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**Nature-Based Education for Elementary School Students with  
Attention Deficit Hyperactivity Disorder**

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LS 400: Liberal Studies Senior Capstone

California State University, Monterey Bay

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## Appendix A

### **Interview Questions for Early Elementary School Teachers**

1. Are there any schools that you know of who have implemented a nature-based curriculum for elementary school students? If so, what does that look like?
2. According to you, what are the benefits or advantages of implementing nature-based education for elementary school students with attention deficit disorders?
3. Are there any disadvantages of implementing nature-based education for elementary school children with attention deficit disorders? If so, what are they?
4. What are the state requirements and standards when it comes to nature-based education in elementary school classrooms?
5. What are ways in which schools can encourage more outdoor learning in its curriculum to support elementary school children with attention deficit disorders?

## Appendix B

### **Interview Questions for Parents of Children with ADHD**

1. At what age was your child diagnosed with ADHD? What presentation do they have?
2. What symptoms did your child display at home that led to their ADHD diagnosis? How about in school?
3. What methods have you/do you use to assist your child's attention disorder?
4. Have you noticed a difference in your child's behavior once they are in an outdoor setting? If so, please explain what you have observed.
5. Do you think your child would benefit from a curriculum that is nature-based? Why or why not?

## **Abstract**

There are several advantages to including a nature-based curriculum and outdoor learning into state standards, and the consequences of students who do not have access to outside learning and activities can be severe. The term “Attention Restoration Theory” (ART) was coined by psychology professors Rachel and Stephen Kaplan in 1989 and claims that exposure to nature can improve mental fatigue and concentration. This senior capstone examines Kaplan’s Attention Restoration Theory and academic studies rooted in its philosophy as it applies to nature-based curriculum and outdoor learning. There are certain advantages for students who are exposed to a nature-based curriculum and outdoor learning as well as disadvantages for those who do not have access to them. Through literature review and interviews with professionals, the finding revealed that, not only does nature-based learning improve an ADHD student’s mood and regulate behavior, it may also improve their concentration on traditional subject materials, which would satisfy curriculum aims derived from the state standards.

## **Introduction**

Knowledge has been passed down outdoors since time immemorial, but over time we've moved children's education from the outdoors to inside four walls and under fluorescent lights. Opportunities for children to access the natural environment are diminishing; today children are spending less time outside and more time indoors staring at screens. Even our modern environments have reduced the amount of "green spaces", also known as parks, sports fields, woods, lakesides and garden areas, that provide people with recreation opportunities, relaxation, and peace (Barton, 2017). These green spaces are sparse but are known to reduce stress, anxiety and boost mental and physical health. Nature-based education is a growing phenomenon and involves more than just taking kids outside to enjoy these green spaces. It immerses the student in an "all-encompassing learning environment that challenges them to actively observe and engage with the world around them" (Natural Start, 2017). By integrating nature into the curriculum, student's brains are in a relaxed, naturally stimulated place and are able to focus better on traditional subject materials commonly taught inside school walls.

The philosophy of nature-based education is rooted in experiential learning, wherein we learn by doing. With this type of curriculum, learning can take place outside in addition to indoor settings; the goal is not to remove indoor learning entirely, but to serve as an external support for teachers as they navigate a growing number of behavioral issues within classroom walls. This could supplement greatly for the demands that teachers face on a daily basis. If it's true that natural environments can improve our attention, boost our problem-solving skills, increase positive emotions and reduce the impact of stress, it would point in favor of incorporating natural settings into our elementary education systems. As things currently stand, there are not many schools who have implemented a nature-based learning curriculum; they are few and far

between. However, they do exist and it can be possible to incorporate this format of learning into our schools, especially in a place as environmentally diverse as California.

Attention Deficit Hyperactivity Disorder (ADHD) is a common childhood behavioral disorder. It involves a difficulty in focusing, as well as trouble controlling personal behavior. Most children with ADHD start school before they are given a diagnosis. According to the Center for Disease Control and Prevention, an estimated 6.1 million children ages 3 to 17 have been diagnosed with Attention Deficit Hyperactivity Disorder. Although there are accommodations for children with this condition, the lasting effects of an inability to regulate emotions and behavior can cause ADHD children to struggle beyond their school years. Dopamine has a strong neurological effect on the brain of an individual with ADHD (Wise, 2004). This means that movement, physical activity, and novelty are important factors that help support memory, attention, and retaining information in school. This can be difficult for the average elementary educator to address on a day to day basis, especially when they are expected to fit the instructional needs of every other student.

With increasing numbers of attention disorders in young children, the need for nature-based learning is becoming widespread. Attention disorders are common in elementary-age children, but little is understood about the educational adaptations that can be made to enhance their learning capabilities. I recently received a diagnosis of the inattentive presentation of attention deficit disorder, and this inspired me to study further into what this disorder looks like in elementary school children across all presentation types. Because I was diagnosed in my adult years, I had to reflect on my early education experiences as a guide to my work on this research topic. I do not have the disruptive presentation of attention deficit disorder, which is most common, therefore my diagnosis was more subtle and difficult to identify as an

adult. This is why I have chosen to focus solely on the hyperactive presentation, as it is much more recognizable.

There are many active studies and theories that can be used to help support the ADHD student when supplemental help cannot be provided. For example, Attention Restoration Theory (ART) has been successfully used as an intervention. This theory suggests that the ability to concentrate may be restored by exposure to natural environments (Kaplan R., Kaplan S. 1989). Children with ADHD who interact regularly in outdoor settings have milder symptoms and less attention fatigue, therefore Attention Restoration can be used as a method of treatment. The theory states that mental fatigue and concentration can be improved by “time spent in, or looking at nature” (Ackerman, 2020). Children with ADHD often struggle in the classroom, which leads to academic difficulties. Nature is often overlooked as a “healing balm for the emotional hardships in a child’s life” (Louv, 2008). Nature-based learning is a pedagogical strategy for enhancing learning, increasing school engagement, and improving student health and well-being. However, elementary school administrators have yet to recognize its non-traditional methods of fulfilling curricular goals.

Throughout this paper, I will seek to answer a series of questions regarding the benefits, barriers, opportunities, and methods to applying nature-based learning in elementary schools, particularly in grades K-2. The primary question I propose to answer is: How can nature-based education be used to improve the success and wellbeing of children with Attention Deficit Hyperactivity Disorder? Related questions are: What is nature-based education and what does this entail? How does nature-based education relate to state requirements and Common Core standards? What does research say about the emotional and behavioral benefits of nature-based education programs for elementary school students with attention deficit hyperactivity disorders?

What do K-2 teachers say are the benefits and barriers of this form of education? How are these nature-based education programs implemented at the school district level? And finally, What are ways in which schools can encourage more outdoor learning in their curriculum to support elementary school children with attention deficits?

Each of the questions proposed above will be answered in the Discussion section of this paper. Before I do so, I would like to spend time reviewing what the literature has to say about implementing nature-based education programs in elementary schools. My aim is to not only answer my primary and secondary research questions, but to deepen my understanding of the diagnosis I recently received. As a future educator, I feel that it is important for us to acknowledge learning disorders on all ends of the spectrum in order to create a classroom environment that is conducive to all types of students. In addition to this, I also want to be more aware of the barriers that come with implementing this form of instruction at the school district level. The benefits of nature is a topic that I am equally familiar with and passionate about, so I wanted to challenge myself and see what limitations to this curriculum might present. Fortunately, I found helpful resources, insightful early elementary educators, and parents with first hand experience helped answer my research questions.

### **Literature Review**

This semester I guided my focus toward Attention Deficit Hyperactivity Disorders in elementary-aged children, particularly grades K-2. I began my research with a hunch; that there may not be as much data collected on this age group as there would be for upper elementary grades, as ADHD is difficult to distinguish from typical child behavior that is often exhibited in early elementary ages. Anticipating this outcome challenged me to refine my research so that I

could answer my primary and secondary research questions. Through a variety of research studies, published articles, medical journals, and knowledgeable authors I was able to gather the necessary information in order to organize my research and set myself up for success. This information allowed me to begin reaching out to my target audiences to help answer my research questions. Out of the literature I have reviewed during this process, the four themes that proved most beneficial to me were the cognitive and behavioral benefits of exposure to nature, nature-based learning as it relates to state requirements, the most commonly perceived benefits and barriers according to teachers, and the neurological relationship between ADHD and nature.

***Cognitive and Behavioral Benefits of Exposure to Nature.*** There is a well-established link between contact with the environment and cognitive health. Studies have shown that exposure to green spaces can lower the effects of a variety of mental health issues that can make it difficult for students to pay attention in the classroom. This can be especially difficult for the ADHD student, as concentration is based on personal interests. In particular, Rachel and Stephen Kaplan's Attention Restoration Theory (1989) makes this connection and asserts that exposure to nature significantly reduces directed attention fatigue.

The 2004 article by Kuo and Faber was the first nation-wide study that explored green outdoor settings as a potential treatment for Attention Deficit Hyperactivity Disorder. The research here looked at attention restoration advantages of nature for individuals with and without the diagnosis. This is important for the basis of my research, as it highlights the need for nature-based learning in both ADHD and non-ADHD elementary school students. It is this initial article that has sparked the phenomenon of outdoor environments as creative solutions for attention control and refocus. In this journal, it is also stated that children function better than

usual after activities in green settings and that “the “greener” a child’s play area, the less severe his or her attention deficit symptoms” (Kuo & Faber, 2004).

(Berman, 2008) states that “unlike natural environments, urban environments are filled with stimulation that captures attention dramatically and additionally requires directed attention, making them less restorative”. His research consisted of an experiment showing that walking in nature can improve directed-attention abilities measured by a concentrated task. These “direction-attention” abilities refer to subjects that require high amounts of focus and concentration, such as mathematics, sciences, or reading comprehension, to name a few. Berman’s experiment concluded that Attention Restoration Theory is valid in its attempts to explain the connection between nature and attention issues in children. This shows that when comparing urban versus natural environments, both provided a surplus of stimuli but a natural setting led to more improvements in direction-attention abilities in the individuals tested.

Kaplan’s Attention Restoration Theory (ART) can ultimately help us explain why natural environments are ideal places for us to restore our attentional capacities. Their research distinguishes the difference between “soft” and “hard” fascination (p. 179), wherein soft fascination refers to nature’s ability to hold one’s attention while leaving sufficient headspace for contemplation and hard fascination refers to environments that overstimulate and occupy the mind fully, therefore leaving little room for reflection. Supporting Kaplan’s theory, author Avik Basu (2019) states that “the distinction between these two types of fascination is relevant to the choice of environments people seek for restoration. Although natural environments are conducive to restoration, not everyone turns to them when fatigued. Rather, many retreat to movies and television when seeking relaxation.” This study can be utilized by educators who

want to implement nature-based learning for their students by helping them learn to “anticipate activities that may or may not be restorative” (Basu, 2019, p.1080). For educators who lack confidence in their outdoor instruction skills, Basu’s work and research following the idea of Attention Restoration also provides a breakdown of soft fascination vs. hard fascination activities and offers outdoor activities that support ADHD students’ learning.

Another study concerning this phenomenon was made by psychologist Rachel McCormick in 2017, which aimed to determine if access to green spaces had a positive impact on the mental wellbeing of children. Results rendered that access to green spaces were associated with these improvements and that exposure to environmental settings “promotes attention restoration, memory, competence, supports socialization, self-discipline, moderates stress, improves, behaviors and symptoms of ADHD, and was even associated with higher standardized test scores”. The data pulled from this study was based off of a collaborative action research project that discussed a wide spectrum of benefits to nature-based learning and perceptions of its integration in elementary schools. Another research group that addressed the connection between green spaces and mental health benefits were Barton & Rogerson in their 2017 journal. As stated in the article, environments shape our behaviors and that “given the current prevalence and costs of worldwide mental ill-health and the concurrent rise in global urbanization, there is a need for greater interdisciplinary collaboration in schools” (p.81).

***Perceived Teacher Benefits and Barriers to Nature-Based Learning.*** The link between nature and better personal health are also well-established. Despite their promising potential, green spaces as learning environments remain largely unintegrated in the state curriculum. Bowler (2010) addressed the subjective improvements in both student and teacher wellbeing.

“Exposure to the natural environment plays a significant role in improving positive mental health and wellbeing for students”. In a similar study, Maller (2005) addresses the connection between conducting experiential outdoor learning activities on a weekly basis. “Hands-on contact with nature is not only essential for protecting the environment but appears to be a means of cultivating community and enhancing the mental health and wellbeing of children beyond and within school bounds”. Benefits to the natural environment community are found when introducing students to a curriculum that is nature-based; suggesting that the more young children engage with the natural environment, the more they grow to appreciate and care for it.

In a six-week study with two kindergarten teachers and 37 kindergarten students aged five to six, Guardino (2019) aimed to determine their perceptions of teaching and learning in a traditional setting compared to a newly constructed outdoor setting. The data was collected through observations in both environments. Of the 37 kindergarten students, five had been previously diagnosed with ADHD. The data at the end of the study revealed that “both students and teachers reported an increased perception of wellbeing, pleasure, and interest when teaching and learning in the outdoor classroom”. In addition to this, it was noted that the five students with ADHD were significantly less distracted and more on task when working in the outdoor classroom environment.

It is clear that the benefits to nature-based education are boundless for parents, teachers, and students alike. Studies suggest that activities in outdoor environments may provide teachers with a pathway to create learning contexts for students to succeed and reach their full potential. However, along with benefits come a number of perceived barriers to implementing nature-based education in elementary schools. In most of the literature mentioned above, the conversation

about maintaining teacher wellbeing, confidence, and job satisfaction is dependent on overcoming the barriers listed below.

(Ernst, 2007) explores the various factors that are associated with K-12 teachers and their use of nature-based education. This journal was a great resource for me, as it explained the perceived barriers of implementing outdoor education that most teachers have. This author used exploratory survey research and a sample of 287 teachers to investigate influences on teachers' decisions to use and their abilities to implement school-based environmental and nature-based education. "Environmental literacy knowledge and skills are important in teachers' decisions to use and their abilities to implement environment-based education" (p.17). Despite the growing amount of evidence that supports the educational efficacy of this instructional approach, relatively few teachers seem to practice nature-based education (McKeown-Ice 2000). "Most schools have few requirements related to environmental education, and in the majority of schools environmental education is not institutionalized" (p.10). There is a larger problem here, that although there is an interest in nature-based instruction, it is rarely utilized due to lack of teacher confidence. Despite the promising potential that nature-based learning has to offer, teachers often "feel hindered to facilitate and improve children's access to outdoor learning" by factors related to proper training, curriculum requirements, and shortages of time and resources (Rickinson et al. 2009).

In addition to lack of teacher confidence, parents of children with ADHD share a similar concern. Researchers in California studying family engagement with nature-based/environmental education found that "many families report that their [environmental] science learning experience have reinforced the views that [environmental] science is complicated and out of their

reach” (Luce, 2017). This is a recurrent theme; parents and teachers have reported feelings of insecurity related to their own expertise as an environmental educator during outdoor activities. Within this broad theme, there are two factors that go hand in hand and can help explain why confidence is so low: fear of losing control and difficulties in managing children’s behavior. In their later explored journal, (Ernst, 2014) aims to encourage the use of natural outdoor settings as learning environments for early childhood education by conducting a survey for 46 early childhood educators. This survey explored these educators’ beliefs and practices regarding natural outdoor settings and also investigated perceived barriers to the educational use of these settings. This journal, supplemented by survey research from (Reese, 2018) allowed me to explain the hesitation from teachers and administrators alike in regards to applying this form of curriculum.

Many of my sources call attention to the perceived benefits and barriers teachers have about learning in outdoor classrooms. The most common barriers cited by early childhood educators included curriculum pressure, high demand on teachers’ time and resources, lack of teacher confidence, safety concerns, costs and access to outdoor resources, and the proper training to conduct learning in green spaces. In addition to the listed challenges, teachers from the reviewed literature also expressed a conflict between choosing outdoor learning as an instructional method or using traditional modalities that they know well and are most comfortable with.

*Nature-Based Learning in Relation to State Standards.* Knowing what teachers perceive as a barrier to nature-based education was critical when structuring this next section of my Capstone around California’s environmental education requirements. McKeown-Ice (2000) did a

great job of emphasizing the pressure on teachers to cut out topics viewed as unnecessary, such as outdoor learning, in favor of teaching things that are viewed as more critical to achieving high test scores. In this study, 715 academic institutions were surveyed using a mail questionnaire. The results indicated that most schools have few state requirements related to environmental education, and environmental education is not institutionalized in the majority of schools in California.

The work of Banilower et al. (2013) also showed me that funding will always be a concern for teachers. Most teachers pay for classroom materials out of pocket and new curriculum does not always guarantee proper funding for teachers. In this study, the two most frequently cited problems were lack of administrative support and teachers' limited training, experience, or confidence in conducting lessons in outdoor settings. In their study, (Powers et al. 2004) helped me understand the preparation necessary for nature-based education from the perspective of faculty members. Infusing environmental education was a topic that this author prompted 18 early childhood professors with, the most commonly reported inferences were that nature-based learning would highlight the state standard's need for students to know how to observe and describe similarities and differences in the appearance and behavior of the natural world (California State Standards, Life Sciences, 2a).

Understanding the environmental education state standards and requirements for elementary students in grades K-2 has helped me expand my understanding about how to increase teacher commitment to this form of education. According to the California Department of Education (2022), the continuation and health of human lives, communities, and societies depend on the health of the natural systems that provide essential goods and ecosystem services.

If our overall health is directly affected by natural environments and what they provide us with, why is there not a strong presence of nature-based learning in the curriculum? Most students do not have an understanding of the environment and therefore might not know how to protect its resources. Although the state requirement on environmental education is a good one, it is not as high a priority as traditional curriculum.

From the published work of Basile et al (2000), it is stated that schools have a very unique role in environmental protection. “They help students become conscientious stewards of and advocates for the environment, protecting it for themselves and generations to come” (p.159). Basile et al notes that nature-based education makes other school subjects equally rich and relevant and can engage disinterested students excited about learning. This book addresses state standards as they relate to environmental education as well as the relation to this subject and the attention control of elementary school students.

*The Neurological Relationship Between ADHD and Nature.* Squirming and fidgeting, carelessness, talking too much or at inappropriate times, risk-taking, challenges with impulse control, and difficulty getting along with others are all symptoms of Attention Deficit Hyperactivity Disorder, according to the Centers for Disease Control and Prevention (2020). These behaviors can make it difficult for students to be successful in any classroom setting. Canu & Gordon (2005) reviewed literature suggesting that time spent in nature can relieve symptoms of attention fatigue, which is very similar to typical ADHD symptoms, as listed above. This study examined whether the green spaces of children’s play settings may be directly related to ADHD symptoms of each presentation type. These authors examined data from 421 parents of children with ADHD between the ages of 5-18 years of age. The results revealed that “children

with the primarily hyperactive-impulsive presentation had less symptoms in an open grass play setting compared to the other settings”. This study helps drive home the fact that exposure to nature serves as an organic medication that helps reduce ADHD symptom severity.

Neuroscience aims to explain the reason for impulsivity and hyperactivity in the ADHD individual. Although dopamine is the primary chemical that helps explain this, few studies have looked at the connection between the neurotransmitter serotonin and Attention Deficit Hyperactivity Disorder. An exception is Howard Hughes Medical Institute investigator Marc Canon that involved a study of serotonin’s ability to balance out low dopamine levels in ADHD individuals. The medical study concluded that stimulating serotonin levels appeared to restore the symmetry between the brain chemicals dopamine and serotonin and also calmed hyperactivity. “Hyperactivity may develop when the relationship between dopamine and serotonin is thrown off balance” (Canon, 1999). This revelation has been further studied and sought out as an explanation for the hyperactivity that represents the “H” in ADHD.

This neurodevelopment affects the way an individual’s brain processes and retains information, how well attention can be controlled, and what attention is driven toward. As a result, this strongly influences a wide set of behavioral traits. Some researchers, such as Oades (2008) have also looked at the neurotransmitter dopamine as a potential contributor to common struggles associated with ADHD. Dopamine is a brain chemical responsible for the regulation of our pleasure, motivation, and learning (Wise, 2004). For someone with this diagnosis, it is especially important. It is acknowledged that children with ADHD have more difficulty focusing than those who do not; they may also act more impulsively than their peers, making it more complicated to perform well in school. Compared to neurotypical people, ADHD individuals are

hard-wired for novelty-seeking, which may cause them to appear apathetic, distracted, or disruptive in academic settings. Recent neuroscience research shows that people with Attention Deficit Hyperactivity Disorder have “underfed” brain reward circuits (Stark, 2011), so they are drawn to new and exciting experiences that compensate for a lack thereof. There are, of course, medical treatments to induce this balance out, but it is strongly suggested that time spent outdoors can be used as a natural intervention.

In his research, neuropsychologist Robert Oades examined the interactions between dopamine and the ADHD brain and found a link between the two. "Dopamine has a strong neurological effect on ADHD brains. Movement, physical activity, and novelty are important factors that help support memory, attention, and retaining information" (Oades, 2008). This study refers to another that explains that dopamine activity is “lower than normal in children with the neurodivergence” (Levy, 2004). Because dopamine levels are lower for those with ADHD, they need to be supported – especially in elementary school environments. It is clear that exposure to the natural environment can lower the effects of various mental health issues that make it difficult for students to pay attention in the classroom. So if there is such a strong relationship between nature, the reduction of ADHD symptoms, and academic success for all students, why is this form of instruction so under-valued in our school system?

### **Methods and Procedures**

In order to answer my research questions and gain a better understanding between the potential benefits and barriers of implementing nature-based education into the curriculum, I knew that I needed to reach out to professionals in the field as well as parents with first-hand experience with children who have ADHD. I compiled a small list of questions for the two

groups in order to get their input on elementary students with attention deficit disorders. To retrieve this data, I sent out various emails and surveys as well as interviews conducted over the phone. I set out a goal to contact individuals from my study groups by March 31, 2022 and was able to complete my interviews by May 4, 2022. The interview questions shown in Appendix A and B were derived from the primary and secondary research questions in my Capstone prospectus. I chose to conduct my interviews on this basis because it allowed me to organize my thoughts and drive the questions I needed to answer.

Depending on who I was communicating with, the questions were provided to fit their expertise. For example, the questions for the two parents (See Appendix B) are different from the questions that were given to the two educators (See Appendix A) that I spoke with. Because two of my secondary research questions relate to state requirements, Common Core standards, and curriculum interventions at the district level, more questions were given to the early elementary school teachers. Fortunately, the answers I received allowed me to deepen my research on nature-based learning and the potential of its academic influences.

### **Results, Findings & Discussion**

In this section, I will be answering the supplemental research questions from the results of my interviews as well as the findings from my research. Next I will expand on the information from my sources that I deem most important to my research topic. In addition to this, I will include direct quotes from the various teachers and parents who I have interviewed. Finally, I will share my thoughts and observations on nature-based education in the classroom and how it affects children with attention deficit disorder. The answers derived from my interviews will help

guide me to answer my primary research question: How can nature-based education be used successfully to improve the success and wellbeing of children with attention deficit disorders?

*What is nature-based education? What does this entail?* I chose to speak with two teachers from different counties in California, as I wanted to get a read on how this form of education could be implemented in a variety of schools. The teachers chosen were both early childhood educators because I wanted to focus on elementary students grades K-2. Out of the two teachers spoken to, one is a kindergarten teacher and one is a second grade teacher here in Monterey County.

*Are there any schools that you know of who have implemented a nature-based curriculum for elementary school students? If so, what does that look like?* The first teacher I spoke with was Heather Myers, a kindergarten teacher from Ojai, California. She has been teaching for 25+ years in the Ojai School District and has been fortunate enough to teach in a town that offers great environmental resources. Despite access to an abundance of green spaces, her answers reflected that a more traditional curriculum persistently takes place. When prompted with the question above, she stated the following:

The only school I am aware of who has a nature-based approach is Pierpont Elementary School in Ventura. They are located close to the beach, and do a majority of their marine science activities there. (H. Myers, Personal Communication, 2 April 2022)

To Ms. Myers, a nature-based education means that students have the right to be outdoors for more than a few hours a day or during recess and lunch.

When I was younger, we'd have time on the playground to be outside, and then we'd go home after school and see how long we could stay out before our parents reeled us back indoors for dinner or homework. After speaking with parents of my kinders, kids are getting outside for half the amount of time we used to. It's sad to me. Learning in outdoor environments could help with this and would move young children away from staring at screens all day. With new technology being embedded in our classrooms, they spend

more time with electronic devices than they do with organic materials. Most of my students, especially post-pandemic, know how to turn on an iPad, find YouTube and look up a video but do not know how to cut construction paper with kid scissors. Nature-based learning would show them how to explore and have the motor skills they need at ages five and six. (H. Myers, Personal Communication, 2 April 2022)

*What do teachers say about the emotional and behavioral benefits of nature-based education programs for elementary school students with attention deficit disorders?* When I asked her what the benefits and barriers of implementing this type of program would be, she responded:

Even though children are diagnosed with ADHD as early as age 3, we do not test for this in kindergarten, it's not mandatory for us to do so. We are also not required to conduct special testing for learning disabilities either but we do test for autism. When they're younger, it's harder to detect the symptoms of ADHD because symptoms are common in most children ages 5-6. They naturally move around a lot in class and have trouble staying focused. In kindergarten and especially in preschool, kids are learning how to be a student and behave in a classroom. Sometimes we'll have a kid that is continually disruptive and deters their own learning and others' and this will lead us to assume that the child has an attention disorder, but we are still not allowed to test or discuss with a parent unless they inquire about it first.

In terms of benefits, I can see many for every type of kid. As I mentioned before, young children simply do not go outside enough and it shows in how restless they are before and after structured play time like recess and lunch. Field trips warrant a type of frenzy that we didn't used to see as often pre-pandemic. My co-workers can agree with me that after COVID-19 our students' anxiety became more severe once we resumed in-person learning – they had to be back inside a classroom for half the day and didn't know what to do with themselves. I can see ADHD presenting itself in students as a result of severe anxiety from the pandemic, an event that kept most of us inside for long periods of time. The biggest benefit I see with nature-based learning is that it could be used as a tool for health promotion. Being outside is known and proven to improve our mental health. I can especially see this type of instruction working for older grades who can handle themselves better outside of class. (H. Myers, Personal Communication, 20 April 2022)

When asked about specific emotional and behavioral benefits of nature-based learning activities, she responded with: “From a kindergarten perspective, it benefits their emotional

health by supporting and developing Social-Emotional Learning (SEL) awareness, a goal of which is attention and impulse management in the classroom. For their behavioral health, it's beneficial for kids who need those body breaks or more wiggle room in general. Kindergarteners are not meant to sit inside a classroom all day, they need variety" (Personal Communication, 20 April 2022).

After sharing the benefits of nature integration in her classroom, Ms. Myers was excited to share the type of activities she does with her students to fulfill SEL curriculum requirements.

Some of our weekly outdoor activities include, silent reading time out on the grass, special stations such as Earth Day, a Signs of Spring Nature Walk, and a 5 Senses Walk. (H. Myers, Personal Communication, 20 April 2022)

I also had the opportunity to speak with Clint Cornfield, a second grade teacher at International School of Monterey in Seaside, CA whose previous employer was Monterey Bay Aquarium. I was lucky enough to complete my last service learning requirement with his second grade class last semester, and noticed nature-based learning being utilized on a weekly basis. When asked the same question about emotional and behavioral benefits of nature-based learning activities, here is what he had to say on the matter:

I don't have the research in front of me, but back when I worked at the Aquarium we had a presentation that specifically cited research that showed a) schools with a strong emphasis on outdoor education led to lower rates of behavior issues, and b) there was a direct correlation between improved mood/outlook and spending time in the outdoors in an education setting. Anecdotally I can tell you that the kids who exhibit ADHD tendencies often find a way to focus better and direct their energy towards the learning engagement when we're learning outdoors. Sure, there will always be kids who ignore you and just decide to play with rocks, but the good outweighs the bad. (C. Cornfield, Personal Communication, 4 May 2022)

*According to you, what are the disadvantages of implementing nature-based education within the curriculum?*

Depending on the school's location, there might not be any decent outdoor location to go; we're fortunate to be in an area with tons of outdoor learning spaces both on-campus and in the nearby community. Logistically, the biggest issues I've seen are teachers who don't know how to properly manage students while outside, but that's something that teachers need practice with. (C. Cornfield, Personal Communication, 4 May 2022)

*What are the state requirements and standards when it comes to nature-based education in elementary school classrooms?* Clint Cornfield had many insightful things to say about nature-based education in relation to California's environmental requirements, noting the following:

I'm not aware of any requirements/standards that explicitly talk about outdoor education, but NGSS (next-generation science standards, our national science standards) definitely emphasize hands-on investigations. Depending on the grade they might call it outdoor education, but I'm not sure. I can at least speak for 2nd grade and tell you that one of our standards asks kids to develop an investigation to determine if plants need sunlight/water to grow so that actually lends itself to having us get outside into the school garden to plant some flowers, do experiments on them, etc.

*Are there any schools that you know of who have implemented a nature-based curriculum for elementary school students? If so, what does that look like?*

I don't know if they've got a dedicated curriculum, per se, but my wife works at Bay View Academy (another charter school in Monterey) and they have a dedicated Outdoor Ed teacher; she plans camping trips, outdoor learning experiences, etc. I know she kind of got shafted when the pandemic hit (the school had a few trips planned for the start of this school year but they all were postponed due to high outbreaks of COVID; they've all been rescheduled to this month) but they're doing some cool things now. (C. Cornfield, Personal Communication, 4 May 2022)

And finally, each teacher was asked: *What are ways in which schools can encourage more nature-based learning in their curriculum in order to aid students with ADHD?* Here is what Heather Myers had to say on this subject:

Proper funding would encourage us to gather more materials and training to teach outdoors could be made possible. If nature-based learning was to take place here, or at any public school, materials and supplies would need to be there, and be there continuously every year following. Teachers will always need support from administration and the community, which includes the parents. We do get a lot of encouragement to try new things from parents whose kids have autism so I can assume that the same type of support would be there for ADHD modalities. (H. Myers, Personal Communication, 20 April 2022)

This statement connects to (Banilower et al., 2013), who noted that school funding will always be a primary concern of teachers when a new curriculum is introduced. When asked the same question, Clint Cornfield was readily able to discuss the various ways in which elementary schools can encourage more nature-based learning. “There are so many authentic, real-world reasons to get kids outside that directly relate to educational outcomes” (C. Cornfield, Personal Communication, 4 May 2022). He connected these real-world reasons to activities that can take place in order to support nature-based learning. Among the activities stated were creative writing, the arts, and science investigations. He concluded his answer with the following statement:

All of these activities can allow students - with and without ADHD - to connect with the curriculum and enjoy learning. (C. Cornfield, Personal Communication, 4 May 2022).

When asked about what would be required by the school in order to implement nature-based learning into the curriculum, Heather Myers gave the following response:

All new standards would need to be created, since we do not have this type of curriculum at my school (yet). I can see us implementing this in the future, because our district has

access to a lot of outdoor resources for kids. When I first started out we had a lot more freedom in both our curriculum and in our teaching, but we don't have that freedom any more. On top of general freedom, we do not have enough time for this type of program because there are so many requirements being pushed onto us by the state and with our district administrators. When you want to add a new curriculum, there needs to be money for it. Right now we do not have that kind of funding. Teachers pay out of pocket and spend enough of their own money as it is, but if we had the funding to do all of these extras, we would. Proper funding would encourage us to gather more materials and training to teach outdoors could be made possible. If nature-based learning was to take place here, or at any public school, materials and supplies would need to be there, and be there continuously every year following. (H. Myers, Personal Communication, 20 April 2022)

A major symptom of Attention Deficit Hyperactivity Disorder is lack of ability to regulate behavior in attention-driven settings. It is the “most prevalent psychiatric disorder that frequently persists into adulthood, and there is increasing evidence of reward-motivation deficits in this disorder” (Volkow, 2009). When discussing symptoms with parents of ADHD children, two out of the three parents said that the biggest struggle they have with their child's hyperactivity is their behavior. These parents will be referred to as Parent A-C, and their children Child A-C for the remainder of this discussion, as they preferred to remain anonymous.

*At what age was your child diagnosed with ADHD? What presentation do they have?*

Parent A had a lot to say about her child's journey leading up to his diagnosis. Child A was four when given a diagnosis from a psychiatrist and showed typical, disruptive behaviors early on. “He was part of a cohort at school that was very well-behaved in class, so he stood out drastically. I was encouraged by his teacher to seek professional help because of this.” (Personal Communication, 12 April 2022). It was revealed after diagnosis that her child was of the hyperactive presentation, as he had difficulty staying seated during class, often interrupted lessons to wander the room, fidgeted in his desk during activities, and had a hard time regulating

negative emotions. She also noted that “unlike a lot of parents who have kids at this age, I could tell he was predominantly hyperactive. It wasn’t even a question”.

When prompted with the same question, Parent C was able to provide insight into the mind of his now fifteen year old son, who received the same diagnosis and attention deficit presentation at age five.

[Child C] just could not sit still. Ever. He is a very bright kid but his attention span has always skewed toward his interests. He still struggles with that, and gets in trouble with certain teachers but easily excels in his favorite subjects, which are science and physics education. He is constantly moving even still therefore subjects that allow him to explore or be active are best suited. When he was younger it was similar, but worse. Like many kids, he looked forward to recess breaks, field trips, science experiments, and after school sports because it took him outside of the class. (Personal Communication, 14 April 2022)

The idea that attention control is determined by our interests is also explored in Volkow’s 2009 clinical study on the reward-system in relation to low dopamine levels in the ADHD brain. This neurological offset often results in poor classroom behavior, which is what Parent C claimed to experience with his child’s condition. “He was diagnosed in kindergarten, but wasn’t like the other kids who couldn’t stay in their seat or follow directions. He was always getting in time-outs or getting into trouble because he couldn’t control himself. I was always getting phone calls from his teacher or the office.” (Personal Communication, 19 April 2022).

*What methods have you/do you use to assist your child's attention disorder?* This question wielded a wide spectrum of responses, as each parent had to attempt more than one method to aid their child’s neurodivergence. This can be a stressful position for a parent, as discussed in the research work of both Dillon (2011) and Hunter (2020). Feelings of self-blame

were reported among the three parents interviewed. Parent B, in particular, had a lot to say on the matter:

When she was 7 and got her diagnosis, I had two jobs, a four year old, and my husband was working full time. Now my youngest is a bit older and we know more about ADHD but it was hard to watch her struggle for those first few years. She really struggled with school as subjects became harder and demanded more from her (reports would come back with notes about her getting distracted easily in class). Or, if she did turn in an assignment the teacher would say there were major pieces she was missing. We put a lot of blame on ourselves for not being able to give her extra homework help or try to come up with solutions for her forgetting important assignments. I was really embarrassed and thought I was a bad parent for not knowing how to fill those academic gaps. (Personal Communication, 14 April 2022)

Parent B also communicated that she and her husband did not know much about ADHD, that it was “overwhelming to understand and gather resources for her” at the head of her diagnosis. Her child has the inattentive presentation of ADHD, which is more subtle than the other presentations and widely underrepresented in females (Rucklidge 2008). According to the Centers for Disease Control and Prevention, typical inattentive ADHD behaviors include, but are not limited to, difficulty staying organized, getting distracted easily, leaving tasks incomplete, frequently losing personal belongings or valuables, and avoiding tasks that require sustained amounts of concentration. Parent B notes that getting her daughter outdoors has been one of the best interventions to these behaviors.

[Child B] We go on hikes almost every weekend and she really enjoys them. If we miss a weekend or two, she will remind us and urge us to go the following one. We also go on walks and she enjoys that as well. Maybe even more so, she loves riding her bike with friends, on the bike trail or in our neighborhood. My husband had the idea to ride our bikes with her to school in the morning to see if it would help her. Her teachers reported that she was much more alert and responsive in the morning after we started doing this with her. I think moving her body and doing an activity that does not take a lot of attentional effort gives her room to focus in school (and relax a bit), at least for those first few hours or so. (Personal Communication, 14 April 2022)

When given the same question, Parent A stated that homework help done in their backyard has been the best method in assisting his child's attention issues. "If the weather permits it, my wife and I do homework outside with him. Initially, we thought this would distract him more since it's a less controlled environment but he actually looks forward to it and will suggest it if we don't first." (Personal Communication, 12 April 2022) Parent C also cited the benefits of his child taking their homework outside and made it a point to say that his son, now a teenager, "still sits outside with his computer to do his homework". (Personal Communication, 19 April 2022) This parent reported

*Have you noticed a difference in your child's behavior once they are in an outdoor setting? If so, please explain what you have observed.* Each parent recognized nature as a beneficiary to their child's behavioral issues, namely the two parents with hyperactive children. Parent A said that his is a "different child" when he is out in nature.

[Child A] is highly explorative of his surroundings and goes into an entirely different mindset when he is outdoors. I think environmental sciences will be a strong suit of his, because he is very insightful in regard to ecosystem functions and species relations at such a young age. When he is stimulated by nature he is almost serene in comparison to the restlessness he gets from being inside for too long. (Personal Communication, 12 April 2022)

*Do you think your child would benefit from a curriculum that is nature-based? Why or why not?* It was noted that all parents saw a need for alternative curriculum. Parent B noted that her child "shows noticeable differences in mood and attention after she has spent time outdoors" (Personal Communication, 14 April 2022) and even claims to have encouraged teachers to do the same. While each parent expressed an interest in this type of learning integration, they all expressed an understanding for school expectations. Parent A seemed to be most interested in this type of curriculum, as he recalled his child's interest in the environment and life sciences.

Through the information collected in the Results, Findings and Discussion section, as well as the reviewed literature, I was able to answer my secondary research questions. Results from the interviews above suggest that everyday outdoor settings make a large difference in overall symptom severity in children with ADHD. Teachers noted improvements in their students' engagement with learning, concentration and overall behavior after being immersed in natural environments. In addition to this, the teachers interviewed recognized many positive impacts on health and wellbeing. It is safe to say that these benefits would also improve the daily job satisfaction of any teacher. Among the educators interviewed, each of them said that curriculum demands were barriers to the implementation of nature-based learning in elementary schools. One teacher noted that this would be especially difficult to be approved for early childhood education but would be a stronger possibility for older elementary grades but that daily interaction with the outdoors would be beneficial for her kindergarteners' emotional health.

Embedding outdoor learning within the curriculum requires education administrators to place higher value on this type of learning approach rather than where it is placed now, on academic performance based on state standards. And if this were to happen, funding must also be provided. The teachers interviewed were both interested in embedding nature-based learning into the curriculum, but shared concerns about limited funding, proper training and support from administration, parents and the community. Speaking with parents of children with ADHD allowed me to see that there would be parental support on this integration, as all three reported significant improvements in their child's behaviors, attention, and overall mood after time spent outdoors. I feel confident in saying that nature-based education would be helpful for students, parents, and teachers alike. The education system also benefits greatly from teachers who take initiative in school change.

## **Challenges and Limitations**

There are a number of limitations to review when considering the findings from the literature collected and statements from the educators who were interviewed. With increasing pressure to meet standardized testing goals and demonstrate measurable academic growth, educators are facing extreme pressure to accomplish more within their classrooms but are given limited time, resources, and support to do so. As reflected in the Literature Review section of this Capstone, teachers reported improved classroom behavior after immersing their students in nature. This proves that by integrating nature into the curriculum, all students, including those with ADHD, are in a relaxed place and are able to focus better on traditional subject materials such as mathematics, science, social science, writing, history, and english, which would fulfill curricular aims.

I also found that it was difficult to get surveys back in a timely manner, and that organizing interviews with five individuals was a bit difficult to do in one semester. This put a limit on the amount of time I had to encourage my interviewees to elaborate on their thoughts. Having this time constraint challenged me to find creative solutions and make critical decisions about moving interviews to an online setting. My communication skills improved drastically through this process and it also gave me the opportunity to make good use of online resources.

Finally, there is not much quantitative research done on the overall success of nature-based education for elementary school children with Attention Deficit Hyperactivity Disorder, therefore the benefits are pulled purely from qualitative and observational data. Although there is debate on whether or not these programs would benefit older elementary school children with ADHD, I'd say that an early intervention is needed for these individuals in the same way it is required for teachers to test early on for autism. Perhaps special testing does

not need to take place as early on as kindergarten, but it is safe to assume that early education teachers, parents and students would benefit greatly from learning done outdoors.

### **Recommendations**

This section of my Capstone gives me the space to suggest ways in which nature-based learning can become more present within the state curriculum and helps answer my secondary research question, *What are ways in which schools can encourage more outdoor learning in its curriculum to support elementary school children with attention deficit disorders?* After reviewing the literature, speaking with early childhood education professionals, and interviewing parents who have first-hand experience with Attention Deficit Hyperactivity Disorders, I was able to deepen my understanding on the obstacles that come with implementing new curriculum in elementary schools.

In order to overcome these barriers and integrate nature-based learning within the school setting, schools need financial support at the district level. Despite research that highlights the many cognitive, physical, social, and academic benefits of outdoor learning, this type of curriculum requires training and appropriate resources designed to support teachers. As a result, elementary schools would need to become more aware of the lasting effects of ADHD on one's learning experience. This would also call for a complete curriculum reform, which I do not believe public schools are ready for just yet.

My second recommendation is for teachers and parents alike. I would suggest that they take sedentary activities that require limited materials and move it to an outdoor setting. The two teachers interviewed noted that they do this every week with their students; Ms. Myers takes her students outside for silent reading time and Mr. Cornfield takes his class on weekly visits to the

school garden. Parents can do the same for their children in their own households. Out of the three parents who were interviewed, two of them mentioned that they take homework help outside and listed many positive changes in their child's attention and behavior control.

My next recommendation is that teachers can partner with local environmental organizations. Both teachers expressed a need for support from the community in order to provide these types of programs. There are many community organizers dedicated to environmental learning that would gladly partner with elementary schools. These organizations could guide field trips and provide an entire year's worth of environmental curriculum. While a teacher may not feel comfortable adding nature-based education to their traditional curriculum, trained community educators can supplement what is missing. In connection to this, my last recommendation is that teachers can find ways to include exposure to nature in the traditional subjects they are required to teach. For example, nature-based education could be added to geography lessons, life science activities, or other similar subjects that demand more space in the curriculum, making learning more experiential and hands-on for the student.

It is for these reasons, among many others, that most early childhood professionals believe schools have the greatest potential and obligation to provide students with access to natural learning environments. A wider support from administration, parents, and the community would encourage a teachers' intrinsic motivation to supplement their students with nature-based learning. This form of instruction is not restricted to the indoor classroom setting; taking learning outside and into the natural world provides the opportunity for an integrated, cross-curricular approach to achieving academic success.

## **Conclusion**

In all areas of this Capstone I have developed into a more well-rounded student and developing educator. Having the support to reach out to various experts in the field has allowed me to think critically about solutions for students who struggle with traditional learning modalities. This paper allowed me to gain a greater appreciation for nature-based programs, and a better understanding of its wider benefits to elementary students with Attention Deficit Hyperactivity Disorder. As with the intervention of many school curriculums, the implementation of nature-based learning does not come without its challenges and a number of barriers that prevent schools from embedding regular outdoor learning for students. Learning more about these obstacles has helped me understand the concerns parents and teachers share about the introduction of new curriculum. If adults do not feel comfortable in nature, we cannot expect them to guide children's outdoor learning experiences. They need to feel supported so that they can support their students; more training and engagement for schools as well as proper resources from administration is also required if nature-based learning is to become a more mainstream method in addressing curricular aims.

Substantial evidence, as discussed in the Literature Review section of this Capstone, strongly indicate that harmonizing nature-based learning approaches with traditional learning methods offer students opportunities to develop their knowledge and skills in ways that add value to their everyday experiences inside the classroom. Academic environments provide excellent opportunities to present a curriculum that engages students in reaching their full potential while also defining their future health outcomes, therefore eliminating health and educational inequities. Nature-based learning is beneficial to a student with ADHD, as it taps

into the underfed brain circuits that are constantly seeking unregimented learning modalities. It also acknowledges their learning style and provides them with an opportunity to refocus. Traditional learning styles coincide with traditional curriculum. But if Attention Deficit Hyperactivity Disorder is diagnosed as commonly as it is, then we are doing a disservice to those underrepresented students.

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