2): the homeroom teacher identified two ADHD behaviors in this student that we counted for in the study: Has problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading; and blurts out an answer before a question has been completed, finishes other people's sentences, or speaks without waiting for a turn in conversation.

Grade K – Student 1 (GK-S1): the homeroom teacher identified three ADHD behaviors in this student that we counted for in the study: Has problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading; Leaves seats in situations when staying seated is expected, such as in the classroom or in the office; and Runs or dashes around or climbs in situations where it is inappropriate.

Grade K – Student 2 (GK-S2): the homeroom teacher identified two ADHD behaviors in this student that we counted for in the study: Has problems sustaining attention in tasks or play,

including conversations, lectures, or lengthy reading; and Fidgets and squirms in seat. **Grade K – Student 3** (GK-S3): the homeroom teacher identified three ADHD behaviors in this student that we counted for in the study: Has problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading; Leaves seats in situations when staying seated is expected, such as in the classroom; and Runs or dashes around or climbs in situations where it is inappropriate.

Table 1. The homeroom teachers provided the behaviors most likely demonstrated by each student based on the 17 ADHD behaviors provided by the National Institute of Mental Health.

Student	Related ADHD Behaviors*
G3-S1	H, O
G3-S2	A, H
G3-S3	J, P
G3-S4	B, F, P
G2-S1	B, H, J
G2-S2	B, P
GK –S1	B, K, L
GK-S2	B, J
GK-S3	B, K, L

*ADHD Behaviors:

A. Overlook or miss details, make careless mistakes in schoolwork, at work, or during other activities
B. Have problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading
C. Not seem to listen when spoken to directly
D. Not follow through on instructions and fail to finish schoolwork, chores, or duties in the workplace or start tasks but quickly lose focus and get easily sidetracked
E. Have problems organizing tasks and activities, such as what to do in sequence, keeping materials and belongings in order, having messy work and poor time management, and failing to meet deadlines
F. Avoid or dislike tasks that require sustained mental effort, such as schoolwork or homework, or for teens and older adults, preparing reports, completing forms or reviewing lengthy papers
G. Lose things necessary for tasks or activities, such as school supplies, pencils, books, tools, wallets, keys, paperwork, eyeglasses, and cell phones
H. Be easily distracted by unrelated thoughts or stimuli
I. Be forgetful in daily activities, such as chores, errands, returning calls, and keeping appointments
J. Fidget and squirm in their seats
K. Leave their seats in situations when staying seated is expected, such as in the classroom or in the office
L. Run or dash around or climb in situations where it is inappropriate or, in teens and adults, often feel restless
M. Be unable to play or engage in hobbies quietly
N. Be constantly in motion or “on the go,” or act as if “driven by a motor”
O. Talk nonstop
P. Blurt out an answer before a question has been completed, finish other people’s sentences, or speak without waiting for a turn in conversation
Q. Have trouble waiting his or her turn
R. Interrupt or intrude on others, for example in conversations, games, or activities" (NIMH, 2016)

Procedures and Design

The teachers were told there would be four lessons to maximize potential to repeat the study for each student participant. The dates and times were flexible and some had to be moved around to make allowance for personal health, family emergency, and the in-flux nature of working with elementary aged children. Though each lesson was different and had different lesson objectives, the framework of each lesson was the same – designed based on the four dimension nature therapy model aforementioned: nature, active self, social group, and activity reflection (Russell, 2012).

The first 15 minutes of each lesson was spent inside the classroom, while the lesson was being introduced and/or journals were being passed out by the environmental educator. The educator would then take the class outside, and engage in a lesson that took 30-45 minutes. The last 15 minutes of the lesson were spent in journal time, which was a facilitation of the environmental educator who would ask journal questions reflecting on the activity the class had just completed. It is important to note that the first 15 minutes of each lesson happened inside the classroom where baseline data was collected before each lesson, and the last 15 minutes of each lesson happened outside, where we collected post intervention data during journal reflection time.

I used a comparative design to collect data on the individual participants through direct observation to conduct an analysis of before and after behavior counts. I modeled the research design off of the single-subject design defined in Applied Behavior Analysis for Teachers 9th edition as "experimental investigations in which each individual child serves as his or her own control" (Alberto & Troutman, 2012). The model fits an ‘abbreviated” ABAB design without sufficient points of measurement to have reliable estimates of stable behavioral states, and thus just indicative of the potential of the intervention. I structured the research to fit a before and after comparison model where I measured the student’s ADHD related behaviors before and after the intervention. I conducted the baseline recording (inside the classroom) on each student’s ADHD related behavior every day they participated in the study and then the post intervention behavior

count was taken after. Behaviors were recorded using time sampled counts of specific behaviors by focal individuals, yielding the number of ADHD behaviors during each 15 minute period directly before and after for each individual.

One student in kindergarten was evaluated using alternate methods for various reasons. In the beginning we had difficulty counting the number of times he left his seat, because he was continuously out of his seat and rarely returned to it. He also left early from the first two lessons, and post-intervention data was not collected. I decided to alter the way we observed and record data on this students using anecdotal report, which is a data collection method that provides detailed and complete descriptions of behaviors over the duration of the program. This required use of time event sampling which allows for a description of characteristics of behavior states of the student. This is not the most reliable method of analysis because there is much room for human error. Yet, there is still merit behind anecdotal research as it can help point to a trend in evidence or provide context on the concept of the intervention model.

The behaviors from the individual students were measured using the Event Frequency Recording document in which the researcher recorded the number of times the student carried out the defined behaviors over time. In this case, the intervention is the four lesson environmental education program developed with a nature therapy framework.

Intervention

The curriculum is designed using environmental education standards set by the North American Association of Environmental Educators (NAAEE). There are six "Guidelines for Excellence" provided by the organization for creating quality curriculum. The guidelines for environmental education curriculum are as follows: materials must (1) be fair and accurate, (2) foster awareness and depth, (3) provide emphasis on skill building, (4) be action oriented, (5) have instructional soundness, and (6) be easy to use (NAAEE.org). These guidelines are applied to each lesson along with the nature therapy framework. Each lesson has a set of Next Generation Science

Standards (NGSS) being fulfilled as well. The NGSS provide context for the educational science standard met by each lesson (ngss.org).

The lessons were also developed using the current edition of the Project Learning Tree Environmental Education Activity Guide because of the credibility of the curriculum. PLT has been developing environmental education curriculum since the 1970s. It started, "as collaboration between the American Forest Institute (AFI), a forest products industry trade association dedicated to improving the management of America's forests, and the Western Regional Environmental Education Council (WREEC), a non-profit organization comprised of representatives from state departments of education and natural resources agencies from 13 western states." The curriculum has goals that each lesson meets that are compatible with the NAAEE goals and fits the nature therapy theoretical framework. The goals include: creating curriculum that is both desirable and useable to educators; building curriculum that is "balanced, fair, and accurate"; and presenting curriculum that could be readily implemented and used effectively (plt.org).

The intervention curriculum I created was centered on the guidelines provided by NAAEE, objectives from NGSS, and goals of PLT, all set to the nature therapy framework. The lessons are as follows:

Lesson 1: Trees and Leaves (based on the PLT lesson "Trees as Habitats")

This lesson allowed students to explore and identify various organisms that use trees as habitat. Students worked together to identify how organisms interact with their habitats. Older students (grade 3) also studied the venation of leaves by looking at visuals and collaborating to find individual leaf examples to reflect on and share with the class. The lesson meets Next Generation Science Standards: 3-LS4-3, 3-LS2-1, K-LS1-1, K-ESS3-1. The lesson meets all four elements of the nature therapy framework:

- Takes place outside (nature);
- Employs the active self by asking students to draw the tree;

- Works with a small group to adopt and decide a name for the tree; and
- Has a reflective journaling component where students reflect on the activity.

Lesson 2 - Land and Seas (based on the PLT lesson "Water Wise")

This lesson had the students dive deeper into their thoughts on the relationship between nature and humans as it relates to water. After an activity showing water and watershed connectivity students were asked to identify various species impacted by watersheds and human activity. Grade three also played a few rounds of 'intertidal animal scramble', where they were asked to identify the after receiving clues. The lesson meets Next Generation Science Standards: 2-ESS2-3. 2-ESS2-2. The lesson meets all four elements of the nature therapy framework:

- Takes place outside (nature);
- Employs the active self by asking students make a model watershed;
- Works with a small group to see the effect of pollution (food coloring) on their model watersheds; and
- Has a reflective journaling component where students reflect on the activity.

Lesson 3 - Birds and Bees (based on the PLT lesson "Nature's Recyclers")

This lesson had the students looking at the many interactions of animals in nature. They learned about decomposition and the circle of life, as well as observe the movements and behaviors of earthworms. The lesson meets Next Generation Science Standards: K-ESS3-1, and K-ESS3-3. The lesson meets all four elements of the nature therapy framework:

- Takes place outside (nature)
- Employs the active self by asking students to act as scientists studying worms;
- Works with a small group to observe and notate movements and activities of the worms; and
- Has a reflective journaling component where students reflect on the activity.

Lesson 4 - You and Me (based on the PLT lesson "Native Ways")

In the activity, students learn about the Samish Native American Indian Nation, and hear a translation of a traditional Samish story, “Maiden of Deception Pass”. After the story, the students were put into groups and given a sheet of paper per group. They were asked to draw a mural of their school bearing in mind all the new information they learned. The lesson meets Next Generation Science Standards: 3-LS4-4, K-ESS3-3, 1-LS1-2. The lesson meets all four elements of the nature therapy framework:

- Takes place outside (nature)
- Employs the active self by asking student to listen to and reflect on a story;
- Works with a small group to create mural of school; and
- Has a reflective journaling component where students reflect on the activity (PLT.org).

Analysis

Data are interpreted on a simple comparison level to reduce confounding variables and outside forces. The analysis included an investigation of the change in behavior over the course of a day (one observation before, and one after, the intervention), repeated the same measures multiple (2 to 4) days determine if patterns were robust, and if so, of what magnitude. A second analysis included measuring the effect size of the overall study compared to each student. Each student participant (again with the exception of the student covered in the anecdotal report) was analyzed on a model where baseline behavior rate is recorded in the classroom at the beginning of each lesson and then behavior rate is measured again post-intervention, this time outdoors. The simple observed counts of individually customized ADHD behaviors immediately before and after the intervention were examined. In addition individuals' mean before and after behavior counts for all days in which they participated were calculated and graphically presented to help determine trends in direction of the effects of the intervention.

The second analysis was done to estimate what effect size was achieved for comparison in future studies. I calculated the average behavior change in standardized units for each child participant, using all data from the sample to produce the pooled standard deviation. Beyond this I will not be using further quantitative analysis methods because there are not enough data points (before and after behavior counts) on each student, the data are not normally distributed nor were there enough subjects, to make a valid design for inferential statistical analysis.

Once data collection was complete, I calculated before and after behavior difference for each student across the number of lessons each one participated in. From these numbers, I was able to deduce average behavior change of the eight students. Because the data are few, I stopped at this point with the analysis of the eight students and only determined effect size on the individual students. Even still, in order to keep the data simple and accurate, I only interpret the means of behavior change among each student because there is a lack of a normal distribution and comparison points between the eight students.

I used relatively simple analysis methods to analyze the data that was collected. The population size was small and the data points were few, which is why this is a pilot study. I attempted to identify trends and themes in order to inform future research into the matter. I analyzed some of the data using visual analysis of graphs which I chose because the simplicity of the assessment. To analyze a graph, one must merely look at it to determine positive and negative trends.

Visual analysis of graphs in ABA is when data points are plotted during various phases where "certain characteristics of the data paths within and across phases are examined in order to judge the effectiveness of the intervention" (2012, p. 162). I used a method of "evaluation of changes in means focus[ing] on the average rate of student performance across the phase design" included in visual analysis of the graphs (2012, p. 162). This method of data analysis utilizes critical criterion (or the researcher's understanding of the impact of the intervention on the student or student groups, based on behavior measurement) and determines whether the intervention will provide practical and/or beneficial impact on the lives of the students. This analysis method determines if the intervention resulted in "consistent and meaningful changes" in the student's mean ADHD related behavior rate from baseline observation to the post-intervention observation of the student's mean ADHD related behavior rate (Alberto & Troutman, 2012).

I did not use a statistical analysis of the data to measure and calculate significant difference between the mean ADHD related rate of behaviors for the baseline data sets of each child, and the post-intervention mean ADHD related behaviors data sets, because of the small population size and corresponding data sets. Students G3–S1, G3–S2, G3–S3, G3–S4, G2-S1, G2–S2, GK–S1, and GK–S2 (a total of eight students) participated in the before and after behavior count comparison research design. GK–S3 participated in the anecdotal research design. I complied and graphed all the data points at the end of the four program lessons.

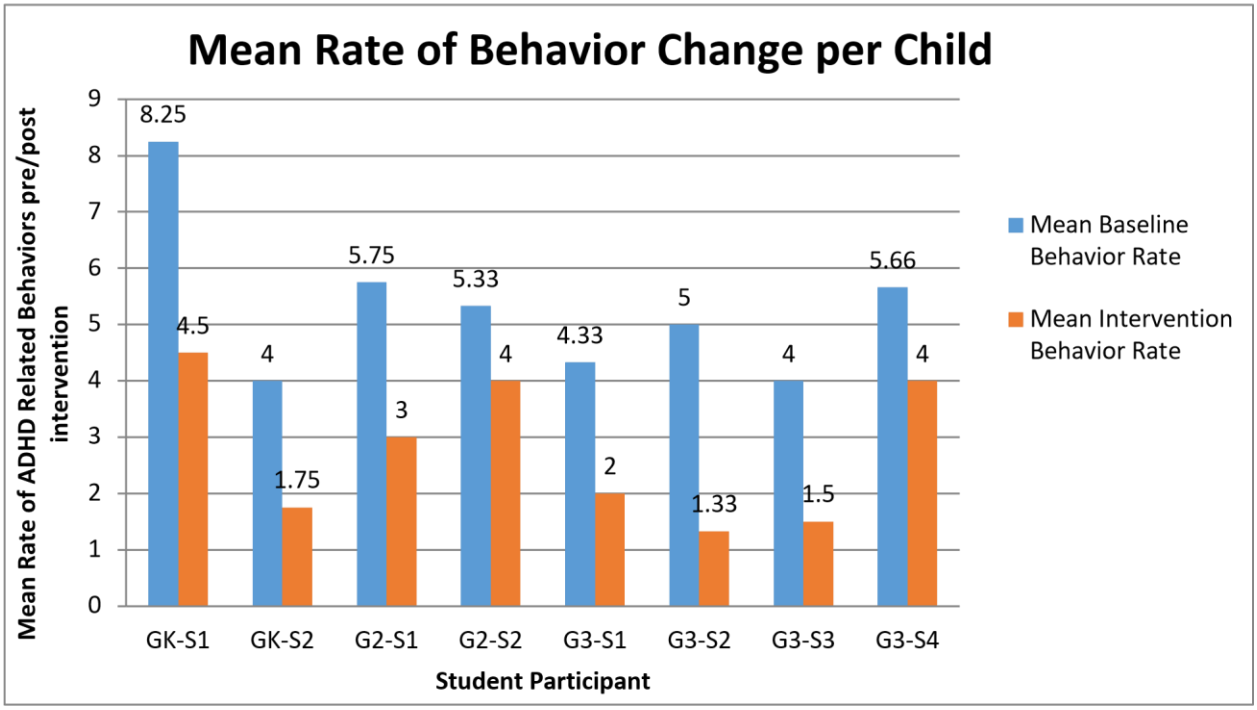
Results

I received nine consent/assent forms for student participants out of 101 potential students to be identified, or 8.9% of the 101 students (I do not know how many recruitment packets were sent home initially for confidentiality and student safety purposes). This rate is congruent with the national percentage of children ages 2 - 17 years reported with ADHD in the U.S. in 2016 at 9.4% (Danielson et al, 2018). The CDC reported 11% of U.S. children ages 4 – 17 years had the disorder in 2011 (Visser et al, 2011).

Three of the participating students were girls and six of the students were boys. This is similar to the ratio that the National Center for Health Statistics reports that more boys than girls ages 3 – 17 were diagnosed with ADHD in 2016 at a rate of 2.3:1 (CDC, 2017). Three of the student participants were in kindergarten, two of the participants were in second grade, and four of the participants were in third grade. We chose not to collect demographic data of the students apart from gender and grade level, due to need for strict confidentiality. Results may have varied or provided further contextual understanding if race, ethnicity, and/or socio-economic status had been accounted for.

The overall trend of the study is shown on Figure 1. Each student had two - three ADHD related behaviors that could be isolated and counted. All eight of the eight students for whom ADHD behaviors were counted decreased frequency of behaviors after the lesson. G3-S2 had the largest average reduction of behaviors at 3.66 behaviors less during the post lesson behavior count. G2-S2 had the smallest average reduction of behaviors at 1.33 behaviors less post lesson.

Figure 1. Mean average of ADHD related behaviors decrease after the outdoor intervention.



The third grade class had four student participants in the actual study. G3–S1 participated in the program three of the four days and had a mean baseline ADHD related behavior rate of 4.33 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 2 behaviors per 15 minutes (Figure 2) with an average change in behavior at 2.33 behaviors per 15 minutes before and after the intervention. The individual mean change is 1.00 in standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student.

G3–S2 participated in the program three of the four days and had a mean baseline ADHD related behavior rate of 5 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 1.33 behaviors per 15 minutes (Figure 3) with an average change in behavior at 3.66 behaviors per 15 minutes before and after the intervention.

G3–S3 participated in the program two of the four days and had a mean baseline ADHD related behavior rate of 4 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 1.5 behaviors per 15 minutes (Figure 4) with an average change in behavior at 2.5 behaviors per 15 minutes before and after the intervention. The individual mean change is 1.07 in

standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student.

G3–S4 participated in the program three of the four days and had a mean baseline ADHD related behavior rate of 5.66 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 4 behaviors per 15 minutes (Figure 5) with an average change in behavior at 1.66 behaviors per 15 minutes before and after the intervention The individual mean change is 0.72 in standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student.

Figure 2. G3-S1 results showing a decrease in ADHD behaviors of 3.66, averaged over 3 sessions.

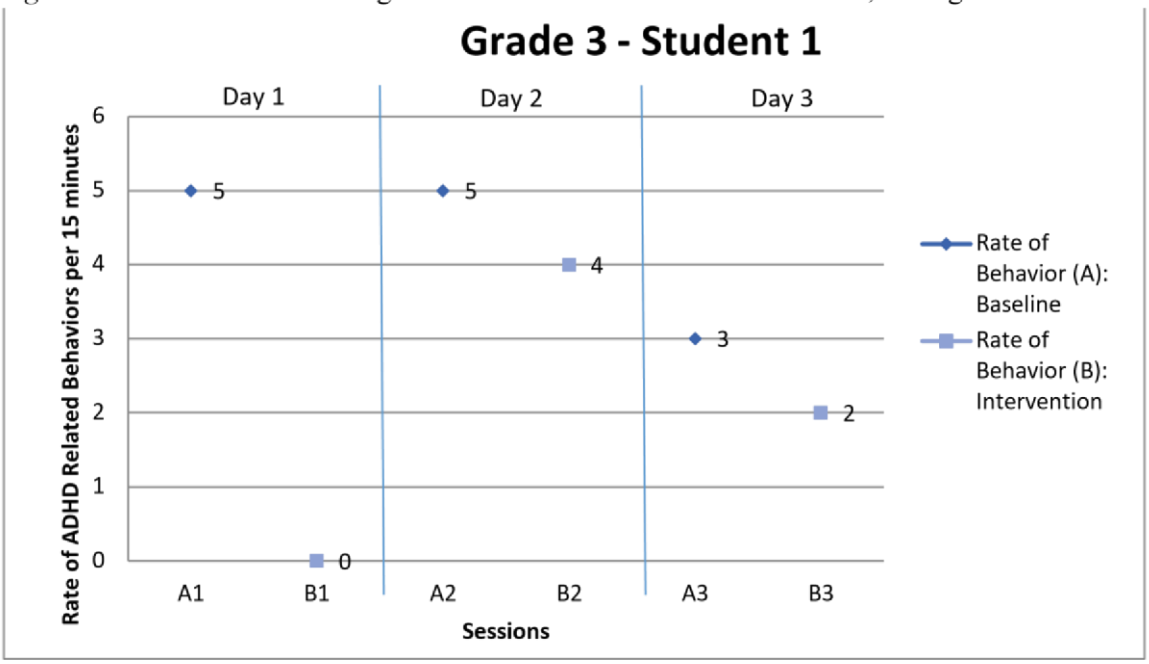


Figure 3. G3-S2 results showing a decrease in ADHD behaviors of 3.66, averaged over 3 sessions.

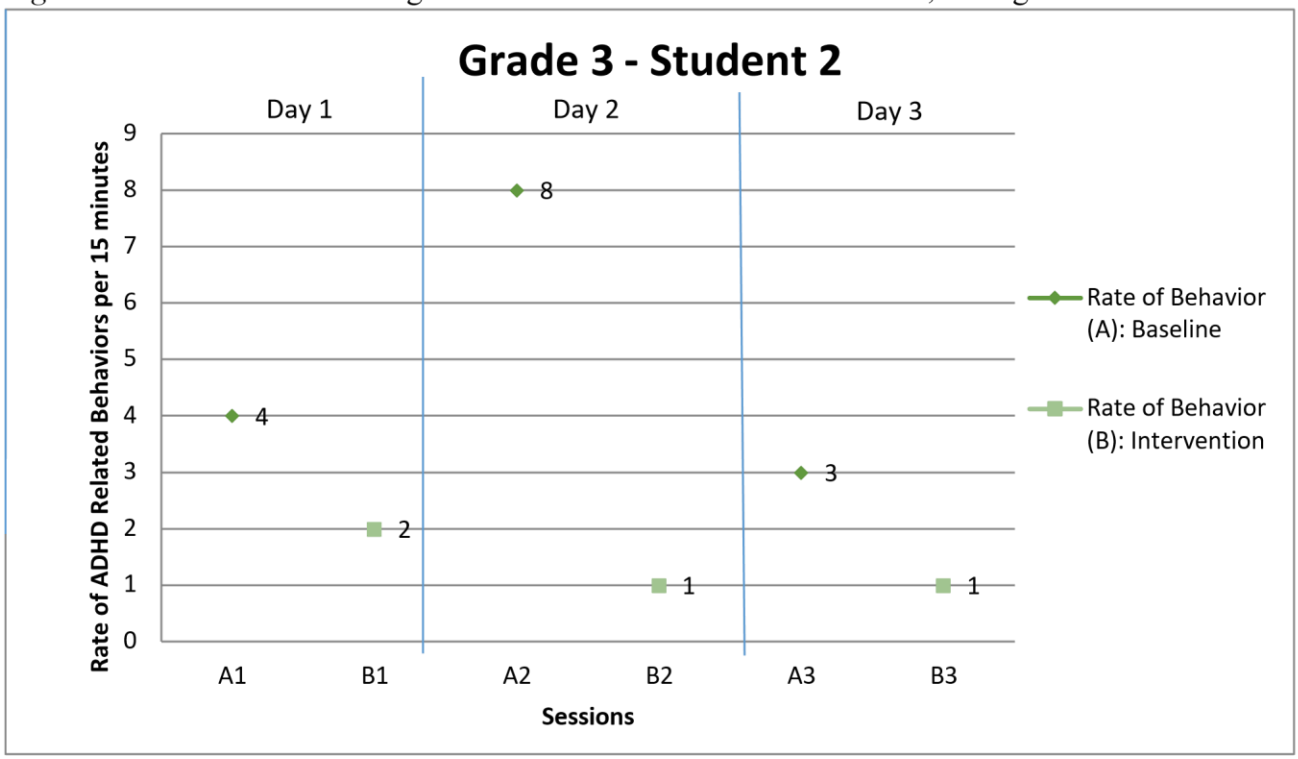


Figure 4. G3-S3 results showing a decrease in ADHD behaviors of 2.5, averaged over 2 sessions.

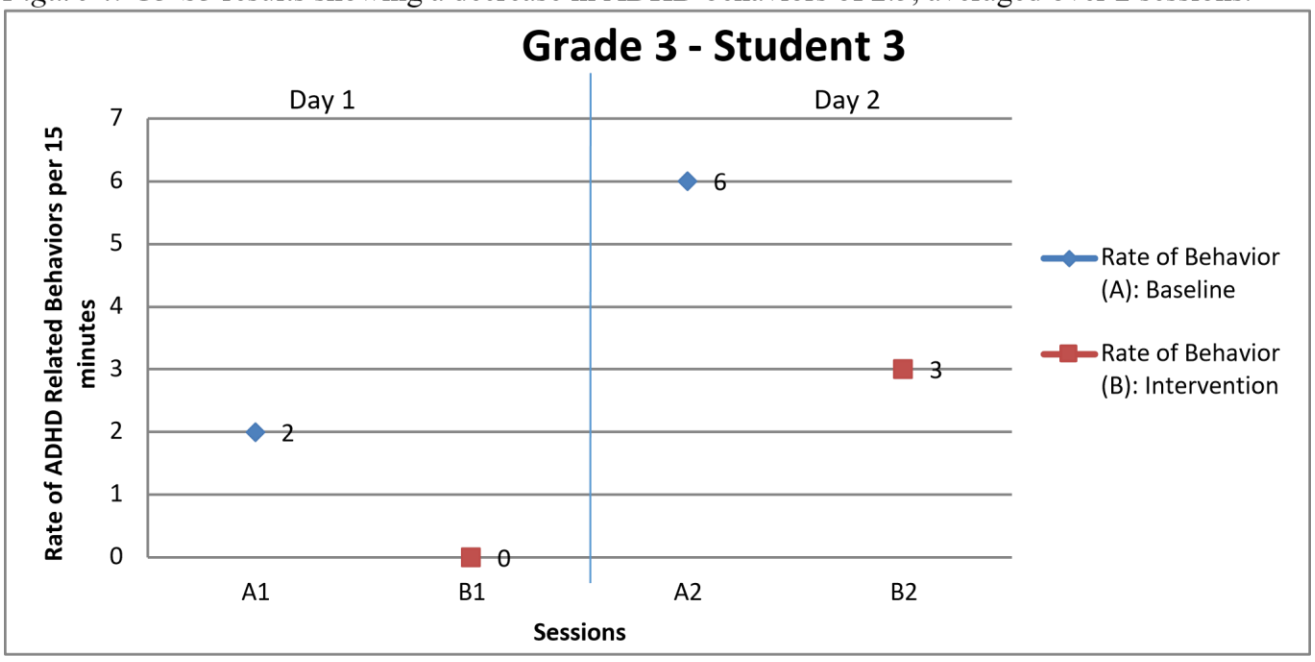
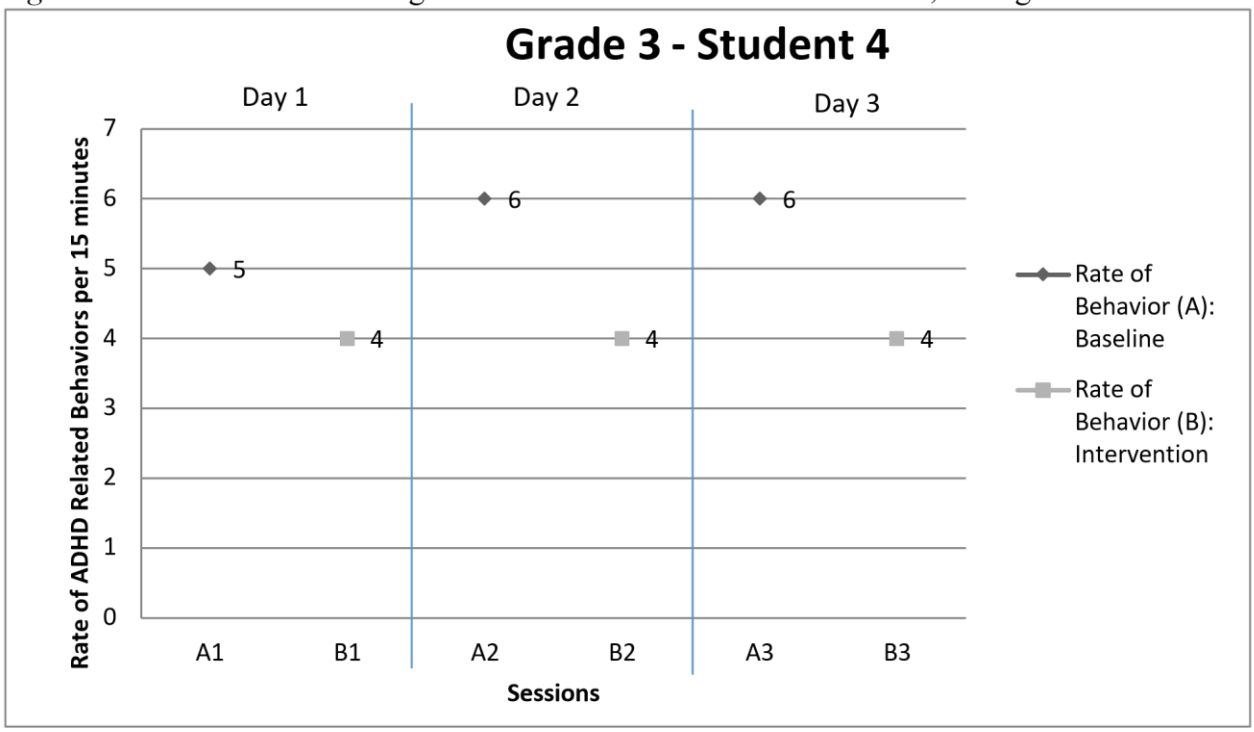


Figure 5. G3-S4 results showing a decrease in ADHD behaviors of 1.66, averaged over 3 sessions.



There were two second grade student participants. G2–S1 participated in the program three of the four days and had a mean baseline ADHD related behavior rate of 5.75 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 3 behaviors per 15 minutes (Figure 6) with an average change in behavior at 2.75 behaviors per 15 minutes before and after the intervention. The individual mean change is 1.18 in standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student. G2-S1 showed the only results indicating an increase in ADHD behaviors. On the day that the post-intervention count was higher, G2-S2 was sitting next to G2-S2 during the post-intervention, which could have caused the higher number. However, this data does suggest that the intervention type may not always be positive.

G2–S2 participated in the program four of the four days and had a mean baseline ADHD related behavior rate of 5.33 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 4 behaviors per 15 minutes (Figure 7) with an average change in behavior at 1.33 behaviors per 15 minutes before and after the intervention. The individual mean change is 0.57 in

standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student.

Figure 6. G2-S1 results showing a decrease in ADHD behaviors of 2.75 averaged over 4 sessions.

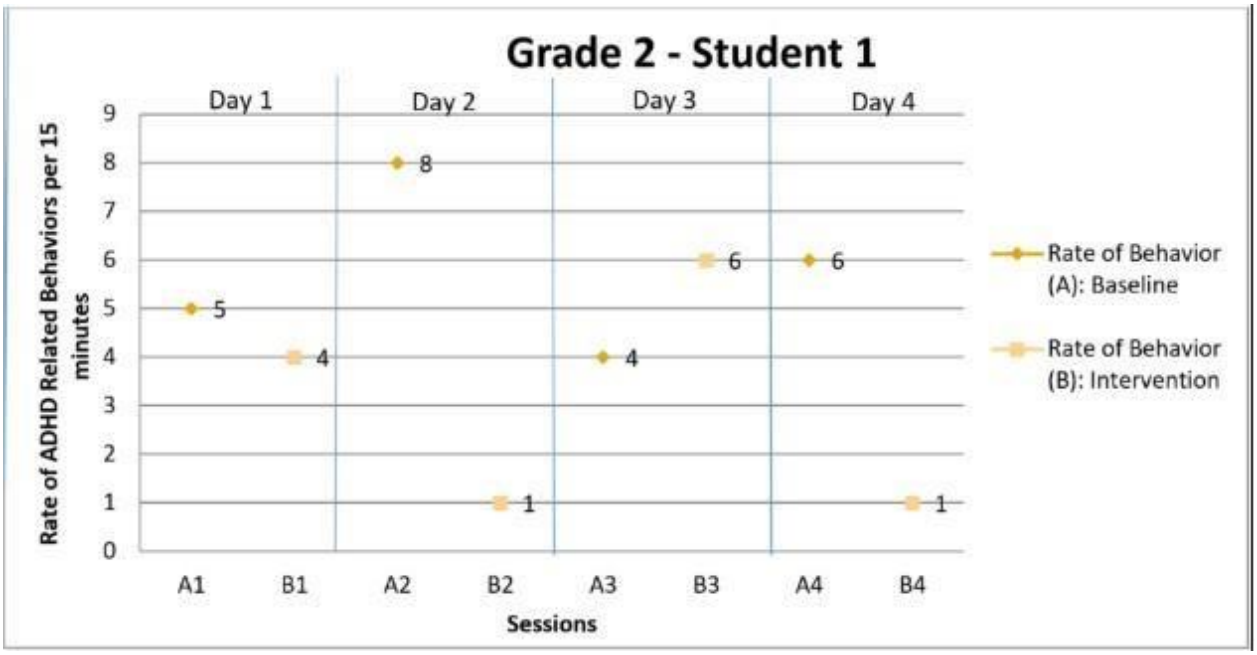
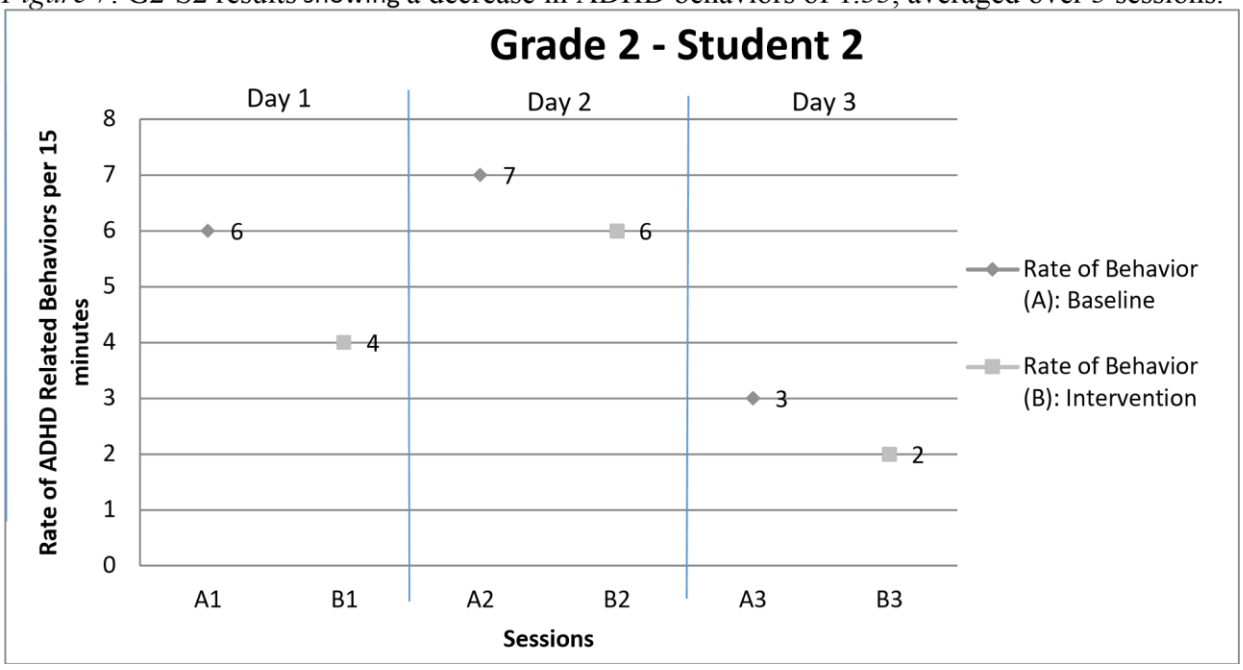


Figure 7. G2-S2 results showing a decrease in ADHD behaviors of 1.33, averaged over 3 sessions.



GK–S1 participated in the program four of the four day and had a mean baseline ADHD related behavior rate of 8.25 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 4.5 behaviors per 15 minutes (Figure 8) with an average change in behavior at

3.75 behaviors per 15 minutes before and after the intervention. The individual mean change is 1.61 in standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student.

Student GK – S2 participated in the program four of the four days and had a mean baseline ADHD related behavior rate of 4 behaviors per 15 minutes and a mean post-intervention ADHD related behavior rate of 1.75 behaviors per 15 minutes (Figure 9) with an average change in behavior at 2.25 behaviors per 15 minutes before and after the intervention. The individual mean change is 0.97 in standard deviation units. Analysis of the graph indicated that the intervention possibly contributed in reducing the number of ADHD related behaviors in this student.

Figure 8. GK-S1 results showing a decrease in ADHD behaviors of 3.57, averaged over 4 sessions.

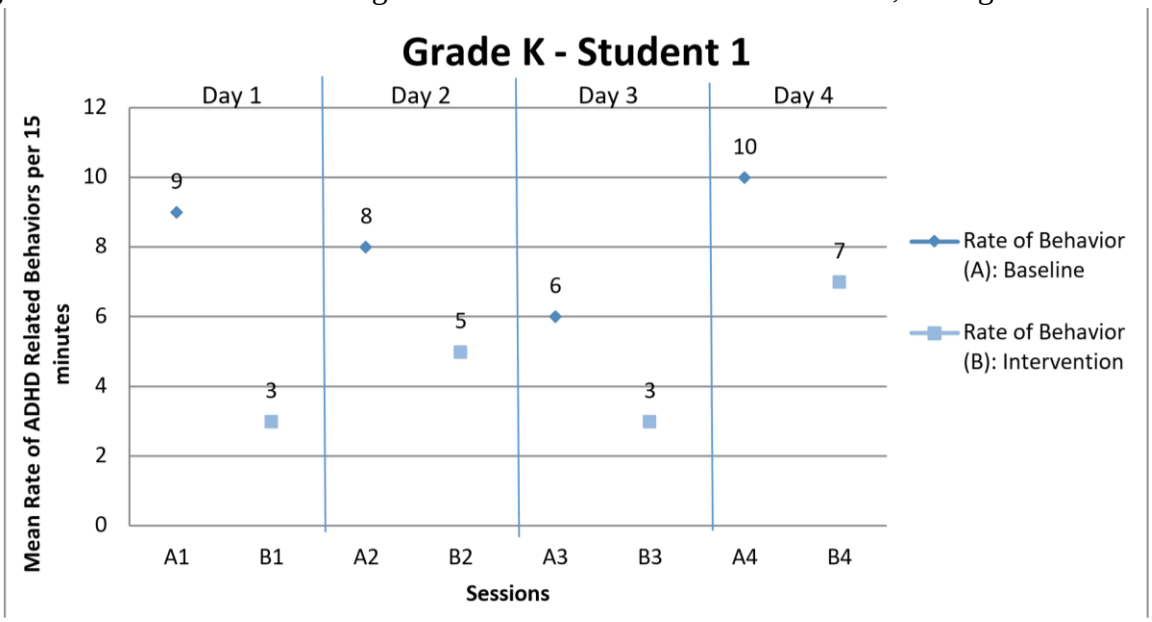
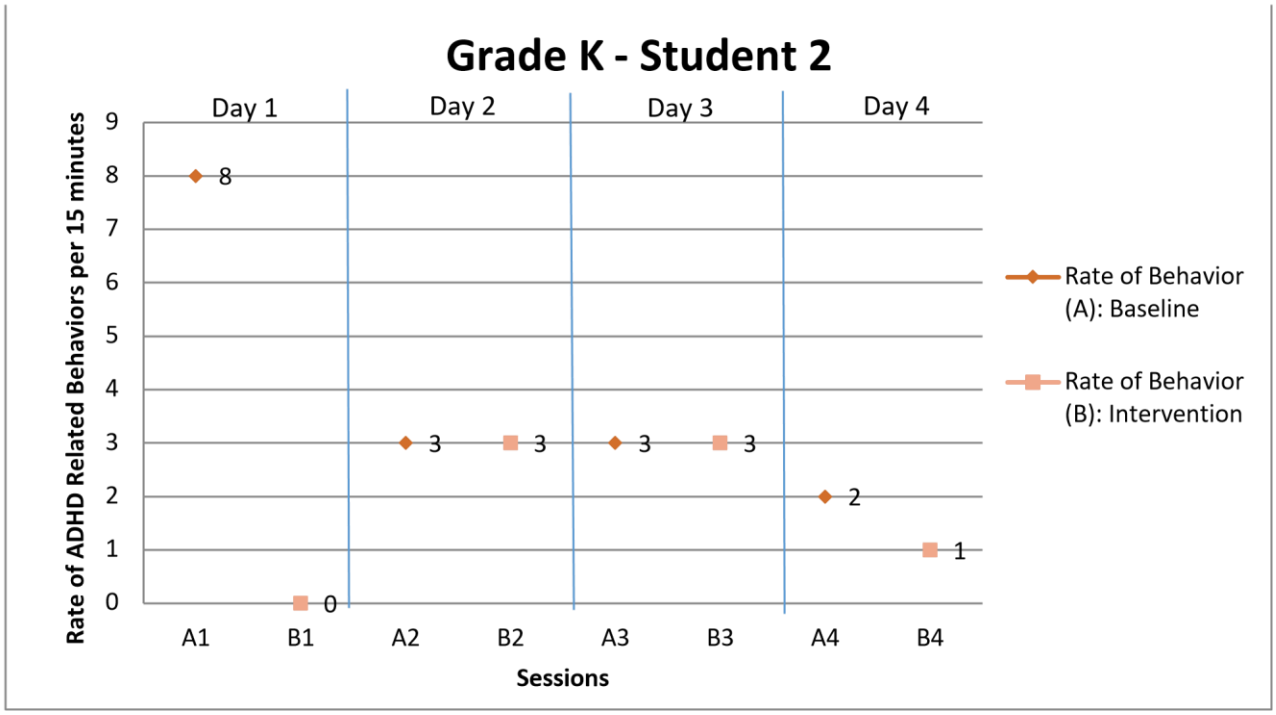


Figure 9. GK-S2 results showing a decrease in ADHD behaviors of 2.25, averaged over 4 sessions.



All eight students assessed in this way had their mean rate of ADHD related behaviors go down from the baseline assessment to the post-intervention assessment. Furthermore it's worth noting that the students in the study that exhibited ADHD related behaviors seemed to be more engaged and attentive to the outdoor lesson than some of the other kids participating in the lesson but not in the study.

Focal individual sampling was used for student GK–S3 because the student would leave his seat and not return to it the entire observation period, making it hard to count multiple ADHD related behaviors. On top of that, the student was present for the post-intervention observation on only the last day of testing out of the three lessons he had started. Therefore, anecdotal evidence observations were made by my research associate, who has behavior analytic experience: "[GK–S3] is a 5 year old who is full of life. I noticed that during transition times he is all over the place and has a lost disconnected look on his face.

> [GK–S3] struggled sitting still and would often get up and leave the group.
>
> When sitting still [GK–S3] was playing with sticks and it seemed his brain

was thinking about things in a [far] off land. [GK–S3] struggled to be engaged for more than a few minutes at a time [in his baseline observations]."

I performed the final assessment of GK–S3 myself on the last day of the program because he was able to stay until the end of the lesson and the 15 minute post-intervention journal reflection questions. I had not done behavior observations on this child myself until this point, but my research associate had done the baseline assessment for him all three times. She had been giving me her notes on the student. She described him as "all over the place" and as being unable to sit in his seat or to listen and follow directions. The last day of the study, all four grade levels were having their last lessons. We needed to divide and conquer to accomplish the task. As a result, my research associate started with kindergarten observations and brought them outside before returning to work with third grade.

I took over when I had finished working with the first graders and my research associate gave me her notes and remarks before rejoining the third grade class. Again she noted that GK–S3 was all over the place and that it was hard to count behaviors with him because he wouldn't return to his seat or follow directions. I taught the final lesson, before taking the final assessment data. At the end of the lesson, I called the kindergarteners together in a circle to ask the last journal questions (which included "What did you learn?" and "What did you like best?"). During this time, I asked the students to write their answers in their journals and raise their hands if they would like to share their answers. I looked around the circle, found GK–S3 and began watching his behavior.

It was hard to believe it was the same student described in the baseline observations. GK–S3 was sitting eagerly in the circle. He wrote answers to all of the reflective journal questions I asked. Each time he finished writing an answer; he would look up and patiently wait for me to ask the next question. When he wanted to share an answer he raised his hand and waited to be called on. If we were still counting ADHD related behaviors in this particular student, I would have counted zero behaviors from that last 15 minutes.

As a result, I studied the change in behavior means on the basis of a lowered ADHD behavior count overall for all students in the study before and after each intervention. I have determined through this pilot study that there is evidence that the outdoor education therapy model leads to the reduction of ADHD related behaviors in elementary students. Therefore it should be stratified and applied to a larger population to determine if there is a significant change in ADHD related behavior for students in elementary school based on an analysis of the nature therapy outdoor intervention.

Conclusion

This study supports the hypothesis that Children with ADHD stand to benefit from outdoor interventions and lessons. Subjects from ages 5 to 10 years demonstrated a reduction in ADHD related behaviors after the lesson was taught outside. Every participant's a mean rate of ADHD behaviors went down from the baseline observations in the post-intervention observation. Each student participant had less average ADHD related behaviors while outside in a natural environment. Also student GK–S3 showed remarkable signs of reduced ADHD related behaviors at the end of the final lesson. What was once an ever-moving, disengaged child became a relaxed, enthusiastic participant in the outdoor lesson. It was very clear that most of the students enjoyed being outside.

This study found that the mean ADHD related behaviors in students with the disorder can be potentially decreased to an observable degree when a therapeutic nature lesson is used as an intervention. If further research determined a significant result in reduced ADHD behaviors, then outdoor lessons from commonly available sources such as PLT could be used in schools across the U.S. as an alternative treatment method.

With childhood ADHD diagnoses on the rise, it's important for parents, guardians, and teachers to be aware of all the potential interventions available. It is critical to have multiple treatment options available for children with ADHD as the disorder is so prevalent. In time, we can learn how to reduce the symptoms of ADHD in children indefinitely, but for now, let's just take them outside.

Limitations and Confounding Variables

This study was subject to a number of limitations and confounding variables. One limitation of the study was the small sample size, with only nine students participating. Given the moderate estimated effect sizes (from 0.67 to 1.81 pooled standard deviations), a much larger sample would be best in a further attempt to demonstrate effects conclusively. To verify the finding across ages, larger samples at

each age would be necessary. Despite the small sample number, each child was tested against him or herself, and the process was repeated at least two times for each student. A threat to the validity of the design of the study is the vulnerability of the single pre/ post observations used to estimate ADHD symptoms fluctuations in the subjects' psychological, social and other factors. An improved design would use multiple observations at each stage of the ABAB sequence to increase the certainty that the change in symptoms is attributable to the intervention and not to extraneous factors (Alberto & Troutman 2012). The rapid expansion of students interested in the program was another limitation this study faced. With so many students, I needed to recruit a few other people to help run the study. Each assistant had experience in either environmental education or behavior. However, we each have different methods of instruction. Variations in instruction by multiple people may have affected the data. We tried to have the same person take the baseline and post-intervention behavior counts while the other person taught the class. To avoid the variation in teaching and recording methods, I trained the research assistants to recognize, count, and record behaviors in a consistent fashion – to make the case your data are reliable across observers as well as in the pedagogy (teaching method) behind each lesson. We were unable to use that structure of data recording a few different times in the program because more classes were participating than we had people to either teach or observe them. Therefore, on a few occasions the instructor had to be both the educator and the behavior observer and it was a bit difficult to do. We had very good luck with the weather as it was a comfortable temperature each day and it didn't rain at all. The good weather is a factor that may have increased the chances of positive ADHD behavior changes. That and other environmental factors could be controlled in future studies.

There are ways that observations of the behaviors could be improved on. We could have used a full checklist of behaviors (rather than a few targeted behaviors and trained ABA observers to be more precise with data observation and collection. The timing of the observations (directly before and after the intervention) might not be optimal. It could be possible that a stronger design could stretch out the duration of observations. We could have used the ABAB model where baseline behavior is taken over the course of a couple of days and then the intervention is

introduced for a couple of days. This observation method is repeated twice to determine the effectiveness of the intervention.

Future Directions

This field is surprisingly lacking in research and there is a great need for a better understanding of how natural environments and lack thereof are impacting students with ADHD and other behavior disorders. Due to time and capacity restraints, this study was unable to identify differences and discrepancies of ADHD related behavior across race, ethnicity, and socioeconomic norms. What trends appear when those demographics are addressed and all other aspects of the study are kept the same?

The obvious next step would be to try to prove this method valid by using applied behavior analysis. By doing a time series recording, an ABAB research design on a single-subject, multiple baseline study with a larger, more diverse population of students with ADHD to determine the actual effect of the intervention, particularly with population with higher than average diagnosed or undiagnosed ADHD symptoms, such as children in foster care, or offspring in families affected by domestic violence or drug addiction. The pilot study indicated a need to develop stronger research methods to quantify the results of the study. There is potential to add valuable data to the existing knowledge on the impacts of environmental education on children with ADHD and provide an alternative treatment method for those students as well.

It would be interesting to use the exact same study design and run it against multiple variables. Keep the lessons the same, but go to the gymnasium for the activity part of the lesson. Do the same but use physical health related curriculum and activities to see if those reduce ADHD. Change the lesson subject material, but still do the lesson outside.

Once a larger secondary study is done to a more secure degree, the results could inform implementation of environmental education as interventions in elementary schools as a method of reducing ADHD related behavior in elementary aged students. It could be worth investigating how

to implement this type of intervention into an everyday school setting. An important next-step assessment would be to determine if this intervention can be used to aid other children with varying behavior disorders. What would happen if instead of ADHD related behaviors, we tested children with Operational Defiant Disorder related behaviors, or children with autistic tendencies? What could potential alternate outdoor therapies include?

There are many gaps in this research and, therefore, many opportunities to study the impacts of environmental education on the development of children with or without behavior disorders. What are we taking away from children when we limit their access to the outdoors and what can we give back by (re)introducing children to the natural outdoor environment? I have only scratched the surface of the potential avenues this research can go.

References

Alberto, P. A., & Troutman, A. C. (2012). *Applied Behavior Analysis for Teachers (9th ed)*. Pearson Education, Inc.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed.—Text Revision)*. Washington, DC: Author.

Bergey, M.R., & Conrad, P. (2018). *The Rise and Transformation of ADHD in the United States. Global Perspectives on ADHD: Social Dimensions of Diagnosis and Treatment in Sixteen Countries*, Baltimore: Johns Hopkins University Press.

Boyle, C. A., Boulet, S., Schieve, L. A., Cohen, R. A., Blumberg, S. J., Yeargin-Allsopp, M., Visser, S., and Kogan, M. D. (2011). Trends in the prevalence of developmental disabilities in US children, 1997–2008. *Pediatrics*, 127, 1034–1042.

Doyle, R. (2004). A Social Development Curriculum: Applying Nurture Group Principles and Practices to Support Socially and Emotionally Vulnerable Children within Mainstream Classrooms. *British Journal of Special Education*, 31(1), 24 – 30.

Dadvanda, P., Nieuwenhuijsena, M. J., Esnaolaa, M., Fo-rnsa, J., Basagañaa,X., AlvarezPedrerola, M., Rivasa, I., López-Vicentea, M., De Castro Pascuala, M., Suf, J., Jerrettg, M., Querole, X., & Sunyer, J. (2015). Green spaces and cognitive development in primary schoolchildren. *PNAS*, 112(26), 7937– 7942.

Danielson, M. L., Bitsko, R. H., Ghandour, R. M., Holbrook, J. R., Kogan, M. D., and Blumburg, S. J. (2018) Prevalence of Parent-Reported ADHD Diagnosis and Associated Treatment Among U.S. Children and Adolescents, 2016. *Journal of Clinical Child & Adolescent Psychology*. 47(2), 199-112.

Golden, A. 2010. Exploring the forest: Wild places in childhood. *Voices of Practitioners*, 12: 1-11.

Hacking, E. B., Barratt, R., & Scott, W. (2007). Engaging children: Research issues around participation and environmental learning. *Environmental Education Research*, 13(4), 529544.

Jackson, R. J., Tester, J., & Henderson, S. W. (2008). Environment Shapes Health, Including

Children's Mental Health. *Journal of the American Academy of Child & Adolescent Psychiatry*, 47(2), 129- 131.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169-182.

Kuo, M., Browning, M. H., & Penner, M. L. (2018). Do Lessons in Nature Boost Subsequent Classroom Engagement? Refueling Students in Flight. *Frontiers in Psychology*, 8.

Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill, NC: Algonquin Books of Chapel Hill.

Malone, Karen & Tranter, Paul (2003). Children's Environmental Learning and the Use, Design and Management of Schoolgrounds. *Children, Youth and Environments*, 13(2). Myers, O.E. (2012). Children and Nature. *The Oxford Handbook of Environmental and Conservation Psychology*, Oxford University Press, New York, NY. (113-127)

The National Institute of Mental Health. (2016). Attention Deficit Hyperactive Disorder. *National Institute of Health*.

Next Generation Science Standards (n.d.). Elementary Science Standards. www.ngss.org

North American Association of Environmental Educatiors (n.d.). Guidelines for Excellence in Environmental Education. www.naaee.org

Plester, B., Spencer, C., & Blades, M. (2005), Children's understanding of environmental representations: aerial photographs and model towns. *Children and Their Environments: Learning, Using and Designing Spaces*, Cambridge University Press, Cambridge, U.K. 42-56.

Powers, Amy L. (2004). An Evaluation of Four Place-Based Education Programs. *The Journal of Environmental Education*, 35:4, 17-32.

Project Learning Tree Environmental Education Activity Guide. (n.d.). Retrieved from https://www.plt.org/

Rosenberg, D., & Gershon, S. (2012). Pharmacotherapy of Child and Adolescent Psychiatric Disorders. *Wiley-Blackwell*, 3.

Russell, K.C. (2012). Therapeutic Uses of Nature. *The Oxford Handbook of Environmental and Conservation Psychology*. Oxford University Press, New York, NY. 428-444.

Stevenson, R. B. (2007). Schooling and environmental education: Contradictions in purpose and practice. *Environmental Education Research, 13*(2), 139-153.

Strife, S., & Downey, L. (2009). Childhood Development and Access to Nature: A New Direction for Environmental Inequality Research. *Organization & Environment*, 22(1), 99-122.

Taylor, A.F., Wiley, A., Kuo, F.E., & Sullivan, W.C. (1998). Growing up in the inner city: Green spaces as places to grow. *Environment & Behavior*, 30(1), 3-27.

Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2001). Coping with add: The Surprising Connection to Green Play Settings. *Environment and Behavior*, 33(1), 54-77.

Taylor, A. F., & Kuo, F. E., (2004). A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence From a National Study. *American Journal of Public Health*, 94(9), 1580- 1586.

Taylor, A. F., & Kuo, F.E. (2009). Children with attention deficits concentrate better after walk in the park. *Journal of Attention Disorders*, 12 (5): 402-409.

Taylor, A. F., & Kuo, F.E. (2011). Could Exposure to Everyday Green Spaces Help Treat ADHD? Evidence from Children's Play Settings. *Applied Psychology: Health and Well-Being*, 3 (3): 229-384.

United States Department of Education. (1995). Disabilities Education Act. (https://sites.ed.gov/idea).

Visser S.N., Danielson M.L., Bitsko R.H., et al. (2011). Trends in the Parent-report of Health Care Provider Diagnosed and Medicated ADHD: United States, 2003—2011. *Journal of the American Academy of Child and Adolescent Psychiatry*, 53(1):34-46.e2.

Wells, N. M. (2000). At Home with Nature: Effects of "Greenness" on Children's Cognitive Functioning. *Environment and Behavior*, 32(6), 775-795.

Wells, N. M., & Evans, G.W. (2003). Nearby Nature: A Buffer of Life Stress Among Rural Children. *Environment and Behavior*, 35(3), 311-330.

White, R. (2004). Young Children's Relationship with Nature: Its Importance to Children's Development & the Earth's Future. *White Hutchinson Leisure & Learning Group*, 3-8.

Recruitment Flyer

Study for Attention Deficit Hyperactive Disorder (ADHD) in children and benefits of using a therapeutic nature education as an intervention

Researchers at Western Washington University want to learn about the relationship between children with ADHD and a potentially therapeutic outdoor education intervention. This research study is for elementary aged students.

Research is always voluntary for you and your child! Either of you can back out at any time.

Would the study be a good fit for me and my child?

This study might be a good fit for you if your child:

- Has diagnosed ADHD
- Does not have diagnosed ADHD but you suspect he or she might
- Does not have diagnosed ADHD but has trouble focusing and paying attention in class

What would happen if I took part in the study?

If you decide to have your child take part in the search study, your child would:

- Have behavior assessed for ADHD related behaviors the week before and directly before the intervention
- Participate in four outdoor environmental lessons with their teachers and classmates
- Have behavior assessed directly after each lesson and in the week following the completion of the intervention

Families that take part get a gift card for $10.00 to thank them for their time.

There may be possible benefits if your child takes part in the study.

- Reduced ADHD behaviors
- Increased classroom attention and participation behaviors
- Possibility of reduction in stressors

To have your child take part in this research study or for more information, please contact Maddie Dineen at 402-943-8523 or dineenm@wwu.edu. You will need to sign the informed consent form and send it back to school with your student.

The principal researcher for this study is Maddie Dineen.

Purpose and Benefit:

Researchers have been interested in the possible link between cognitive development and outdoor engagement to better understand how nature-based education and involvement can lead to improved cognitive ability. The purpose of this experiment is to examine the results of utilizing environmental education as an intervention for children in school with ADHD. The findings of this study will advance our understanding of the role of environmental education as an intervention for students with behavior disorders and may lead to improved ADHD interventions.

I UNDERSTAND THAT:

1. This experiment will include outdoor interactive lessons aimed at improving attention and classroom engagement, as well as a reflective journal piece. Behavior will be measures before and after the four outdoor interventions. Your child's participation will involve approximately 300 minutes of environmental education split between four sessions in two weeks.
2. We may experience inclement weather, poisonous plants, singing insects, thorns, wild animals, falling branches, ice, uneven ground, or allergies. Your child may experience biophobia, which is fear of the outdoors. Children with ADHD are a vulnerable population and there are emotional risks that come with working with students with behavior disorders. The student participating in the study might gain a stigma from their peers. He or she might also be more prone to severe reactions in unfamiliar environments. However, one possible benefit to my child may be temporarily reduced symptoms of ADHD and a new way to manage those behaviors. We will use participation from the teachers and their classroom associates to reduce risk as much as possible.
3. My participation and my child's participation are voluntary; I may choose to withdraw from participation at any time without penalty. My child may do so as well.
4. All information is confidential. My signed consent form will be kept in a locked cabinet behind a locked door. Only the primary researcher and her advisor will analyze and code the results. These records will be destroyed at the end of the study. Neither my name nor my child's name will appear on any publication of the study results at anytime.
5. My signature on this form does not waive my legal rights, or my child's legal rights, of protection.
6. This experiment is conducted by Maddie Dineen with advisement from Dr. Gene Myers. Any questions that you have about the experiment or your participation may be directed to her at 402-943-8523.

If you have any questions about your participation or your rights as a research participant, you can contact the WWU Human Protections Administrator (HPA), (360) 650-3220. If during or after participation in this study you suffer from any adverse effects as a result of participation, please notify the researcher directing the study or the WWU Human Protections Administrator.

********** **I have read the above description and agree to participate in this study.**

_____ _____

Parent's Signature Date

_____

Guardian's PRINTED NAME

_____

Child's PRINTED NAME

Child Assent Form

We are doing a study to learn about children with Attention Deficit Hyperactive Disorder (ADHD) and if we can help those children by taking them outside for an outdoor lesson. We are asking you to help because we want to prove that going outside and learning is healthy for children like you.

If you agree to be in our study, we are going to take you with your class outside for an outdoor lesson four times in two weeks. We want to know if your mood changes before and after the lesson. For example, we will observe you in the classroom before and after the outdoor lesson. The other students will not know you are the person being observed in the study unless you tell them.

You can ask questions about this study at any time. If you decide at any time not to finish, you can ask us to stop.

This is not a test and we are not asking you to act any differently than if we were not there.

If you sign this paper, it means that you have read this and that you want to be in the study. If you don't want to be in the study, don't sign this paper. Being in the study is up to you, and no one will be upset if you don't sign this paper or if you change your mind later.

Your signature: _____ Date _____

Your printed name: _____Date _____

Signature of person obtaining assent: _____Date _____

Printed name of person obtaining assent: _____Date _____

TEACHER CONSENT FORM

Purpose and Benefit:

Researchers have been interested in the possible link between cognitive development and outdoor engagement to better understand how nature-based education and involvement can lead to improved cognitive ability. The purpose of this experiment is to examine the results of utilizing environmental education as an intervention for children in school with ADHD. The findings of this study will advance our understanding of the role of environmental education as an intervention for students with behavior disorders and may lead to improved ADHD interventions.

I UNDERSTAND THAT:

1. This experiment will include outdoor interactive lessons aimed at improving attention and classroom engagement, as well as a reflective journal piece. Behavior will be measures before and after the four outdoor interventions on the students identified by the school. My classroom's participation will involve approximately 180 minutes of environmental education split between four sessions in two weeks in the spring of 2018.
2. We may experience inclement weather, poisonous plants, singing insects, thorns, wild animals, falling branches, ice, uneven ground, or allergies. Students may experience biophobia, which is fear of the outdoors. Children with ADHD are a vulnerable population and there are emotional risks that come with working with students with behavior disorders. The student participating in the study might gain a stigma from their peers. He or she might also be more prone to severe reactions in unfamiliar environments. However, one possible benefit to my child may be temporarily reduced symptoms of ADHD and a new way to manage those behaviors. We will use your participation along with any classroom associates to reduce risk as much as possible.
3. My participation and my classroom participation are voluntary; I may choose to withdraw from participation at any time without penalty. Children participating in the study may do so as well.
4. All information is confidential. My signed consent form will be kept in a locked cabinet behind a locked door along with any sensitive records and student confidentiality records. Only the primary researcher and her advisor will analyze and code the results. These records will be destroyed at the end of the study. The names of the student participants will not appear on any publication of the study results at anytime.
5. My signature on this form does not waive my legal rights, or students' legal rights, of protection.
6. This experiment is conducted by Maddie Dineen with advisement from Dr. Gene Myers. Any questions that you have about the experiment or your participation may be directed to her at 402-943-8523.

If you have any questions about your participation or your rights as a research participant, you can contact the WWU Human Protections Administrator (HPA), (360) 650-3220. If during or after participation in this study you suffer from any adverse effects as a result of participation, please notify the researcher directing the study or the WWU Human Protections Administrator.

********** **I have read the above description and agree to participate in this study.**

_____ _____

Classroom Teacher's Signature Date

_____

Teacher's PRINTED NAME

INVEST

[IMPLEMENTING NATURE'S VALUES EMPOWERS STEWARDS OF TOMORROW]

The INVEST program is a curriculum designed of lessons applicable for students in elementary school. The program consists of four 45 minute lessons over that will take place over the course of two to four weeks that consist of place-based learning, systems and interconnected community ties, basic outdoor survival skills, and much more all in the name of creating the future stewards of this earth. Program will take place in May at Samish Elementary.

At the end of the in-school program, students will receive a Future Earth Steward Badge.

HUXLEY
COLLEGE OF THE ENVIRONMENT

DATES AND TIMES IN MAY SUBJECT TO HOMEROOM TEACHER'S DISCRETION

STUDNETS PARTICIPATE IN FUN, EXPERIENTIAL LEARNING AND RELATIONSHIP BUILDING ACTIVITES

THIS PROGRAMS TEACHES STUDENTS TO EMPOWER SELF AND OTHERS, AND STEWARDSHIP FOR THE SURROUNDING WORLD

WE AIM TO CREATE A POSITIVE NATURE-BASED LEARNING ENVIRONMENT THAT IS PHYSICAL, AND ALL-INCLUSIVE OF LIFE SYSTEMS

OUR GOAL IS TO INSTILL IN YOUNG PEOPLE A SENSE OF PLACE (IDENTITY) IN THEIR OWN NATURAL ENVIRONMENT

WESTERN WASHINGTON UNIVERSITY
516 High St.
Bellingham, WA 98225

Primary Contact: Maddie Dineen
Email:dineenm@wwu.edu

Appendix B – Assessments

Functional Assessment Interview (edited for ADHD related behaviors) for Teachers before the start of the study.

Describe the behaviors of the child with ADHD related to the disorder?*

How often do the ADHD behaviors occur on a daily basis?
How long do they last?
How intense are they?

What is happening in the surrounding environment when the ADHD behaviors occur?

What conditions are most likely to set-off the ADHD behaviors?

What usually happens after the ADHD behaviors?

What is the likely function (intent) of the ADHD behaviors? What does the child get or avoid?

What behaviors might serve the same function for the child in the social/environmental context?

What other information might contribute to creating an effective intervention (a condition where the ADHD behaviors do not occur)? (Alberto & Troutman 2012)

List of ADHD associated behaviors

"Children may:

a) Overlook or miss details, make careless mistakes in schoolwork, at work, or during other activities
b) Have problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading
c) Not seem to listen when spoken to directly
d) Not follow through on instructions and fail to finish schoolwork, chores, or duties in the workplace or start tasks but quickly lose focus and get easily sidetracked
e) Have problems organizing tasks and activities, such as what to do in sequence, keeping materials and belongings in order, having messy work and poor time management, and failing to meet deadlines
f) Avoid or dislike tasks that require sustained mental effort, such as schoolwork or homework, or for teens and older adults, preparing reports, completing forms or reviewing lengthy papers
g) Lose things necessary for tasks or activities, such as school supplies, pencils, books, tools, wallets, keys, paperwork, eyeglasses, and cell phones
h) Be easily distracted by unrelated thoughts or stimuli
i) Be forgetful in daily activities, such as chores, errands, returning calls, and keeping appointments
j) Fidget and squirm in their seats
k) Leave their seats in situations when staying seated is expected, such as in the classroom or in the office
l) Run or dash around or climb in situations where it is inappropriate or, in teens and adults, often feel restless
m) Be unable to play or engage in hobbies quietly
n) Be constantly in motion or "on the go," or act as if "driven by a motor" o) Talk nonstop
p) Blurt out an answer before a question has been completed, finish other people's sentences, or speak without waiting for a turn in conversation
q) Have trouble waiting his or her turn
r) Interrupt or intrude on others, for example in conversations, games, or activities" (NIMH, 2016)

INVEST –

Implementing Nature's Values Empowers Stewards of Tomorrow

An Outdoor Education Program developed by Maddie Dineen

With Lessons Adapted by Novella Randall and Rebecca Moore

Edited by Jayme Gordon

Table of Contents

Introduction

We saw a need in our community, to find viable and quick response to the rapidly changing climate. Today's youth could stand to inherit a very unhealthy planet. While the mess shouldn't be their responsibility to clean up, eventually, they will be the keepers of the Earth. The INVEST (Implementing Nature's Values Empowers Stewards of Tomorrow) program provides methods for students to reconnect with and ultimately rehabilitate the native environment.

The South Salish Sea and the North Puget Sound region is rich in biodiversity and learning resources. There is great potential for the student to explore and experience a deeper understanding of the place where they live. The INVEST program offers opportunity to have classes focused solely on environmental education, rather than a segment of broader programming. Lessons include a place-based, interdisciplinary approach to learning that builds upon ecological concepts and related experiences. Through the program, students will gain a sense of awareness, appreciation, and understanding of nature and their place in it.

The INVEST program is designed of lessons applicable for students in grades K – 6. These classes include outdoor education, environmental education, place-based learning, systems and interconnected community ties, basic outdoor survival skills and much more all in the name of creating the future stewards of this earth. The curriculum can be used all in one day outdoor education class or multiple smaller classes split up over time. The curriculum design and lesson plans are adapted from sections of Project Learning Tree's Environmental Education Activity Guide and set to a nature therapy framework.

Integrating this program into community organizations allows for the process of making plausible change in the surrounding environments, because humans are a part of nature and it is impossible to separate one from the other. This valuable, place-based knowledge allows students to better anticipate and comprehend the impacts they make on the future, as members of natural communities of today.

As an environmental educator I feel concern not only for the health of the earth, but for the children who stand to inherit it. I developed this program as a way to respond to the growing planetary concerns. We are already seeing some devastating results of climate change. It is in no way the responsibility of the younger generations to fix the world we were handed, but it seems as if we have no other choice. My intent is for this program to engage youth of various communities to stewardship for the Earth.

Special thanks to Project Learning Tree, Dr. Keith Russell, Dr. Gene Myers, Dr. Nick Stanger

Vision

Sponsored by Samish Elementary School and Huxley School for the Environment at Western Washington University, the INVEST program aims to create a fun outdoor learning environment rich in experiential learning and relationship forming. Our vision is to work with the youth in the region to create viable interworking communities empowering self, other, and stewardship for the surrounding world. Each child has a spark, or a source of motivation. It is our job as environmental educators, to light it.

Our goals for the INVEST program align with our vision to empower youth and develop future earth stewards. We wish to implement a program that:

1. Creates a positive learning environment that is nature based, physical, and all-inclusive of life systems;

2. Provides an interdisciplinary and field-based environmental education program designed to (re)introduce learner to the natural world;

3. Fosters an awareness of dynamic ecological systems and the individual's part within them;

4. Delivers an understanding of connections between the natural and human communities; and

5. Helps students comprehend personal and societal responsibilities.

And outcome-driven student goals where:

6. Learners develop knowledge about the components of the natural outdoor environment in any given season;

7. Learners understand how social and natural systems are fundamental in supporting lives, economy, and emotional well-being;

8. Learners recognize how individual decisions and actions can impact the environment; and

9. Learners develop and refine some of the skills necessary for cooperative action to sustain the surrounding natural environment.

Background

The INVEST program was designed using lessons from Project Learning Tree Environmental Education Curriculum as it was developed by more than 300 environmental educators, researchers, and employees and every year the curriculum is updated and a workshop for 20,000 environmentally minded people is held every year. Each lesson also met the components of the nature therapy framework provided by Dr. Keith Russell: Professor in Western Washington University's Humanities and Social Science Department. One of Dr. Russell's main research interests is in nature and wilderness therapy. The nature therapy framework must include four components: 1. Nature – as an outdoor source containing biotic and abiotic features; 2. Active Self – the student is actively engaged in the lesson; 3. Social Group – students work with peers to complete activities in small groups and 4. Activity Reflection – students reflect on what they learned in the lesson (Russell, 2012). Students in the program received an outdoor education lesson in an outdoor setting with an experienced environmental educator in attempts to foster self-healing and earth advocacy.

Curriculum Design

Curriculum Overview

The purpose of this curriculum is to engage learners in actively working with, caring for, and understanding the earth and acknowledging their own place within it. The purpose of this programming is to instill in young people a sense of place (identity) in their own natural environment. The curriculum emphasizes interconnectivity of the Salish Sea and introduces students to their individual responsibility to care for the Earth. As mentioned before, the each lesson has at least one activity adapted from Project Learning Tree and is set to the nature therapy framework.

Next Generation Science Standards

The lessons and objectives of this curriculum are congruent with NGSS standards for Life Science and Earth and Space Science.

Lesson Titles	**Objective**	**Goals met***	**NGSS Met**
Trees and Leaves	Understand trees as habitats and be able to explain the varying organisms that use trees as habitats	1,2,3,4,6,8	K-LS1-1. K-ESS3-1. 3-LS2-1. 3-LS4-3
Land and Seas	Learn about the relationship between humans that inhabit this area and the importance of the watershed	1,2,3,4,6,7	2-ESS2-3. 2-ESS2-2.
Birds and Bees	Understand and describe the process of decomposition and camouflage	1,2,3,4,6,7	K-ESS3-1. K-ESS3-3.
You and Me	Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment	1,2,3,7	3-LS4-4. K-ESS3-3. 1-LS1-2.

Risk Assessment

This program is intended to be outdoors and there is always a level of risk when interacting in the outdoor environment. There are many potential hazards such as: weather, poisonous plants, potential to fall, and under-supervision. In order to minimize risk, be sure to know of any allergies or disabilities students in the program may have. Also be sure that the guardian of the child is aware of the assumed risk. This can be achieved by having the guardians fill out a liability waiver. Preventative measures include being ready for whatever the weather may be, bringing extra water, supplies, and first aid kits, and discussing safety procedures to the students before the lesson.

Lesson Planning

Lessons will be outcome oriented and locally significant and specific, and will be outdoors regardless of weather. We would like to foster an understanding of outdoor ready habits, thus classes should persist outside in most weather, unless it is dangerous to do so. Each individual lesson is 45 minutes to an hour long and mapped out on the lesson page. In each lesson, there are two objectives: one for grades K-2, and one for grades 3 – 6. Instructions and objectives for grades K – 2 will be in green, and 3 – 6 will be in blue. Instructions that are the same for all age groups will be in standard black.

Example of Lesson Schedule

Time	Activity
00:00 - 00:05	Hike or walk to outdoor location
00:05 – 00:07	Learn student's previous knowledge
00:07 - 00:20	First part of the activity
00:20 - 00:30	Group part of activity
00:30 – 00:45	Activity reflection in journals

Program Evaluation

This program is focused on making positive change in the community and on fostering outcome based results. Therefore, we are interested in evaluating the outcomes of our programs within the larger community. The assessments provided in each lesson give instructors the ability to measure the growth and understanding of the students participating in the program. Each lesson has an assessment factor for the benefit of the instructor. An evaluation option is to provide a survey at the end of the day. This can allow for an evaluation of the program and what could be enhanced or done differently.

Lesson 1 Leaves and Trees

Adapted from: Project Learning Tree Environmental Education Activity Guide: Trees as Habitats, FOSS: Living Systems
Adapted by: Maddie Dineen, Novella Randall, and Jayme Gordon

Lesson Overview:

This lesson allows students to explore and identify trees as habitat. Students will work together to identify how organisms interact with their habitats. **For grades K-2:** Students will learn about leaves' shapes, colors, and their matching trees. **For grades 3-6:** Students will also study the venation of leaves by looking at visuals and collaborating to find individual examples to then reflect on and share with the class.

NGSS:

K-LS1-1 – Students will use observations to describe patterns of what plants and animals (including humans) need to survive.
K-ESS3-1 – Students will use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
3-LS2-1 – Students will engage in a discussion that some animals form groups that help members survive and engage in relationships as they relate to trees.
3-LS4-3 – Students will create an argument with evidence that in a particular habitat, organisms survive well, some do not survive as well, and some cannot survive at all.

Focus Question: How do trees and plants survive and thrive in their natural environment?

Instructional Materials:

1. Journals 2. Veined leaves from different trees (Visuals) 3. Large Chart Paper 4. Bags for leaf collection

Lesson Objectives:

1. Students will understand trees as habitats and be able to explain the varying organisms that use trees as habitats
2. Students will be able to identify interconnectedness of trees and surrounding organisms
3. Students will be able to classify leaves on a venation level

Background:

"A habitat is the place where a plant or animal gets all the things it needs to survive, such as food, water, shelter, and space for having and raising off spring. A habitat may be 100 square miles (259km2) of grassland for a lion or a single plant for an insect. A tree may serve as part of an organism's habitat, or it may be the organism's entire habitat. For example, an oak tree may provide food for squirrels and nest sites for crows. But lichens and moss get everything they need right on the tree. Even snags, or standing dead trees, provide habitat for many different species. Tree frogs and beetles live under a snag's bark. Woodpeckers and other birds feed on the insects that live in snags. Chickadees nest in cavities created by woodpeckers. Squirrels and deer mice store food in them. Leaves serve many purposes for trees, and therefore help sustain the tree as an individual and a habitat" (plt.org, p. 102). "Leaves are the food production factories of most vascular plants. They are thin—usually only a few cells thick—and filled with the green pigment called chlorophyll. The water and minerals transported by the xylem "spills out" into spaces around the cells. The sugar produced in the green cells transfers to the tiny phloem tubes. These run side by side with the xylem tubes, but flows in the opposite direction. The vascular bundles of xylem and phylum tubes are visible in leaves as the visible, raised veins. Vein patterns are characteristic for different kinds of plants. There are, however, general variation strategies used by plants, and these can be used to classify a collection of leaves. The three basic strategies are palmate, pinnate, and parallel. Palmate leaves (shaped like your hand) have several major branching veins leading away from the end of the petiole (leaf stem). Pinnate leaves (featherlike) have one major branching vein running more or less down

Time	***Teacher Tasks***	***Student Tasks***
00:00-00:05	Pass out journals and take students outside to an area with many trees.	
00:05-00:10	Ask them to name some plants and animals that might depend on the tree. Then ask what other examples of habitats the students know. Ask what they know about three most common conifers in the Pacific Northwest (Red Cedar, Douglas Fir, Hemlock).	Brainstorm and answer questions in journal. *3-4 Think-Pair-Share: What do you know about Lichen?
00:10-00:20	Tell students they will be studying the tree to find out which plants and animals depend on it or utilize it. Explain that they should try to determine which animals (including humans) only visit the tree, and which plants or animals live on it or in it. They should watch for clues and signs such as chewed leaves, holes in the bark, or carved initials.	Record where on the tree they find either living things or signs of life. Students can work in teams to examine the tree. Draw pictures of all the plants and animals or signs of each that they find, especially those they cannot identify.

the center of the blade. Parallel leaves have lots of parallel unbranched veins running the length of the blade" (FOSS – Living Systems)

Key Vocab: **Habitat, Leaves, Biodiversity, Ecosystem, Organism, Vascular Bundles, Palmate, Pinnate, Parallel**

		Use all their senses to find plants and animals. Name and draw the tree (plt.org).
00:20-00:27	Transition to discussion on leaves. Vascular plants are composed of millions of cells. Cells need water, minerals, and food (sugar). The vascular system of plants is two systems, xylem that transports water and minerals to the cells and phloem that transports sugar to cells. Xylem tubes begin in the leaves and end in the roots. What we can find out about the place where xylem ends, and phloem begins in the leaf?	Gather leaves with their teams. Collect as many different plants as they can find in 5 minutes. Leaves should be all different sizes and kept in a bag. Collect leaves with groups. Create own criteria for sorting leaves.
00:27-00:32	Tell students to sort their leaves into two groups, those that show evidence of xylem and phylem and those that don't. Ask students what their criteria was for sorting? What do the leaves have in common and how do they differ? What do the leaves feel like? Who found the biggest leaf? The narrowest? Smallest? Have the leaves been eaten by insects?	Sort leaves into groups. Trace the veins on their leaves with their fingers.
00:32-00:37	Bring group back together. Tell students one thing scientists do is organize, or classify, things so they can think about them more efficiently. A group of things that go together based on a property or behavior is a class. At school, for example, we classify students by age. They also categorize sand by particle size. One way to classify leaves is by the basic patterns of the veins. Show examples of palmate, pinnate, and parallel leaves. One way to classify leaves is by shape and size. Have students classify their leaves based on shape and add drawings to their journals.	*Palmate: Several large veins extending from the place where the leaf stem attached to the leaf. Pinnate: One large vein extending the length of the leaf with smaller veins branching off. Pinna means feather, so a pinnate leaf resemble a feather in a way. Parallel: Many small veins running the length of the leaf. Long, narrow leaves, like blades of grass tend to have parallel veins.* Think of the palm of their hands and fingers as the main veins
00:37-00:42	Have students classify their leaves based on venation pattern or shape. Ask students to look through their journals at the drawings they've done. Ask them to write some of their thoughts on trees and leaves in their journals.	Visit other groups to see the results of their leaf collections (FOSS – Living Systems) Write and or sketch in journal about trees. What do you like about trees? What do you like about leaves?
00:42-00:45	Wrap-up by connecting leaves and their role with trees and how trees can act as independent individuals in a habitat or can be an organism's entire habitat.	Gather together for journal time.

Formative Assessment:

Ask students what they know about habitats, leaves, and trees.

Journal Questions/Lesson Reflection:

"What did you find on the tree's trunk? What did you find in the tree's branches? How might the tree be affected by the plants and animals that live on it? Which of these organisms seemed to harm' the tree? Why do you think so? Do any of the plants and animals you observed seem to benefit the tree? In what ways? (plt.org)". Are there other ways to classify your leaf collections?

Risk Assessment: We may experience inclement weather, poisonous plants, singing insects, thorns, wild animals, falling branches, ice, uneven ground, or allergies. Have instructor check lesson location for any hazards before start of lesson.

Lesson 2 Land and Seas

Adapted from: Project Learning Tree Environmental Education Activity Guide: Water Wise *Adapted by:* Maddie Dineen, Novella Randall, and Jayme Gordon

Lesson Overview:

This lesson has the students dive deeper into their thoughts on the relationship between nature and humans as it relates to water. After an activity showing water connectivity students will be asked to identify various species impacted by watersheds and human activity. **For grades K-2:** Students will create models of watershed to understand how pollution moves through the waterways. **For grades 3-6:** Students will pair up and play intercoastal animal scramble with their partner. They will take turns reading the description of animals on one side of the card while the other guesses the animal on the other side.

NGSS:

2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid. 2-ESS22. Develop a model to represent the shapes and kinds of land and bodies of water in an area.

Focus Question: How do my actions and lifestyle impact the natural environment of the watersheds around where I live?

Instructional Materials:

1. Journals 2. Food Coloring 3. Large Trays 4. Containers of varying sizes 5. Spray Bottles
6. Large Pieces of Sheet Plastic 7. Intercoastal Animal Scramble cards

Lesson Objectives:

1. Students will understand the relationship between humans that inhabit this area and the importance of the watershed.
2. Students will develop knowledge on how human consumption and pollution affect our water systems
3. Students will begin to explore the vast biodiversity of the intertidal life in the Salish Sea region

Background:

In Western Washington, the season of spring resonates with most people as the return of rain. Some people dread the weather change, but it serves a large ecological role in our region. We will be looking at the rejuvenation of watersheds that result as the weather changes. Watersheds define the landscape form high evaluation mountain meadows and forests, to saltwater marshes and estuaries, to the larger Puget Sound. By looking at the land in terms of the watershed, we can gain a better understanding of the many connections which exist between diverse habitats, as well as those connections between our own health and wellbeing and that of the land and water on which we depend. We need to learn to "think like a watershed". We can compare what pressures a watershed faces throughout the different seasons. In the Pacific Northwest our watershed has been affected by dyking and draining deltas for agricultural purposes, logging forest, damming waterways, and increased human population. Human can impose pollutants and have a heavy demand on water use.

Key Vocab: **Intertidal, Watershed, Estuary, Pollutants, Marshes, Delta, Ecosystem, Stewardship**

Assessment and Performance Tasks:

Time	***Teacher Tasks***	***Student Tasks***
00:0 -00:05	Hike to appropriate location where students who are able to sit, can sit for activities and journaling.	
00:05-00:10	Share that the students will begin the lesson by reviewing what they already know on watersheds. Ask students how we can use the materials we have to make a model watershed. Break students into watershed groups.	Brainstorm and answer questions in journal.

Risk Assessment: We may experience inclement weather, poisonous plants, singing insects, thorns, wild animals, falling branches, ice, uneven ground, or allergies. Have instructor check lesson location for any hazards before start of lesson.

Journal Questions/Lesson Reflection: How do you impact the water cycle in your daily life? How is pollution carried across various water ways? What is the difference of water between seasons? What waterways do you live by? (plt.org) What are some intertidal animals that you have seen? Which ones haven't you seen? Do you think you will be able to name the organisms if you see them in the wild?

00:10-00:20	Pass out a large tray to each group, along with containers of varying sizes (though smaller than the tray). Tell students that they are making a model watershed. Each container will act as a mountain or peak. Have the students cover their peaks with a sheet of plastic. Go around each group and add a few drops of different colors of food coloring to the top of each peak. Explain that the food coloring represents things like pollution, road, and fertilizer run-off. Then have the students use the spray bottles to act like rain and spray the tops of their peaks and watch what happens.	*Vegetation plays a valuable role in a watershed because plants and soils slow down and absorbs water. It allows water to be released gradually so that it can be stored for later use, like during times of drought, and lessens the impact of flood season as not a much water is able to rush into streams and rivers.* Build model watershed.
00:20-00:28	After the students have completed their watershed models, ask them to record in their journals what they witness happening as the water interacts with the food coloring. Ask about different types of pollutants that can get in the waterways. Ask students what happened in their makeshift waterways. What do they think that means? How does it relate to what happens in real life?	Observe/draw/write about what they witnessed happen in the model waterways.
00:28-00:33	Wrap-up watershed.	Have students pick up and return materials. K-2 return to classroom or journal outdoors.
00:33-00:37	Now, ask students to relate this to a plant or animal that is endangered or extinct due to changes in the watershed. Talk about how and why it has been affected and how it relates to any other species. Explain that human impacts are especially devastating in certain instances like in water because we have such a capacity to alter the land and those habitats that are related.	End the lesson with a discussion on the interconnections between all living and nonliving things. Review stewardship around the issue. If time with K – 2. play intertidal animal scramble. Instructor shows cards and asks questions, students think-pair-share and write the guesses in their journals.
00:37-00:43	Hand out "intertidal animal scrabble" cards and have students play in pairs (cards are in appendix).	Pair off to play "intertidal animal scrabble". Students take turns reading the questions on one side of the card to allude to the sea creature on the other side of the card. The partner guesses what the sea creature might be.
00:43-00:45	Wrap up	Walk back

Formative Assessment:

Have students answer opening questions the instructor asks at the beginning of the lesson in their journals or in a thinkpairshare.

Lesson 3 Birds and Bees

Adapted from: Project Learning Tree Environmental Education Curriculum: Nature's Recyclers *Adapted by:* Maddie Dineen and Jayme Gordon

Lesson Overview:

This lesson has the students dive deeper into their understanding of interrelationships between birds and insects and how various animals use camouflage They will also contemplate the life cycle and the role of decomposers in nature. **For grades K- 2:** Students will observe earth worms and contemplate the places these critters are found and the role they play in decomposition. **For grades 3-6:** Students will create a data sheet and fill it out with observations of the earthworms they are given. They will learn about the process of decomposition and how a land crustacean plays a key role.

NGSS:

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live

K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment

Focus Question:

How do animals use camouflage, and what happens to a plant or animal once it has died?

Instructional Materials:

1. Live worms
2. Small objects in assorted colors (e.g., pipe cleaner segments, colored pieces of yarn, paper shapes, or punched holes)
3. Journals
4. Markers/Crayons/Colored Pencils
5. Large Chart Paper

Lesson Objectives:

1. Understand and describe the process of decomposition
2. Explain the function of scavengers and decomposing
3. Demonstrate their knowledge of how camouflage is used for protection and survival.

Background:

"Turn over a rock or log or lift the leaf litter in a forest. Chances are you'll see small, gray, armored animals scurrying out of sight. These sow bugs (Oniscusasellus) and pill bugs (Armadillidium vulgare) are not "bugs" at all, or even insects. These relatives of crabs and lobsters are crustaceans, and they feed on dead plant material. Earth worms (Lumbricus terrestris) are also decomposers. By eating, digesting, and then excreting dead plant material, scavengers and decomposers recycle nutrients back into the soil where they are reused by live plants. Both sow bugs and pill bugs are found in the forest as well as in the urban environments (gardens, road side vegetation, garbage, woodpiles, and parks). When people compost, they create the optimal conditions for this decomposition to occur and provide the necessary components for the process: soil (including microorganisms), organic wastes, nitrogen, water, air, time, heat, and mass. Many animals are "color coordinated" with their surroundings. A box turtle's dappled shell and a fawn's white spots mimic blotches of sunlight on the forest floor. And the two-toned appearance of many fish, dark on top and light on bottom, helps them match differing levels of light in the water. When vie wed from below, a fish's light-colored belly blends in with the sky. When viewed from above, the darker top blends in with the waters underneath. Any coloration, body shape, or beha vior that helps an animal hide is called camouflage. Blending in with the environment is a great way to avoid being eaten, but it's not an adaptation limited to prey animals. Many predators are also camouflaged: the better to avoid being spotted by a potential meal. For example, a lion's tawny coat matches the grasses of the African savanna and the leopard's spots match the patchy sunlight the African forest (plt.org)."

Key Vocab: **Crustaceans, Scavengers, Decomposition, Microorganisms, Biodegradable, Camouflage**

Assessment and Performance Tasks:

Collect Earthworms ahead of lesson

Time	***Teacher Tasks***	***Student Tasks***
00:00-00:05	Hike to appropriate location where students who can sit will sit for activities and journaling.	

00:05–00:10	Have the students pretend that they are teams of scientists who have been asked to solve a mystery. Someone has found a few strange-looking creatures and wants the scientists to observe and notate. Give each team a couple of the worms you collected earlier so students can look at them.	Participate in activity Asses what they know about the sow bug
00:10-00:15	Tell students that the person who collected the animals found them under moist leaves around a house and under several large rocks in the backyard, or by digging in the garden. Tell students that each team will setup a study container and devise a data sheet to record their observations. Hand out earth worms in premade containers and have the students in K-2 observe the worms.	Brainstorm a list of foods the animals might eat, and write the foods in journals Observe organisms and notate movements.
00:15-00:25	Tell students their data sheets in their journals should include observations of the earth worms (how many there are, how they look, and what they do), as well as observations of the food (what was put in the container, how much was put in, what it looks like, and how much remains).	Give one container to each team. Play birds and bugs.
00:25-00:30	Give a few earthworms to each team to put in its container. Make sure there is plenty of dirt/soil in the containers for the worms. Call K-2 back together into large group.	Record their observations on their datasheets. Come back together in large group.
00:30 – 00:32	Call group back together. Ask students whether they know what it is called whe n animals blend in with their surroundings (camouflage).*	Give examples of how camouflage hel ps both predators and prey.
00:32 – 00:38	Divide the group into two to four teams with the same number of stud ents in each team. Take everyone to where the "worms or bugs" are hidden. Tell students that various types of tasty animals are scattered here and that the students are hungry birds. E xplain that the object of the race is to be the first team to get every bi rd fed. When you say, "Go," the first bird in each line should "fly" over the prescribed area and pick up the first worm or bug he or she sees . Each bird flies immediately back to the line and tags the next bird, who does the same thing.* (For K-2 do this activity in the 00:15 – 00:30 time slot).	Arrange teams into relay race lines. W hen the last bird returns, everyone on the team should sit down. The first tea m to be seated wins.
00:38 – 00:42	When all teams have completed the relay, spread a large piece of p aper (at least poster size) on the ground. Make columns on the poster that correspond to the different colors of camouflage used. (For K-2 do this activity in the 00:30 – 00:45 time slot and have it followed up with journal reflection).	Place worms or bugs in the appropriat e color column. Record the number of each color. Ans wer journal questions(plt.org"
00:42 – 00:45	Wrap up	Walk back

Formative Assessment:

Ask students what they know about animals that use camouflage and about animals that are part of the decomposition process.

Lesson Reflection/Journal Question: "Which foods did the sow or [worms] eat? What other foods do you think [worms] eat in the "wild"? How might [worms] be important to a forest ecosystem? [Worms] and other scavengers are often called the "garbage collectors" of nature. How does that name apply to them? How is camouflage used by inhabitants of the forest?

(plt.org)"

Risk Assessment:

Discuss with students how they should handle the worms so as not to hurt them. DO NOT let the students touch the worms. We may experience inclement weather, poisonous plants, singing insects, thorns, wild animals, falling branches, ice, uneven ground, or allergies. Have instructor check lesson location for any hazards before start of lesson.

Lesson 4 YOU and ME!

Adapted from: Project Learning Tree Environmental Education Activity Guide: Native Ways *Adapted by:* Maddie Dineen, Rebecca Moore and Jayme Gordon

Lesson Overview:

Patterns of change can be observed in human uses of natural resources. In this activity, students read a story attributed to the Samish Native American Indian Nation, "Maiden of Deception Pass", or the instructor will read the "Maiden of Deception Pass" story to the group, to reflect about native ways and natural resources. Students will end the lesson by drawing a mural of their school.

NGSS:

3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
K-ESS3-3 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment
1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

Focus Question: What can I learn about the Samish Indian Nation, and what have I learned in the INVEST Program?

Instructional Materials:

1. Journal
2. Large Sheets of Paper

Lesson Objectives:

1. Explore some traditional Samish Indian attitudes with respect to the land and its resources.
2. View how the Samish create differing social, cultural, and economic systems and organizations to help them meet their physical and spiritual needs.
3. Understand how natural beauty, as experienced in forests and other habitats, enhances the quality of human life by providing artistic and spiritual inspiration, as well as recreational and intellectual opportunity.

Background:

Please keep in mind when delivering this lesson that one must be aware of cultural competency and respect when teaching about the Samish peoples or any other indigenous tribes. Never use past tense when talking about the Samish, because these people are still here. Do not use "us" "them" language. There could be students in the class who are part of or closely connected to indigenous tribes. Gently remind students that this land is the Samish peoples, and has been Since Time Immemorial (since the beginning of time; or thousands and thousands of years prior to now), and that European settlers stole this land from the Samish. Say that everyone has different views on the environment around them, and that the Samish have beliefs that probably differ from some of those in the classroom, and that is okay, because everyone uses land differently and believes different things.

When Columbus first came to North America, there was an estimated one to two million people living here. At that time, the densest American Indian populations were along the western and eastern coasts of what is now the United States. American Indians generally had strong spiritual beliefs and had strong connections to the land (plt.org). It is important to note that there are currently about a million Native Americans alive in the U.S. today. It's vitally important that we do our best to understand Native Culture and not appropriate it. Essentially, the Coast-Salish and Samish people have lived on this land Since Time Immemorial. Therefore, we use utmost respect when discussing and learning about Native Americans and their widely diverse cultures. This lesson, and the previous three lessons, took place on traditional Samish lands and this should be noted at the beginning of the lesson. The aim of this lesson is to educate students on the historically and culturally accurate information about the Samish Indian Nation. To minimize risk of disrespect or appropriation, we use language that is carefully chosen and devoid of negative stereotypes and unintentional slurs.

If you do not feel comfortable delivering this lesson or do not believe that you can do it is a culturally competent way, a brief alternative to the lesson introduction is provided at the end of this lesson

Key Vocab: **Ancestry, Ceremonies, Chelangen, Territory, Treaty, Unity, Respect**

Assessment and Performance Tasks:

Time	***Teacher Tasks***	***Student Tasks***
00:00-00:05	Hike to appropriate location where students who can sit will sit for activities and journaling. Start by reminding the students that we are	
	on native Samish First Nation land and take a moment to thank the Samish People for allowing us to use their lands for education.	

00:05–00:07	Ask students what they know about the Samish People. Tell students that "The Samish Indian Nation is the successor to the large and powerful Samish Tribe, a signatory to the Treaty of Point Elliott in 1855. The Tribe's traditional territory stretches over a wide region of the Salish Sea in Northwest Washington, from the tops of the Cascades Mountains to the far western shores of the San Juan Islands."	Listen to story about the Samish. Asses what they know about the Samish people
00:07-00:15	Tell students "The Samish are historically comprised of four important social groupings: *the family, the house group, the villages, and the tribe as a whole*. Samish oral history includes teachings of the plant people, the sea creatures, the fur bearing and winged creatures. These stories passed down from their ancestors convey how both the natural and spiritual worlds entwine and cannot be separated. These teachings, also called Chelangen, guide Samish people in their daily lives and offers a unique and irreplaceable system of beliefs, which takes us through the transitions of life from birth to death and beyond. The elders would often say, "When the tide goes out our table is set for dinner." Nearly everything [they] need to survive can be found living on the beaches or in the waters close to shore. In gratitude for accepting any one of these gifts they always use a prayer or a song of thanks for the gift that was left for [them] by the ancestors to survive such as the clam, the oyster, the salmon, the waters, the air, the roots, and everything else in nature." (www.samishtribe.nsn.us) Introduce vocabulary words and key themes. Read the "Maiden of Deception Pass: A Traditional Samish Story" and discuss the story.	Discuss knowledge of the Samish People. More information: "In 1847 the Tribe had over 2,000 members. Twelve years later at the time of Treaty of Point Elliott negotiations, raids from Northern Tribes and epidemics of measles, smallpox, tuberculosis, and influenza had decreased the Samish population to about 150. Documents show 113 Samish were present in Mukilteo at the time of the Point Elliott Treaty signing in 1855." Draw in journal while listening to story.
00:15-00:20	Introduce and pass out copies of the "Maiden of Deception Pass: A Traditional Samish Story". Call upon different kids to read individual paragraphs of the story. Break students into groups of four or five and give each group a large sheet of paper and some markers.	Listen to the story. Draw in their journals if they wish.
00:20-00:25 ***00:20-00:30***	Lead discussion on the "Maiden of Deception Pass" Have students write "This is Samish Elementary School" on the top of the paper. Remind students that they have learned about the trees in the yard, about the watersheds we live in, and about the birds and worms in the sky and ground. Have students draw a mural of their school while remembering the things they learned.	Discuss story. Draw school.
00:25 – 00:30 ***00:30 – 00:45***	Tell students that they are about to start their last activity of the program. Remind them that earlier in the program they learned about the trees and leaves in the yard, about the watersheds we live in, and about the birds and worms in the sky and ground. Ask students to review what they have learned and what they remember. Tell students that as a class, they will create a large banner. The top of the paper should say "This is Samish Elementary School". Lead final journal session and pass out certificates	Discuss what they learned over the course of the program. Journal and receive certificate.
00:30 – 00:42	Instruct students to work as a class and draw a large mural of Samish Elementary, remembering everything they learned in the INVEST Program. If time allows, have students draw a mural of what they learned in their journals.	Draw mural with class
00:42 – 00:45	Wrap up	Walk back

Formative Assessment:

Ask final journal questions and pass out certificates.

Lesson Reflection/Journal Questions:

What did I learn about pollution? What did I learn about watersheds? What did I learn about the trees in the yard? What did I learn about stewardship? What did I learn about the Samish People? What was the best part?

Alternate Lesson Plan for “You and Me”:

1. On a board, write numbers 1 through 4, and ask students to help you recap what they learned in the previous three lessons. (ex: what did we talk about in week 1? Trees and leaves! Do you remember what kinds of trees are in your schoolyard? what are the different types of leaves? etc) for each week.

2. For number 4 remind them that this week the lesson is titled “You and Me”. Help students understand that the previous three weeks have been discussing components of the environment around them. Ask, what are some uses that people have for the land and environment around us? list them on the board

3. Help students understand connections to the weeks prior. (ex: if growing crops is mentioned, tie it back to water cycle, and decomposition with worms, etc) to help students realize everything is connected, including them!

4. Ask, what are some ways we can protect the environment and the land around us? list them on the board (connected later to the Stewards part of their certificate)

5. Introduce concept of the mural of their school and encourage them to think about all aspects of what they have learned so far. Go outside and make murals!

6. Participate in final journaling activity where students describe what they liked best about the program and what they learned from the four lessons.

7. Wrap-up and pass out certificates.

Whelk Snail (Nucella emarginata)

1. I am related to land snails and slugs.
2. I am a carnivore, but sometimes I prefer to scavenge.my meals.
3. Using my raspy tongue (radula), I can bore through the shells of my prey items and lick out the tasty insides.
4. It sometimes takes me 2 days to bore through the shell of my prey and then to eat them. 5. I like to eat barnacles, hermit crabs, snails, and decaying matter.
6. There are many types of creatures just like me thatcarry my name, including channeled dogwinkles and boreal wentletraps.
7. My shell is spiral shaped and pointy.

Ochre Sea Star (Pisaster ochraceus)

1. I am related to the sea urchin and the sand dollar.
2. My "skin" is both spiny and spongy.
3. I am a major intertidal predator.
4. I love to eat mussels, and in the intertidal zone I keep their population in check.
5. I come in many different colors, ranging from red to orange to purple.
6. I can survive for more than a day out of the water, but I am happiest when I am submerged.
8. I am not too fond of the sun; I can often be found in cool, shady crevices in the rocks.

Purple Sea Urchin (Strongylocentrotus purpuratus)

1. I am related to sand dollars and sea stars.
2. I have tube feet that reach out through holes in my shell and help me to feed.
3. I can live up to 70 years.
4. I am an herbivore, and I love to eat iridescent algae.
5. My "mouth" is on the underside of my body.
6. I am most common in areas with a lot of exposed rock, as that is where I make my home. I am not well adapted for the sand.
7. I may look sharp and spiny, but I won't pierce your skin with my spines, they are too dull on the ends.

I use them for protection from predators.

California Mussel (Mytillus californianus)

1. I am related to clams and cockles.
2. I support the intertidal community by providing food and habitat for many different creatures.
3. I am what is known as a bivalve.
4. I live in large colonies called beds.
5. Other organisms often live in my beds, including acorn barnacles, gooseneck barnacles, many species of algae, and aggregating anemone.
6. My shell can be up to 10 cm in length. 7. Gulls, sea stars, oystercatchers, and surf scoters love to eat me.
8. Ochre sea stars keep my population in check within the tide pool community.


alamy stock photo


gettyimages


gettyimages
Roger Dixon


gettyimages
David Wrobel

Giant Green Anemone
(Anthopleura xanthogramica)

1. I am related to sea jellies.
2. I stick to rocks, and won't move much over the course of my lifetime.
4. I eat whatever comes my way; mussels, barnacles, small fish, and crabs.
5. I feed when the tide is in & I'm submerged.
6. I don't like being exposed to too much sun, so when the tide is out, you may see me coated in small rocks and bits of shell; I am using them as camouflage and sunscreen.
7. My tentacles have more sticky cells than stinging cells.
8. My skin is green because of small, singlecelled plant-like organisms that live in it. They soak up the sun and make extra energy for me to use, in return, I offer them protection from predators.

Aggregating Anemone
(Anthopleura elegantisima)

1. I am related to sea jellies.
2. I don't have a shell to protect my soft body.
3. I grow in large colonies of genetically identical "brothers" or "sisters." When two different colonies meet, they will fight for territory.
4. I can reproduce 2 ways; sexually and asexually.
5. When I reproduce asexually, the process is called binary fission.
6. I will eat most anything that comes my way, if it is small enough. I love to eat small crabs and fish, but will happily dine on zooplankton.
7. My genetically identical relatives may be living in the same spot thousands of years from now; this leads scientists to wonder whether or not I should be considered an immortal life form.

Hermit Crab (Pagurus spp.)

1. As an arthropod, I am related to barnacles and dragonflies.
2. I love to eat almost anything I can get my claws on, from algae to meat and fish. In captivity, I especially like fruit.
3. I have 10 legs.
4. When I am scared, I can retract my body completely into "my" shell.
5. "My" shell is actually a borrowed shell left behind by a sea snail. I can only move in if the shell was left intact.
6. My soft abdomen is specially adapted to fit snugly into my new shell.
7. Throughout my life, I will slowly outgrow my home; when I do, I will go in search of a new one.

Dungeness Crab (Metacarcinus magister)

1. I am a forager and scavenge along the sea floor for organisms.
2. I have an exoskeleton, called a carapace that I molt has I grow.
3. I can live between 8 and 13 years.
4. I live in the intertidal and subtidal areas in my youth, and eventually live in eelgrass begs and the muddy substrate.
5. I have two big pinchers
6. I am most common in areas with a lot of exposed rock, as that is where I make my
7. I have many appendages, two pairs of antennae, pincers, and four walking legs. I am able to regenerate my appendages if they get torn off.

Maiden of Deception Pass: (as told by Charlie Edwards to Martin Sampson, 1938)

"Ko-Kwal-alwoot and other maidens were gathering sea food on the beach one day, when one of the shellfish slipped from her grasp and fell into deeper water. She reached for it, and it slipped from her hand again and again, and she kept following it until she was in deep water, well over her waist. Suddenly she realized that what seemed to be a hand had grasped hers and was holding her there. Terrified, she attempted to free herself, but a voice told her not to struggle or be afraid, that she was very lovely, and he was merely holding her there so that he could look upon her beauty. Soon her hand was released, and she returned to her people.

After a number of such meetings, during which the spirit held her hand longer and longer each time, and spoke soothingly to her, telling her of the many beautiful things which were in the sea, there came a day when a young man emerged from the water, and accompanied her to her father's house, to ask for her hand in marriage. The people of the village knew not from whence he came, or who he might be, but they noticed that in his presence they were chilled, as though icy winds were blowing.

At first when he asked for Ko-Kwalalwoot's hand, her father was indignant and said "No, my daughter cannot go into the sea with you—she would die." "On the contrary," said the young man, "she will not die; we will give her eternal life, and we will be very good to her, for I love her dearly." Then he warned the father that if he could not have Ko-Kwal-alwoot for his bride, all the sea food would be taken from them, and they would be very hungry, but the father still would not agree.

As time went on, there was a great scarcity of food of all kinds, and even the streams started to dry up, so that they could have no water to drink. When she could stand it no longer, Ko-Kwal-alwoot went out into the water, and called the young man, begging him to give her people food. But he replied, "Tell your father that only when you are my bride, will the waters teem with fish, and your people may again live in plenty." Bull Kelp in Deception Pass At last her father, realizing that his people were starving, reluctantly agreed to give up his daughter so that the many members of his tribe might live. He made one stipulation, however, and that was that she was to return to her people for a visit once a year, so that they could see if she was being cared for and was happy.

This was agreed upon, and Ko-Kwal-alwoot, wrapping her garments about her, walked into the water, farther and farther until she was out of sight, and only her hair could be seen floating in the current. True to the agreement, there was food in plenty, and the tribe prospered. And Ko-Kwal-alwoot returned to her people once each year, and before her coming there was always more food than ever before. Still each time she came, her people noticed more and more of a change in her. Barnacles grew upon her hands, up to her arms, and the last time she came they had started to grow upon the side of her face which had been so beautiful, and her people felt the chill winds wherever she walked, and they noticed that she seemed to be unhappy out of the sea. On her last visit they told her she did not need to return to them again, unless it was her wish to do so.

Since that time she has been their guiding spirit, and through her efforts there has always been plenty of shell fish and food of all kinds in that vicinity, and the spring water has always been pure and sweet. The Samish Tribe believes that as the currents flow back and forth through Deception Pass, her hair may be seen drifting gently with the tide, and that she is always there to look out for the welfare of her people." (http://www.bladegallery.com/graphics/Maiden_of_Deception_Pass_Legend.pdf)

Conclusion

INVEST students should be able to recognize and understand the interconnectedness of the Salish Sea and its inhabitants, including their own vital roles. Throughout the course students experienced, hands on, the inner workings of the Salish Sea and North Puget Sound through a compilation of place-based methods that focused on the connectivity of plant, animal, place, and self. Students will be able to go outside and not only recognize the species of plants and animals around them, but also know why they are there and why they are important. Students will have become familiar with the system and processes that allow the continuity of the world such as watersheds, habitats, and decomposition. INVEST helps students see how humans are a part of nature, and find comfort and love from the plant.

INVEST CERTIFICATION

Resources Used:

Project Learning Tree's Environmental Education Activity Book FOSS – Living Systems

Appendix D - Data Collection Tools

Event Recording/Frequency Data Collection Sheet

Student's Name: _____Observer's Name: _____

Date	Class	Behavior/Skills			Teacher Initials	Comments

Daily Event Recording for Multiple Students

Recorder's Name: _____ Date: _____

Student	Behaviors	Number of Events	Length of Observation	Total
