5-2018

Natural Learning Environments and the Social-Emotional Development of Students with Sensory Processing Challenges

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Natural Learning Environments and the Social-Emotional Development of Students with Sensory Processing Challenges

by

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A culminating thesis submitted to the faculty of Dominican University of California in partial fulfilment of the requirements for the degree of Master of Science in Education

San Rafael, CA

May 2018

This thesis, written under the direction of the candidate's thesis advisor and approved by the department chair, has been presented to and accepted by the Department of Education in partial fulfillment of the requirements for the degree of Master of Science in Education. The content and research methodologies presented in this work represent the work of the candidate alone.

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Abstract

This study examined the impact of a natural learning environment on the social-emotional development of students with Autism and/or Sensory Processing Disorder. For this research, social-emotional development consisted of social behavior, communication, and participation. The elements of a traditional classroom are characterized by confinement, harsh lighting/acoustics, and other habitual triggers for sensory discomfort. A natural learning environment can provide students with natural stimuli, fresh air, natural acoustics, natural lighting, etc. Additionally, the natural learning environment fosters a connection with nature, which research shows is important for the self-discovery, self-advocacy, and self-efficacy of all humans. Considering the artificial nature of the traditional classroom, this study attempted to inquire into how natural settings can serve as the Least Restrictive Environment for students with sensory processing challenges. Previous research regarding natural learning environments has been predominantly carried out among neuro-typical individuals.This study was conducted with a sample of seven students with sensory processing challenges in natural learning environments wherein they engaged in academic and social learning. Data was collected through surveys, observations, and field notes. Results identified that the natural learning environment was conducive to increased sensory regulation, a less restrictive learning environment, and a greater sense of self-advocacy and efficacy from a connection with and exposure to nature.

Acknowledgments

First and foremost, I want to thank my amazing husband for everything he has done for me. James, I would not be where I am now if our paths had never intertwined. There are no words that I can put on one single page to express how much your love and support mean to me. Thank you for everything. To my parents and my little brother, thank you for your continued support in all my endeavors. Thank you for the phone calls, the venting sessions, and for always showing me love through all my various stages of life! To Britton, Rachel, Rose, and my other Dominican cohort, especially Alex Z., thank you for not only being my partners in academia, but for being such supportive, encouraging, and wonderful friends. To my thesis supervisor, Jennifer Lucko, a huge thank you for your support, care, and assistance throughout my time at Dominican and through my writing process! I've thoroughly and wholeheartedly enjoyed my journey! Lastly, to my students, this is all for you. You may never read this, but you are some of the most wonderful individuals I have ever known, and it is my promise to never stop advocating for you and other kids like you. I love each of you so dearly and I hope you never forget your immense worth and value in this world.

Chapter 1: Introduction

Children are expected to spend six to eight hours per day for 12-14 years of their lives within the confines of classrooms. This amounts to roughly 15% of their entire lives. The traditional classroom environment has been relatively unchanged within the past century: desks facing a central focal point, four walls, fluorescent lights, and the occasional light-giving window. While educators agree that all students learn differently, and curriculum and modifications have addressed diverse learners, why has the classroom environment not been altered accordingly? This question is particularly relevant given that the number of diverse learners in the classroom has significantly increased in terms of Autism awareness and diagnosis. The Center for Disease Control (CDC) estimates that Autism prevalence has increased 78% over the past 20 years, and the current estimates indicate that one in 68 children have Autism Spectrum Disorder, also referred to as ASD (Christensen et al., 2016).

Autism Spectrum Disorder (ASD) is a social/behavioral disorder which is characterized by social challenges, maladaptive behaviors, cognitive dysfunction, a lack of empathy, and is often accompanied by Sensory Processing Disorder (SPD) (Levy, Mandell, & Schultz, 2009). Not all individuals affected by sensory processing disorder are also affected by Autism. In fact, the majority of those affected by sensory processing disorder are not on the Autism spectrum. However, over 75% of people with Autism suffer from a significant form of sensory processing disorder (Crane, Goddard, & Pring, 2009).

Those with Autism often suffer from sensory processing challenges that cause sensory input to become aggravating, discomforting, and even agonizing. Common sounds, touches, scents, and light levels are felt on a drastically more intense level than non-affected individuals. For example, the rub of a maker's label on a t-shirt, the sound of a leaf blower, the smell of certain scents, or even the slightest brush against one's hand may trigger extreme discomfort and even pain. Those affected often exhibit maladaptive behavior such as elopement, screaming, vomiting, and even aggression in response to these stimuli (Baranek, Foster, & Berkson, 1997; Brown & Dunn, 2010). Due to the nature of their sensory, social, emotional, and behavioral needs, children with Autism often require accommodations, modifications, and additional mechanisms as outlined in the child's Individualized Educational Plan (IEP) to assist with the achievement of educational success in a public education setting.

Background and Need

Until 1975, children with disabilities, including what we now know as Autism, were alienated from public education, with some areas of the United States prohibiting students with disabilities from enrolling in the public school system (Wright & Darr-Wright, 2006). The Education for All Handicapped Children Act was introduced in 1975, referred to today as the Individuals with Disabilities Education Act, or IDEA (National Education Association of the United States, 1978; Individuals with Disabilities Education Act, 2004). With the introduction of this act, millions of children with disabilities were granted equal access to a free and appropriate public education. In addition to being granted

public education rights, children with disabilities were given the right to education within their least restrictive environment, or LRE. A more restrictive environment would limit access to neurotypical peers, general state curricula, and other opportunities/activities (Rozalski, Stewart, & Miller, 2010).

While the least restrictive environment promotes equality, it does not necessarily promote equity for students with sensory processing challenges. The traditional classroom, in which students spend most of their day, is unfriendly and potentially damaging for children with more severe sensory processing issues, such as those on the Autism spectrum. The classroom population has changed significantly over time, but the environment has not. Most children are still spending the majority of their day in a sterile, artificially lit classroom with little access to natural spaces besides blacktop and playground environments. This experience is potentially unfair and unfriendly to children who have sensory needs that are different from their neurotypical peers. Alternatives to the traditional indoor classroom are worth considering in order to adhere to the guarantee of least restrictive environment for children with ASD/SPD, especially a more natural learning environment (Louv, 2005).

The rationale for researching the effect of an outdoor learning environment with this population comes from the current researcher's time teaching at a non-public behavior management school for children with Autism and behavioral needs. The students in the researcher's class have a primary diagnosis of Autism and/or have demonstrated sensory processing difficulties. There have been considerable observations of lower levels of sensory distress while these nine

students engage in outdoor activities (hiking, biking, laying in the grass, playing outdoors, etc.). As such, increased social communication, participation, and a reduction of maladaptive behaviors have been previously noted.

Much of the research on the benefits of natural environments has primarily been conducted on the neurotypical population, and these studies indicate that exposure to nature and/or natural environments is beneficial for the physiological and psychological wellbeing of adults. The specific benefits included: increased attention, emotional regulation (Hartig et al., 2003), and increased social interaction (Taylor et al., 1998). Additionally, adults with exposure to nature reported that breathing in the natural air and odors produced a positive effect on mood, vitality, and gave participants an increased sense of calmness (Weber & Heuberger, 2008).

Additional studies have indicated the same effects on children, including an increase in interactions between the child and their peers and/or parent, improved communication, and a general increase in mood from being outdoors (Alexander et al., 1995; Waliczek et al., 2001; Dirksa & Orvis, 2005). These studies, however, focused only on neuro-typical populations, and very little has been researched regarding the effects of the outdoors on individuals with Autism, especially children.

Problem Statement

There is little to no significant research studies that have examined the connections between potential benefits of a natural learning environment on the

social, emotional, and academic development and wellbeing of children with Autism/Sensory issues. Most of the previous studies regarding natural environments and ASD/SPD have a recreational focus, emphasizing adventure activities and play (Chang & Chang, 2010). This study has a focus on the natural learning environment as an alternative educational environment for students with sensory challenges.

Statement of Purpose

Since the therapeutic effects of nature are well documented (Breunig, 2008; Garst, Scheider, & Baker, 2001; Louv, 2005; Louv, 2008; Wilcox, 2017; Scott, Boyd, & Colquhoun, 2014), the purpose this research was to observe the potential effect of a natural learning environment on the social-emotional development of children with Autism and/or Sensory Processing Disorder. Since there have been studies that indicate the benefits of contact with and/or exposure to nature for children with Autism (Brincker & Torres, 2013; Chang & Chang, 2010), the aim of this study is to examine the experience of seven students with Autism in an outdoor learning environment in order to determine its impact on the social communication, behavior, and participation of those children.

Research Question

This was a qualitative study which inquired into to the question: What are the effects of a natural learning environment on the social behavior, communication, and academic participation of seven students with Autism and/or Sensory Processing Disorder at a non-public school in Northern California?

This is an extremely vulnerable population, so the research was conducted with the utmost care, attention, and confidentiality. Students, their parents, and paraprofessionals/teachers completed surveys about experiences in outdoor environments. The seven paraprofessionals working in the classroom recorded data related to behavioral issues on a daily basis as well as the location within which the behavior occurred. Any maladaptive behaviors and/or communication/participation observations which were witnessed in the traditional classroom environment were gathered to establish a baseline prior to the introduction of the outdoor learning environment sessions.

The study took place over the course of four weeks, taking seven out of the ten students into natural environments (beach, forest, meadow) to engage in typical school activities (story, academic work, group work, collaborative activities, mindfulness practice, etc.). The paraprofessionals documented observations and collected data as per the traditional school day.

After the completion of the one month of learning sessions in the natural environment, the researcher examined the data collected (field notes, surveys, observations, behavior charts). The researcher compared this data to the baseline data to ascertain if any changes resulted from the project. Frequency of behavioral issues was analyzed to determine if the outdoor classroom contributed to any changes in behavior patterns and/or occurrences. Additionally, paraprofessional/researcher observations regarding increased/decreased social communication and participation helped in determining any changes observed

over the research period. Interviews and surveys were coded and analyzed to understand experiences of the natural learning environment on these students.

Summary of Findings

Nature proved to be a successful strategy for sensory regulation, with students taking off their shoes, rolling toes in the sand and/or grass, rubbing/smelling leaves, spinning in the sunlight, and other positive sensory interactions and experiences. Student surveys indicated that more positive emotions and experiences are associated with outdoor environments, with students frequently using the words “happy”, “calm”, and “relaxed” to describe their feelings when in nature. Words with negative connotations such as “sad”, “mad”, and “too loud” were used to describe their feelings while indoors. Frequency of behavioral incidents decreased in the natural learning environment, which may have been due to the students’ ability to better regulate their sensory input. With students demonstrating greater sensory and behavioral regulation, they showed higher levels of engagement, participation, and retention skills in their academics than observed in the classroom.

Due to the behavioral, academic, and sensory regulation improvements, the natural learning environment proved to be an excellent learning environment for these seven students with sensory processing challenges. Nature provided a space in which students could process sensory stimuli with greater ease than in the classroom, which made for a more conducive environment for academic participation, a decrease in negative target behaviors, and an increase in social communication. Additionally, the students social-emotional development was

positively impacted by the exposure to nature, as students were able to demonstrate self-efficacy and self-advocacy, which is rarely observed in the classroom.

The ability to take students to natural learning environments is not always feasible due to budgetary, transportation, and access issues and barriers. However, there are steps that can be taken by educators and parents to ensure that students with sensory processing challenges are being educated in a more equitable manner. Some of these steps include increasing classroom sensory strategies, incorporating plants into the classroom, adding an outdoor area for specific academic time, and/or adding a designated desk/table for students to engage in academics.

The results of this study are significant for the educational and social-emotional wellbeing of students with sensory processing challenges. The exploration of the natural learning environment as an alternative learning environment for students with sensory needs is a way to promote educational equity. Students with ASD/SPD have been historically disadvantaged by being expected to learn and thrive in an environment which is potentially detrimental to their learning. Nature in and of itself was found to be a highly effective strategy for sensory regulation for students with sensory processing challenges, making the natural learning environment a less restrictive environment than the traditional classroom.

Chapter 2: Literature Review

A burgeoning body of scholarship links time spent in natural environments with human physiological and psychological health benefits (Breunig, 2008; Garst et al., 2001; Louv, 2005; Louv, 2008; Wilcox, 2017; Scott, Boyd, & Colquhoun, 2014). Studies carried out across various disciplines indicate a profound reduction in levels of stress, and improved cognitive function (Bass, 2012; Bredderman, 1983; Breunig et al., 2015; Haury & Rillero, 1994; Obenchain & Ives, 2006; Scott et al., 2014) However, despite strong evidence for the positive effects of time spent in a natural environment for neurotypical children, studies indicate that the average child spends an average of seven hours per day in front of a screen, and a shocking 30 minutes per week outdoors between the ages of eight to eighteen (CEQ 2011). With such a lack of time spent in natural environments, many children have developed the idea that nature is remote, dangerous, inaccessible, and something to fear (CEQ 2011, Louv 2005).

In his 2005 book, Last Child in the Woods, Richard Louv coined the term, Nature Deficit Disorder (NDD). According to Louv, Nature Deficit Disorder is caused by the lack of outdoor exposure children receive, which, he asserts, contributes to significant social and behavioral issues (Louv, 2005). With the increase of screen time and time spent indoors, humans are becoming further removed from nature (CEQ, 2011; Louv, 2005; Louv 2008). Louv argues that exposure to nature is essential to healthy human development, specifically in terms of the emotional health of children. One of the ways with which Louv indicates that nature deficit disorder is affecting children is through the lack of

ecological identity. He suggests that humans form their connections with nature through their experiences and interactions with natural environments, and that the way in which we understand ourselves within the context of nature is infused in shared experiences, understandings and definitions of nature (Louv, 2005; 2008). Given that the majority of a child's day is spent in the classroom and considering the positive benefits of nature exposure to children of both neurotypical and neurodiverse populations, it is important to explore the potential consequences of the traditional classroom environment for children with Autism and/or Sensory Processing Disorder (ASD/SPD).

Autism/Sensory Processing Disorder

In the last several decades, our understanding of the factors that affect student's level of educational success has greatly increased - recognition of different learning styles, the impacts of neurological conditions, and other individual differences now commonly integrated into lesson plans in classrooms across the country. In tandem with this growing recognition of neurobiological and psychological factors, we have seen the ongoing implementation of regulation and legal framework to support the needs of diverse learners by ensuring their rights to learn in the least restrictive environment according to their needs.

According to the Individuals with Disabilities Education Act (IDEA), a least restrictive environment (LRE) means that a student who has a disability should have the opportunity to be educated with nondisabled peers, to the greatest extent appropriate. Alternative placements (such as an outdoor learning

environment) are, according to official language in I.D.E.A., "intended to ensure that a child with a disability is served in a setting where the child can be educated successfully in the LRE” (71 Fed. Reg. 46587). For children with disabilities, there has been a long-supported idea that inclusive education better prepares students for a more successful and independent adult life.

However, the traditional classroom has not proven to be an environment conducive to learning for children with sensory issues. Sensory Integration Theory states that “processing and integration of sensory inputs is a critical neurobehavioral process that strongly affects development" (Ayers, Robbins, and McAtee, 1979). Individuals with sensory processing issues experience difficulty with the reception, modulation, integration, discrimination, and organization of sensory stimuli (Fernández-Andrés, Pastor-Cerezuela, Sanz-Cervera, TárragaMínguez, 2015).

In a 2014 study of sensory dysfunction within the home and classroom environments for children with and without Autism, significant statistical differences were observed within individuals with Autism versus the control group. Sensory dysfunction was measured through the Sensory Processing Model (SPM), which is based on Sensory Integration Theory. The SPM analyzes sensory inputs utilizing various methods: visual, hearing, touch, body awareness, balance and motion, planning and ideas, and social participation. The data collected within the SPM was then analyzed to determine the Total Sensory System, or amount of general sensory dysfunction experienced in the classroom environment. In exposure to the classroom environment, sensory dysfunction was reported to be much more prevalent in children with Autism, especially within

the areas of social participation, touch, planning and ideas, and hearing. The results indicated that specific issues within the classroom environment, including environmental factors, the demand of school assignments, acoustical factors, extreme lighting conditions, fluctuation of noises, unpredictability, and overstimulation can cause significant sensory dysregulation and distress in children with Autism and/or sensory processing issues (Fernández-Andrés et al., 2015).

Difficulties in sensory processing have been reported frequently among individuals on the Autism spectrum (Kern et al., 2006). The comorbidity rates of Autism and sensory processing disorder vary throughout multiple studies. However, they show a significant coexistence with comorbidity ranging from 45% to 95% (Ben-Sasson et al., 2007; Leekam et al., 2007; Tomchek & Dunn, 2007,). Sensory processing difficulties can be experienced in a variety of ways, from multisensory binding (which involves integrating information from a variety of senses), to unisensory sensitivity (which causes hypo/hypersensitivity to specific stimuli, limiting the extent of sensory input one can comfortably receive) (Howe & Stagg, 2016). There are three categories of sensory difficulties which are experienced in individuals with sensory processing abnormalities: sensory sensitivity, sensory insensitivity (Ben-Sasson et al., 2007), and sensory seeking (Miller et al., 2007).

Sensory Stimuli in the Classroom

Hypo/Hypersensitivity to stimuli can have substantial consequences in daily life for children in a school setting. The school environment can be

especially challenging because of the constant change of sensory input/output. For example, a 2008 study measured anxiety levels of individuals on the Autism spectrum in their daily lives, including the school day. Many of these individuals reported experiencing high levels of anxiety toward navigating the hallways and corridors of their school without having bodily contact with others because of sensory distress (Humphrey & Lewis, 2008). The authors of this 2008 study point out that the school day is an essential aspect of a child's daily life, and sensory processing issues can have serious consequences regarding the accessibility of education for those impacted.

A Brown & Dunn study explored sensory seeking and sensory avoidance in children with Autism in both the home and the school environments. Teachers and parents were interviewed to determine how the home/school environments impact the sensory needs of their children/pupils with Autism. Teachers reported witnessing higher levels of sensory distress than parents, indicating that the home environment provides a less stressful sensory experience. For example, several teachers reported that their students with Autism will respond to loud auditory stimuli by covering their ears with both hands, whereas parents reported fewer auditory reactions in the same children (2010).

Sensory distress during the course of the school day can cause children to become engrossed and distracted by sensory stimuli and has the potential to notably impact academic growth and success. Sensory processing patterns and educational outcomes were studied, and researchers found a link between difficulties with processing auditory stimuli, sensory seeking, and sensory under-responsivity with poor academic performance (Ashburner, Ziviani, & Rodger,

2008). Additionally, another study reported that sensory processing difficulties had negative social impacts for school-aged children. The higher the severity of the sensory issue, the more social deficits were likely to be exhibited (Hilton et al., 2010).

The experience of sensory distress can even be fear-inducing (Volkmar, Cohen, Bregman, Hooks, & Stevens, 1989) and cause individuals to suffer physical pain in the form of severe headaches (Smith & Sharp, 2013). A 2016 qualitative study asked students with Autism to complete a questionnaire with regard to their sensory experiences during the school day, with the emphasis on touch, hearing, vision, and smell. The study also utilized semi-structured interviews and a rating scale to determine the severity of various stimuli. The questionnaire revealed that 88% of students surveyed reported having sensory issues in relation to hearing, 75% reported issues with touch, 50% with vision, and 38% with smell. All participants reported sensory difficulties with at least one of the senses which, according to the participants, resulted in difficulties within the classroom setting (Howe & Stagg, 2016). In the same study, these individuals were asked to report whether or not they believed that their sensory processing issues impacted their ability to learn. All participants experiencing auditory sensory distress reported that their sensory issues did, indeed, impact their ability to learn, with the majority of the participants citing difficulty with concentration to be the greatest barrier to learning. These auditory processing issues often manifested themselves in physical responses, which further distracted from the learning process.

Commentary provided by participants indicated that the anticipation of such auditory stimuli was particularly difficult. One participant commented, “When I am in mainstream classrooms, I can hear lots of conversation/noise, and it makes me feel tired” (Howe & Stagg, 2016). This response was also prevalent with vision modalities. When coding the data in relation to the study, the researchers found the most often referenced experiential factor were the terms “anxious” and “uncomfortable” when exposed to various sensory stimuli, as experienced in a typical classroom environment. The next most common codes were “frustrated”, “annoyed”, and “physical discomfort”. This “physical discomfort” was characterized by sensations such as scraping sounds making one participants stomach ache, and shouting causing another participant to experience pressure in the head. Physical pain and anxiety were codes that were found in all four senses within the study (Howe & Stagg, 2016). These results are consistent to prior studies with regard to sensory processing difficulties (Dawson & Watling, 2000;

Crane et al., 2009; Tomchek & Dunn, 2007; Kanakri, Shepley, Tassinary, Varni, & Fawaz, 2017). As individuals with Autism already experience notably higher rates of anxiety than neurotypical individuals (Vasa et al., 2013), it seems that a focus on sensory aspects of Autism Spectrum Disorder could prove to have significant impacts on the success of those affected, especially in terms of educational and social/emotional aspects.

Benefits of a Natural Learning Environment

Because so many students with sensory processing challenges experience negative sensory experiences in the classroom, it is important that educators examine the objective of providing a less restrictive environment. If the classroom environment has been shown to be unfriendly to children with ASD/SPD, it is important to look at alternative learning modalities for this population. One learning modality that has seen great success in neurotypical populations is the idea of an outdoor learning environment. This type of classification can be used for a variety of settings: outdoor classroom, school/class garden, outdoor adventure education, and other processes by which students are taken outdoors to engage with academic subject matter.

Prior research has shown that the incorporation of experiential outdoor learning environments in K-12 curricula contributes to greater performance in standardized testing, reduced behavioral/disciplinary occurrences, and increased levels of enthusiasm and motivation to learn (Breunig, 2008; Garst, Scheider, & Baker, 2001; Wilcox, 2017; Scott, Boyd, & Colquhoun, 2014). Additional studies have indicated that the outdoor learning environment results in higher emotional and academic engagement (Blad, 2014). This experiential approach to education utilizing the outdoor environment is a more exciting, engaging, and hands-on mechanism for the promotion of meaningful and lifelong student learning (Bass, 2012; Bredderman, 1983; Breunig et al., 2015; Haury & Rillero, 1994; Obenchain & Ives, 2006; Scott et al., 2014). There is also evidence that underserved, often neglected, students (those that struggle with academic

performance, those that lack social/emotional skills, unmotivated or disengaged students, and those with attention issues) show the most benefit from an outdoor learning environment. This population of students has been observed to exhibit increased critical thinking and leadership skills, placing them on a more educationally equitable level than in traditional learning environments (Barlow, 2015; Breunig, Murtell, & Russell, 2015; Moulton, 2008; Scott, Boyd, & Colquhoun, 2014).

In outdoor learning environments, the element of being in and around nature is in and of itself beneficial for individuals (Benfield, Rainbolt, Bell, & Donovan, 2015). Breathing in fresh air, receiving natural light, and viewing natural environments have been shown in countless studies to have a positive impact on health, cognitive function, and academic performance (Faber Taylor & Kuo, 2011). There is additional evidence which indicates that nature can alleviate concentration problems, including in individuals with Attention Deficit Disorder (Faber et al. 2011; Berto, 2005).

These findings are especially interesting in conjunction with Louv's theory of Nature Deficit Disorder (Louv, 2005; Louv, 2008). NDD proposes a significant relationship between exposure to nature and the knowledge and understanding of self within nature. This is especially important for children with ASD/SPD in terms of self-efficacy, self-advocacy, emotional regulation, and sociality, as these are areas with which these populations most often experience difficulties (Dawson & Watling, 2000; Crane et al., 2009; Tomchek & Dunn, 2007; Kanakri, Shepley, Tassinary, Varni, & Fawaz, 2017).

The Benefits of Nature for ASD/SPD

The benefits of natural/outdoor learning environments are especially critical for individuals on the Autism spectrum and/or those with sensory difficulties. Children with autism have a number of therapeutic activities which take place indoors, which limits their opportunities for exposure to natural and/or outdoor environments. Often, indoor environments are perceived as being more convenient and secure environments, should any behavioral issues arise (Chang & Chang, 2010). It is crucial to rethink this notion, however, and understand the consequences that deprivation of nature exposure can pose on the child's potential human development.

Nature plays a particularly important role in the development of a child. One of the first books written on the subject was Children's Experience of Place in which the author interviewed children about their favorite places (Hart, 1969). Among the top places mentioned were natural environments such as lakes, rivers, beaches, mountains, etc. Children often cited these places as particularly important in times of trouble, as they provided a place of solitude and reflection. He also noted that engaging with natural environments helped children learn about themselves, as well as the world around them (Hart, 1969). Another pioneer in the subject of children and nature, (Moore), observed that time in nature was beneficial to human development, in that it enabled children to challenge their own capabilities, explore and foster the acquisition of new skills and areas of knowledge, and gain new levels of environmental proficiency (Moore, 1986).

Previous studies indicate that when exposed to outdoor programming and play, individuals with intellectual disabilities demonstrated increased sense of self-efficacy, self-esteem, personal growth, social/relationship skills with neurotypical peers, and a reduction of negative behavior (Davis-Berman & Berman, 1989; McAvoy, Smith, & Rynders, 2006). A 2016 study on the effect of an outdoor adventure program on children with Autism noted significant improvements in social communication and motivation in its participants (Zachor, Vardi, Eitan, Brodai- Meir, Ginossar, & Ben- Itzchak, 2016). This adventure program consisted of challenging physical activities requiring engagement with other peers in cooperative and communicative ways. The program resulted in lower symptomatic repercussions such as behavioral issues and sensory aggravation, and increased communication skills (non-verbal/verbal, imitation, socially reciprocal behavior). The outdoor challenges and adventures offered a unique opportunity to collaborate and problem solve with their peers in a meaningful way, which resulted in significant improvement of social skills. Additionally, the severity of repetitive behaviors (self-stimulatory, scripting, echolalia, etc.), and inappropriate behavior were decreased (Zachor et al., 2016).

Researchers in a 2010 study noted that children with Autism gained seven main benefits from engagement in outdoor activities; increased initiation of and participation in social interaction, promotion of communication skills in both ability and content, positive behavior improvement (including increased self-control), emotional benefits, improved cognition (observation skills, knowledge, and attention), greater physical activity, and decreased sensory sensitivity. The dynamic scenery provided by nature played an important role in the student's

stimulation of interest and decrease in sensory difficulties (Chang & Chang, 2010). It should be noted, however, that this study was carried out in the unstructured outdoor play activities of children with Autism, and not specifically in the context of an outdoor learning environment (outdoor classroom).

With the widely supported notion that increased level of indoor activities through technological means are leading to developmental, social, academic, and behavioral issues in children, it is important to consider the consequences that Nature Deficit Disorder and a lack of ecological identity pose for children with Autism and/or Sensory Processing Disorder. It is well regarded that children with ASD/SPD need significant support systems in place for success in academic and social emotional areas (Baker, Lane, Angley, & Young, 2008; Baranek, Foster, & Berkson, 1997; Bowler, 2006; Crane, Goddard, & Pring, 2009; Fernández-Andrés, Pastor-Cerezuela, Sanz-Cervera, & Tárraga-Mínguez, 2015). With the increased interest and awareness of ecological identity, nature deficit disorder, and sensory processing difficulties, it would be of significance to explore the intersectionality of these issues. There is very little information regarding sensory processing disorder, the connection to/therapeutic effects of nature, and nature deficit disorder.

Perhaps of greater significance, however, is how these issues come together in terms of least restrictive environment. Inclusivity in the traditional classroom is considered a way of placing students on “an even playing field”. Yet while acknowledging that inclusivity in a specifically traditional classroom model may promote equality, it may not be the most equitable approach. The traditional learning environment, as prior research has shown, has a tendency to be a

potentially harmful modality for children with ASD. It is crucial for educators to consider the potential benefit of outdoor learning environments and natural settings as a form of therapy for children with Autism and/or sensory processing issues.

This study examined the effect of nature and the outdoor learning environment on children with Autism/Sensory processing disorder. Children affected by Autism are often cloistered in clinical environments such as doctor's offices, occupational therapy and/or speech therapy offices, psychologist's office, and traditional classrooms. If children with ASD/SPD are suffering from sensory distress due to factors within the traditional classroom, it is vital to explore alternative learning environments as a Least Restrictive Environment.

Chapter 3: Methodology

The traditional classroom environment has remained relatively unchanged despite specific elements of the classroom environment itself have had a detrimental impact on sensory-sensitive students (Dawson & Watling, 2000; Crane et al., 2009; Tomchek & Dunn, 2007; Kanakri, et al., 2017). Because of these negative experiences in the traditional classroom environments, it is essential to examine these student's experiences in a natural learning environment to determine if there are benefits to this alternative approach. The natural learning environment was investigated to discover the affect of this environment on the social behavior, communication, and participation of seven students with Autism and/or Sensory Processing Disorder.

Description and Rationale for Research Approach

A mixed-methods approach was chosen for this study in order to obtain an in-depth understanding of the experience of the outdoor learning environment from the perspective of teachers, paraprofessionals, students, and parents. Additionally, most students within the classroom population have limited communication skills, so observations and interpretations of behavioral antecedents are mainly subjective but based on the precedent historical data. Behavioral data collection is undertaken in the classroom on a daily basis and provided the historical baselines from which patterns, observations, improvements, or regressions were noted.

A mixed-methods approach was used to better understand the experiences of students with sensory processing challenges both in traditional

and natural learning environments. The qualitative data derived from the behavioral charts provided raw data regarding the frequency of maladaptive behaviors within both the traditional and natural learning environments. This data was vital in comparing the number of behavioral instances experienced in both environments and determining if there were changes observed between the two. Qualitative data (surveys, observations, and field notes) provided experiential perspectives of students, parents, teachers, and paraprofessionals. These perspectives, especially those of the students, are significant in furthering the understanding of how environment can influence social behavior, communication, and engagement.

Because this study involves such a vulnerable and often marginalized population, a humanized research approach was utilized. The data collected throughout the study were used to directly benefit the participants and provide implications to assist teachers, parents, schools, districts, and policy-makers. The intent of the study was to shift conversations around Least Restrictive Environment to include perspectives of students with sensory processing challenges.

Research Design

This mixed-methods study was executed from a transformative perspective, intended to promote equity and directly benefit students with sensory challenges, a historically marginalized population. The power of determining the environment in which a student learns generally resides with school districts and administrative faculty, rather than with students. Students with sensory processing challenges experience difficulty accessing educational

material (Dawson & Watling, 2000; Crane et al., 2009; Tomchek & Dunn, 2007; Kanakri, et al., 2017), which I theorize is due to a classroom environment which is detrimental to their learning.

The objective of using a transformative perspective in this study is to shift focus away from the prevailing pedagogical approach which prioritizes simply maintaining student's sensory regulation in the traditional classroom by investigating an alternative learning environment in which these students can thrive. In this study, the natural learning environment was examined as a more equitable and less restrictive educational setting. The results from this research are intended to be meaningful to educators, parents, and students who have had to experience sensory dysregulation in the traditional classroom environment. It is my hope that the resulting implications of this study will catalyze and assist educators and parents to advocate for and encourage local action from districts and policy-makers in order to improve the educational experience of students with Autism and/or sensory processing challenges.

Research Site

The school in which I conducted research is a school for Autism and behavioral challenges in Northern California. The school serves individuals ranging in ages from five to twenty-two. The school provides academic curricula for grades K-12 and vocational programming until the student reaches 22 years of age. I am a current classroom teacher for students aged 10-17 (fifth through twelfth grade) with Autism and/or sensory processing disorder who have significant behavioral issues. After a discussion about this research study with

the director of the school, the director agreed to permit this study within my classroom, as well as conduct interviews with students, parents, paraprofessionals, and other teachers. This study did not disrupt the school day and allowed students to receive their regularly scheduled services (Occupational Therapy, Speech Therapy, etc.).

Participants

The classroom involved in this study was located in a suburban section of the north San Francisco Bay area. Of the seven student participants, two are Latino and five are white. Six out of the seven students live at home with their parent(s) in suburban setting, and one student lives in a group home in a nearby suburban area. All students in this classroom have been diagnosed with Autism and/or another intellectual disability which is characterized by sensory processing challenges. The school site is a non-public primary school specializing in addressing the behavioral challenges of students who have been significantly impacted by these challenges in the public school setting. The students in this classroom range in age of 12-14 and are in grades sixth through ninth.

The participating students ranged in age from 12-14 and are at various academic levels ranging from pre-kindergarten to fourth grade. Of these students, four students have moderately high communication abilities, two students have very limited communication abilities, and one student is completely non-verbal, utilizing an augmented communication device. Five students utilize sensory tools such as noise-eliminating headphones, weighted vests, chewable aides, fidgets, and alternative seating (bouncing ball, stabilizer, wedged seating).

Two of these students wear the noise eliminating headphones throughout most of the school day. These tools assist the students with their various sensory needs, whether these needs involve seeking, avoiding, or regulating sensory input. When their sensory needs are not met, these students often become visibly and/or audibly upset. This often manifests in the form of maladaptive behaviors such as elopement, property destruction, or aggression toward others or themselves (self-injurious behavior). All five students who utilize the sensory tools exhibit aggressive behavior toward others when their sensory needs are not being met. Three of these students also exhibit self-injurious behaviors under these circumstances. These have historically consisted of self-biting, self-pinching, and self-hitting/punching. The instances of aggression (to self or others) typically occur for durations of anywhere from 30 seconds to four hours, depending on the child's sensory regulation level.

All students enrolled in this school site have Individualized Educational Plans (IEPs) and Behavior Intervention Plans (BIPs) to address their specific academic and behavioral needs. Because the needs of the students are so specific, each student is provided with a trained paraprofessional classroom aide on a one to one or two to one basis dependent on the severity of the student's challenges. These paraprofessionals collect valuable behavioral and academic data on a daily basis in order to assist the teacher with providing accurate baselines and progress monitoring toward academic and/or behavioral IEP goals. This data was used to establish the baselines for this study, and the same data collection methods were used in the outdoor learning environments. Additionally,

paraprofessionals (in addition to the researcher) conducted observations in the field and documented the participation and social/emotional developments of the participants while in the outdoor learning environment.

Students in this classroom and their parents/guardians were recruited for participation in this study. Out of the ten students in the classroom, seven students provided parental consent to participate in the study. These seven students range in age from 12-14. The researcher has been involved with the students in this classroom as an instructional aide or teacher since 2014 and conducted classroom observations and interviews from both students and their parents/guardians during the spring semester of 2018. Students in this classroom were under the age of 18 and required parental consent for participation. Parents/guardians were recruited through an introductory email and Informed Consent Forms. Students were recruited through face-to-face explanation and verbal assent. Informed consent forms were signed by all parents/guardians who had students participating in the study.

Data Collection Procedures

Qualitative data was retrieved using surveys. Surveys were given to the participating students to gauge their comfort levels when indoors and outdoors. A survey was given to the parents/guardians of the participating student to collect their perceptions of their child's overall wellbeing both indoors and outdoors, preferred outdoor activities, hesitations or anxiety toward taking their child outdoors, statistical information regarding their child's time spent indoors/outdoors, and descriptions of the outdoor space(s) at the child's home.

Seven out of ten of the parental surveys were completed and returned. Parent surveys were valuable in providing insight to the extent and frequency that their children spend in natural environments and gathering information regarding comfort levels and overall demeanor both indoors and outdoors.

All teachers and paraprofessionals at the school site (both in and out of the participating classroom) were surveyed to determine their anxiety/hesitations taking students outdoors, and general observational perceptions regarding the child's overall wellbeing indoors/outdoors. Out of the 30 surveys sent to teachers and paraprofessionals, 14 were returned completed.

Student participants engaged in their typical group and individual academic lessons and activities in an outdoor classroom environment. Students have a one to one or two to one ratio of staff to student, and paraprofessionals participated in this study alongside the students. Students were transported by designated school staff in mini-vans which are used to regularly transport students to and from school, as well as on daily community outings (the school operates by having paraprofessionals and teachers transport students every day to outings ranging from dance classes, gymnastics, farm visits, gardening, etc.). There was no additional permission needed for transportation, as students were already transported on a daily basis in the classroom's pre-assigned vans. The students were taken to three different outdoor environments (beach, forest, park) twice a week for four weeks. The students engaged in their typical morning classroom routine, starting with a morning meeting (review day of the week, date, schedule for the day, overall feelings, and general share-outs [15 minutes]). Students and their paraprofessionals often took a short (10-15 minute) walk around the

environment, before returning for a snack (10 minutes). After eating, students broke into their one to one or two to one pairings and engaged in their normal academic work for the day, as if they were in the classroom, using their typical classroom materials such as pencils, workbooks, notebooks, etc. (20 minutes). Paraprofessionals took notes on participation, behavior, and communication using frequency charts and A.B.C. charts (Antecedent, Behavior, and Consequence). After this time, students gathered together and engaged in a group lesson (30 minutes), a story time session (15 minutes), and ending with question/answer or discussion (10 minutes). This was often followed up with a deep breathing mindfulness exercise (five minutes) before departing to go back to school.

Research Positionality

I am the education specialist within the classroom participating in the study, as well as the researcher. Since I have spent over three years with these students, it is understandable to consider research bias regarding my positionality within the classroom. It was my desire to focus on a holistic approach to determine if an outdoor environment has an impact on the students and by doing so, the students could directly benefit from a learning environment that is friendlier to their sensory needs.

Because so many participating students are limited in their communication abilities, my positionality as education specialist of the classroom was vital in understanding the nuances and implications in the responses to student surveys and observations/field notes. Much of these nuances and implications are

subjective interpretations of a few words spoken by or observations of the participating students. To mitigate bias, I ensured that I practiced member checking of both students and teachers/paraprofessionals. In member checking, surveyed/observed students, teachers, and paraprofessionals were given my interpretations of their answers and observations in order to ensure that I was not making assumptions or introducing a false narrative into my findings.

Data Analysis

After the completion of the four weeks of learning sessions in the natural learning environment, the researcher examined the data collected (questionnaires, observations, behavior charts, etc.). Frequency of behavioral issues were analyzed to determine if the outdoor classroom contributed to any changes in behavior patterns and/or occurrences not observed in the traditional classroom environment. Additionally, paraprofessional/researcher observations regarding increased/decreased social communication and participation in individual/group academics, social activities, and read-aloud activities were noted and compared to the historical data and analyzed to determine any changes observed over the outdoor sessions.

Interviews and surveys were analyzed to understand experiences of the outdoor classroom using coding techniques using web-based reference management software to assign codes and organize data. The data from the interviews and surveys were given codes based on the researcher's understanding of the meaning of the passage or information contained within. These codes were used for data retention and representation when reviewing

other data that is either similar or different. These codes served as an organizational tool to discover patterns and themes within the data, providing a clearer focus for drawing conclusions.

Validity and Reliability

In this qualitative study, it was extremely difficult to study the same thing twice due to the human and environmental factors involved. Therefore, it was crucial to account for the ever-changing conditions of the natural setting, and to accurately describe all changes which occur within each setting and how those changes impact the ways the data was collected. Additionally, results from prior research regarding natural learning environments was examined to determine ways with which the data can be confirmed or corroborated. Results from this study and similar prior research were consistent, substantiating this study's data reliability and findings.

To ensure the validity and reliability of data within this study, a methodological data triangulation process was utilized to mitigate any potential bias and seek out comparative similarities and differences throughout various accounts to ensure that all perspectives were corroborated. Because both the observations and data collection (ABC chart) were conducted by both the researcher and a team of paraprofessionals, the qualitative data (observation/field notes, survey responses, ABC chart data) were composed of multiple sources, rather than a single source Additionally, this qualitative data were compared with pre-existing baseline data (collected in the two months preceding this study) to further validate data and confirm data reliability for this

study. The surveys, observation/field notes, and ABC chart data were cross-verified and used to gather perspectives from different dimensions of the same circumstances and experiences from multiple points of view.

Chapter 4: Findings

Students with Autism and/or Sensory Processing Disorder experience their learning environment in a vastly different way compared to their neurotypical peers. The constant under or overstimulation produced by the environments themselves impact the ways in which they learn and their capacity to thrive academically, socially, and emotionally. The need for appropriate sensory input and output is an essential consideration when considering placement for children affected by sensory processing challenges. While this consideration may entail seeking accommodations and modifications to better equip the student(s) for classroom success, these efforts may not be enough to address the underlying issue, which is often the classroom itself.

Although possible alternatives to the traditional classroom are seemingly endless, this study addresses the natural learning environment as a highly promising alternative to the traditional classroom. Three major themes were apparent when analyzing the data collected for this study. The first theme is that an outdoor learning environment has a positive impact on the student's ability to regulate their sensory input. A second theme is the natural environment as a less restrictive learning environment for students with sensory processing challenges. The third theme is that the natural learning environment fostered an improvement in student's overall wellbeing.

Nature as a Sensory Regulator

All of the participating students have challenges with sensory processing, often being over or under stimulated with serious difficulties identifying and/or

meeting their sensory needs. Students with sensory processing issues have difficulty processing stimuli which are unnatural and intensified. The acoustics and set-up of a traditional classroom is characterized by echo and confinement—habitual triggers for sensory discomfort and meltdowns. The indoor learning environment has un-natural acoustics and bright lights which can trigger sensory discomfort in students with Autism and/or sensory processing disorder.

Baseline data (collected for two months prior to research) indicates that the traditional classroom environment may be inherently problematic for these seven students with sensory challenges. This data and student observation show patterns of negative sensory experiences in the classroom. These experiences are primarily students reacting to unfriendly stimuli and seeking coping mechanisms to avoid this artificial stimulation such as unpredictable volume levels, fluorescent or bright lights, and confinement. In class, students avoid unwanted sensory input by using sensory strategies such as wearing headphones, placing filters on lights, or using weighted vests. When students become overwhelmed due to confinement or anxiety over unmet sensory needs, they often seek out sensory input/output by utilizing chewable toys, fidgets, and pressure wraps. These sensory strategies are often accompanied by, or precursors to, severe sensory aggravation, self-injurious behaviors, and other physical manifestations of the sensory challenges they experience in this environment. It is quite clear that for these students the traditional learning environment often forces them in the role of seeker and avoider of problematic stimuli.

In contrast, the outdoor learning environment can provide students with natural stimuli, fresh air, natural acoustics, natural lighting, etc. If a student's sensory system is at ease, they are in a better position to learn, grow, and thrive. This was witnessed several times throughout each outdoor session both in terms of sensory regulation and in the ways with which the students engaged with stimuli.

On arrival in every outdoor session, observations indicated that students were interested in their surroundings, looking around and observing what was around them. Some made comments about interestingly shaped trees, pretty flowers, large waves, and other general comments about the environment. Joey, upon seeing a bee land on a flower said, "Bee pollen. Bees flower, pollinator". Jenny and Marie frequently made observations about the sunshine and the trees, with Jenny stating, "Oh the sun is so warm and feels good". Marie skipped in the grass and picked flowers with Joey and sometimes Jenny and Matthew on five separate sessions. Of significant note was the degree to which this facilitated self-regulation immediately upon arrival. Depending upon the environment (beach, park, forest), the students engaged in activities such as dropping pebbles into puddles or ponds, instantly removing shoes and running in grass or digging their toes in the sand, scraping moss off trees, hitting a tree or bush with a stick, running sand through their hands, smelling leaves or bark, and even simply soaking up the sunshine. The students' roles in the outdoor environments were receiver and explorer, with students receiving natural stimuli and input and

exploring the way which they could engage with the stimuli. This is quite different than their roles while indoors.

The natural learning environment seemed to especially impact the students on a self-regulatory level, especially in terms of sensory regulation. One morning, Joey began the school day (in the classroom) very dysregulated (self-injurious behavior, aggression toward staff [biting and scratching], and verbal outbursts). Upon arrival at the park, his regulation level changed significantly. The paraprofessional field notes indicated that on leaving the vehicle, Joey became “more relaxed and willing to listen and learn.” During the lesson, they were able to work more independently and was “in a much better and happier mood after going outdoors”.

Behavioral data was analyzed to determine if any significant changes were seen between classroom baselines and the outdoor learning experience. There was a significant decrease in historically seen maladaptive behaviors during the outdoor learning sessions, with many students seeing their behavioral challenges decrease by over half (See Figure 1 below).

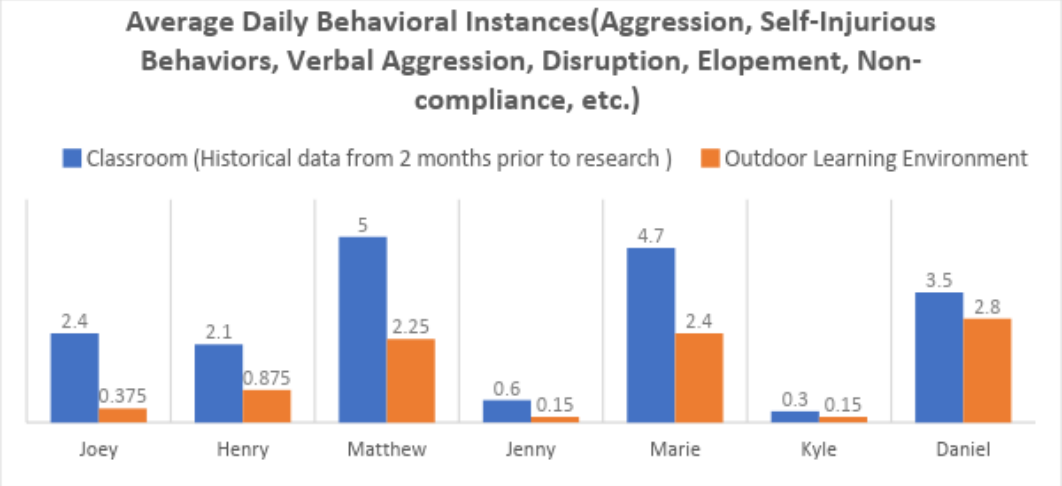

Figure 1

This change in behavioral trends could be associated with the increase of natural stimuli that the children received during these outings. Most surveyed parents (5/7) reported that their children are sensory seeking and are constantly aware of/seeking out the sensory stimulation from their environment. Overall, parents reported that their children were much more relaxed, calm, and regulated in outdoor environments. Indoor environments, on the other hand, triggered responses from parents that included over/under stimulated, easily irritable, angry, anxious, upset, self-absorbed, isolated, and device driven. The connection between mobile devices/screen time and indoor environments were significant throughout the parent responses. A parent reported that their child, Jenny, spends most of her indoor time on devices and takes short, shallow breaths. In an indoor environment, Jenny is “over or under talkative, irritable, angry, tense, and ready to lash-out”. However, her parent reports that in nature, Jenny is

“happy, curious, explorative, focused, awake/aware, has an appropriate talking level, and takes deeper breaths”. Another parent stated that their child, Marie, (who utilizes noise-cancelling headphones daily), has difficulty filtering noise indoors, making her anxious and more likely to have repetitive behavioral responses such as scripting (repeating familiar phrases or sounds to oneself). Parents reported that in outdoor environments, their children are explorative, curious, focused, awake, positively sensory stimulated, and are taking deeper breaths. Another parent reported that being outside was her son, Henry’s, “happy place”.

Teacher/Paraprofessionals had similar responses to questions regarding taking their students into outdoor environments. Simply based on historical context, most participants stated that they experienced relatively high levels of anxiety in terms of taking their students into the outdoors due to potential behavioral and/or safety issues (some participants cited instances of students eloping into dangerous areas [into the ocean, down a steep hill, into forested areas]). Others reported that students become upset or anxious around crowds, so certain public outdoor areas were historically unsuccessful outings for their students. For many teachers and paraprofessionals, their main hesitation in taking their students outdoors was that the classroom was perceived to be a “safer place to deal with meltdowns” as there was not public safety and community reception issues to be concerned with. Molly, a paraprofessional with two years of experience offered some insight into these hesitations.

> *Sometimes, because the behaviors that happen outside can cause more trauma for us (paraprofessionals) and the kids too. I think that it's easier to think about bad experiences that happened in the community because you just want them to be over-for the kid's sake and your own. There are definitely more behavioral problems at school, but at least you can call for assistance or get something the kid might want from class. There is just more at your disposal. I think maybe I'm just nervous about what the public thinks and I probably should just be thinking about what is better for the students. The kids' sensory regulation levels are so much higher outdoors though, so I feel bad for not taking them outside more.*

Often, the maladaptive behaviors experienced in community settings can be more difficult for teachers and paraprofessionals due to perceived public scrutiny. Additionally, teachers indicated that they felt intimidated being outside the realms of control that the school environment offers. Despite these hesitations, however, participants indicated that there was an overall improvement in the wellbeing of their students, especially in terms of the sensory stimulation the students experience while in nature. Teachers and paraprofessionals reported that their students were more calm, relaxed, and focused when in the outdoors, and that despite a few historical traumatic occurrences, they recall far less noted instances of maladaptive behaviors while engaged in these environments. The surveyed teachers and paraprofessionals generally agreed that natural environments have been more conducive to

sensory regulation, leading to generally better behavioral experiences, social engagement, and explorative play.

The indoor sensory experience has not been historically positive for these students and tends to trigger maladaptive behaviors when students are not sensory-regulated. In a parent survey, one responder described their child, Matthew's, sensory experience indoors as being self-absorbed and isolated and explained that her child uses electronic toys to engage with his senses, looking for specific sensory outcomes. This has been confirmed in the classroom, where the students regularly seek out familiar patterns which produce outcomes that are satisfying to their senses.

Nature is a Less Restrictive Environment

The traditional classroom environment is a familiar and comfortable place, but also a place where students know and understand how their behaviors happen and how they will play out. Classroom sensory strategies are typically put in place to preempt sensory dysregulation and potentially maladaptive behaviors such as aggression toward self and others. Just as Matthew's mother reported that he was seeking sensory responses out of familiar stimuli, students in the traditional classroom seek out ways to escape or avoid certain sensory stimuli. For example, if Matthew makes certain noises at Marie, she becomes upset and eventually Matthew will be removed from the area. The need to be removed and isolated indicates a highly restrictive environment. When he is removed, it means that he is often removed from the classroom and placed in a quieter room where he can focus and self-regulate with more success. He has successfully escaped

and avoided the classroom environment in favor of a quieter, less overwhelming environment. If this happens repeatedly, students are becoming familiar with these patterns and can become dependent on these strategies (including noise-eliminating headphones, fidgets, and weighted vests) in order to cope with unwelcome sensory stimuli. With students relying on these tools, the classroom becomes a place where students are attending, but not thriving. It is difficult to learn and thrive in an environment in which you must use coping strategies to simply exist within its realms.

The outdoor learning environment is familiar (in terms of trees, grass, dirt, shrubs, etc.), and yet unfamiliar in that it does not feel like a traditional classroom environment. The novelty and natural sensory stimulation helps them move past their preconceptions of school/learning/teacher expectations. In essence, the outdoor learning environment disarms them, reducing or eliminating behaviors and self-regulation issues which impede learning. Within the outdoor learning environment, students were able to actively participate in academic activities on an individual and group basis. This increase in the student's ability to participate is indicative of an environment that is less restrictive than the classroom. Students retained information and voluntarily gave answers to academic questions in much greater instances than in the traditional classroom environment (see Figure 2 below). It should be noted that in this study, successfully completing an activity means that the student not only started and finished the activity (with assistance or independently), but also completed the activity with little to no negative target behaviors.

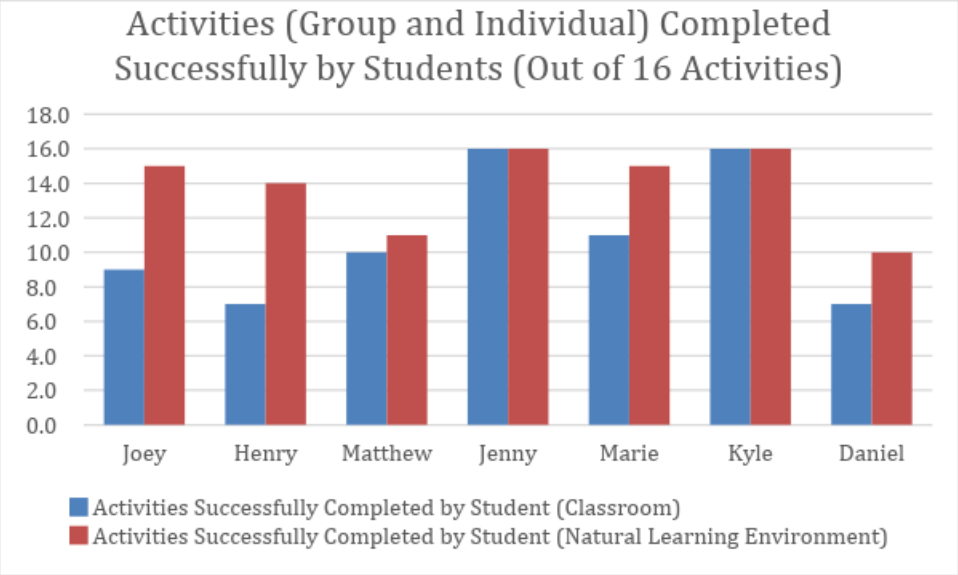

Figure 2

Environmental factors such as the weather played an interesting role within academic participation. Most days were sunny, clear, and between 65-75 degrees Fahrenheit. However, the first two outdoor sessions were quite cold (53 and 58 degrees Fahrenheit). Cold weather seemed to discourage sociality but encourage focus and academic participation. Students were less talkative but made eye contact, did not fidget, and were able to demonstrate greater comprehension skills (all challenges within children with Autism) in reaction to the cold weather.

The weeks which followed proved to be ideal weather for outdoor exploration and instruction. The students looked forward to the outings and a few would inquire as to which days during the week they “got to do outside school.” This is not typical behavior; historically, there are often school days where students either do not attend school or must be coerced by teachers or paraprofessionals into the classroom from their respective vehicles. These

students are not excited to learn and have anxiety and/or negative associations with their traditional classroom, even with the vast amounts of sensory tools they have been provided. A learning environment for which student anxiety produces truancy issues or the need for coercion into the classroom is a very restrictive environment and not conducive to learning.

Through the use of student surveys (with the option to respond either verbally or using picture icons), it is apparent that there is a preference to outdoor environments over indoor. Seven out of seven students surveyed indicated they like being outdoors, while only three out of seven said that they also liked being indoors, although these three also expressed that they would be upset if they had to be indoors for too long. The students who reported that they also enjoyed indoor environments seemed to associate the indoors with video games, their televisions, their computers/tablets, and other familiar or comforting factors. However, students surveyed used the words, mad" (seven out of seven), "sad" (five out of seven), "bad" (six out of seven), and "scared" (four out of seven) when describing how they feel when indoors. When discussing the outdoors, there was a visibly joyful response in the students' body language which was not seen when answering questions about the indoors, as the students sat up taller, made greater eye contact, and smiled more often when answering questions about their feelings in outdoor environments. Students surveyed used the words, "happy" (seven out of seven), "relax(ed)" (five out of seven), and "calm" (six out of seven) when describing how they feel when outside. One student stated that she felt more comfortable outdoors and that "the trees make me feel peaceful,

like I'm at home. I pretend the stumps are my couch."

Breaking away from the historical patterns and emotions that students experience in the traditional classroom, students in the outdoor learning environment were much keener to participate in academics and group activities. Jenny, a student who typically rushes through academics, guessing and blurting answers, took her time and took deep breaths before answering questions or completing academics. She gave the correct answers more often and was not skipping ahead when other students needed further assistance. Historically, this is rare to witness in the traditional classroom environment, she is typically anxious to just "get through" her work. Academic time is usually met with anxiety, slumped posture, and habitual rocking of her body back and forth. During the outdoor academic sessions, this student did not engage in habitual rocking and even brought extra schoolwork from class to complete during free time.

Students Joey and Matthew are historically very distracted in the classroom environments, requiring multiple staff prompts and redirection. During the outdoor experiences, these two students were much more focused and participated in group activities and academics. Matthew, who rarely verbalizes said "good time" after answering two questions correctly. Staff commented that the students seem much less distracted and can engage in longer academic sessions and group activities. Joey rarely voluntarily answers to group academic questions in the classroom, but in an outdoor session, he was easily able to retain two key details from informative text (What do plants need to survive? "Air and soil") and volunteered his correct answer.

The outdoor learning environment seems to be a less restrictive environment for populations with sensory processing challenges, as it gives students greater control over their educational experience. Students in natural learning environments are sensory receivers and explorers, taking in the natural (friendlier) stimuli and exploring the ways with which they can engage with the environment. In terms of this study, the explorative nature of the outdoor learning environment created students who were interested, motivated, and engaged. These qualities, combined with the decrease in behavioral challenges, points to the natural learning environment being better at preparing students for engagement with neurotypical peers. The decrease in sensory challenges and increase in positive student interactions supports the notion that a natural learning environment improves social/emotional wellbeing, especially in terms of self-awareness and their connection with nature.

Nature Connections and Student Wellbeing

Students with Autism or Sensory Processing Disorder are often in transition modalities between indoor environments (home, car, classroom, car, doctor's appointment, car, occupational therapy, car, psychological therapy, car, speech therapy, home). As these children become more familiar with the indoor environments, outdoor environments become increasingly foreign. Patterns in social/emotional behavior tend to form around their experiences indoors. As previously stated, the indoor learning environment has proven to be a more restrictive environment, especially in terms of student engagement and sensory regulation.

By taking students into natural learning environment with more frequency, new patterns (influenced by positive sensory experiences) begin to form and new self-expectations and self-discoveries can be had. These new patterns were witnessed during this particular research on both individual and group levels through increased social communication, collaboration, and overall improvement of student wellbeing.

One student, Marie, is often behaviorally triggered by another student, Matthew, who purposely makes noises and tones which aggravate Marie. During four different instances during outdoor sessions, Marie used words to calmly, but firmly redirect Matthew to “sit somewhere else if you are going to make those sounds! Please be quiet and leave me alone”. This rarely occurs within the classroom and the typical reaction is for Marie to scream and become aggressive or elope. Instead, she remained calm and demonstrated self-efficacy, advocacy, and self-regulation.

Field notes from the researcher and paraprofessionals signal improvements in the overall wellbeing of the participating students. Kyle, a student who has historically shown signs of self-doubt and severe self-esteem issues served as a peer mentor in all outdoor academic outings. He was much more talkative and engaged than has been witnessed in the classroom and was engaging in meaningful play with peers. Kyle’s sociality increased dramatically as he led his peers in games, encouraged peers to engage in academics, and congratulated students on getting correct answers. At one point, another student answered a question incorrectly and Kyle said, “It’s ok to be wrong sometimes as

long as you try hard and don't get mad". Baseline data from Kyle's IEP characterizes his personality in the classroom as quiet, shy, and timid. Staff observations and comments during outdoor sessions used the words "talkative, laughing, upbeat, social" to describe Kyle's demeanor.

In addition to verbal sociality and communication, an increase in communication for the non-verbal participating student, Henry, was also noted. Henry has been historically reluctant to utilize his Alternative Augmentative Communication device (tablet with a communication application). According to prior behavioral data (two months before research), staff observations, and field notes, Henry "squeals", "stomps", and "pinches self" when prompted to use his device to communicate. In five out of eight outdoor sessions, he utilized the device to answer academic questions and engage with peers with minimal (two-three times) prompting from staff and no protest behaviors. Prompting by staff usually consist of verbal, visual, and gestural prompts, while staff guidance includes hand-over-hand writing, modelling, sentence starters, hints, and other general assistance with a task.

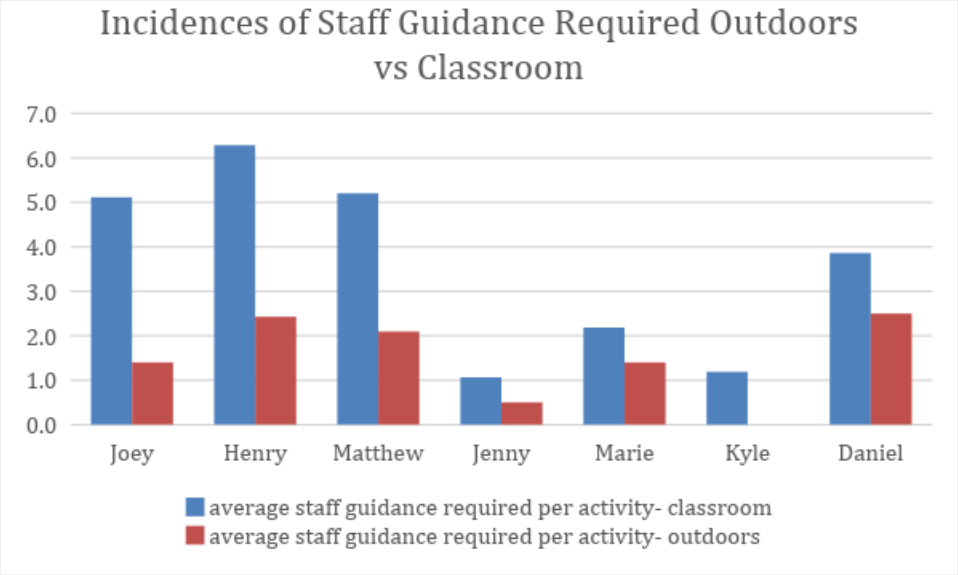

Figure 3

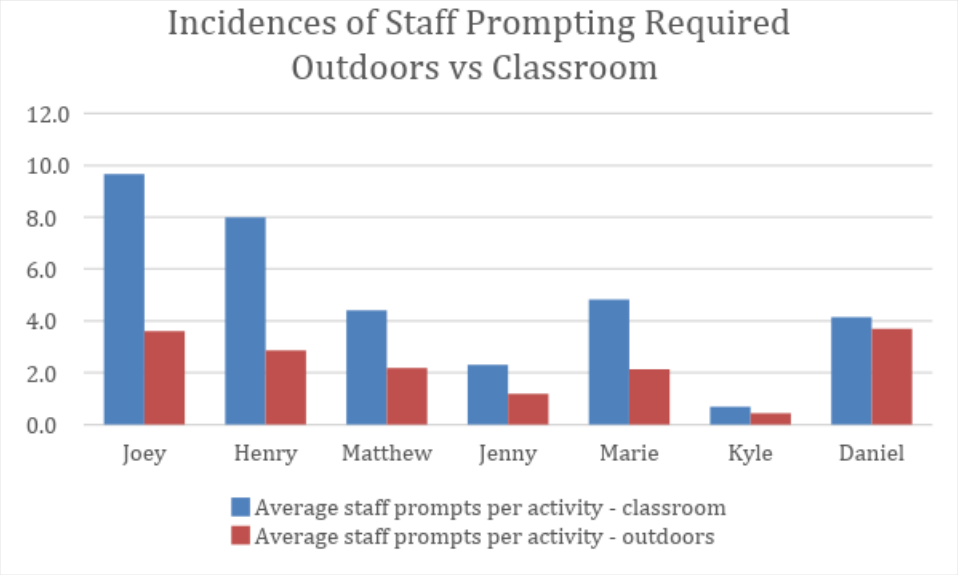

Figure 4

Overall, students did not rely on staff for prompting, sensory regulation, guidance, or direction as much as observed in the classroom (see Figure 3 and 4 above) Students were discovering that in the natural environment, they were free to participate in their own self-discovery. As previously noted, the increase in

academic participation set more positive patterns into place for students to increase self-esteem and agency around their learning. Nature provided not only an environment conducive for sensory regulation and decreased maladaptive behaviors, but also an environment which fostered individual exploration, both literally and figuratively.

Chapter 5: Discussion

Throughout this study, the natural learning environment proved conducive to increased levels of social engagement and communication and decreased incidents of behavioral challenges for participating students. The natural learning environment positively impacted this population of student's ability to learn (academically and emotionally) by giving students agency over their sensory needs, providing a less restrictive environment, and allowing students to form a greater connection with nature and its positive impact on psychological well-being (Louv 2005, 2008).

Comparison to the Literature

The results of the study are in alignment with those documented in prior research conducted on primarily neurotypical populations (Breunig, 2008; Garst, Scheider, & Baker, 2001; Louv, 2005, 2008; Wilcox, 2017; Scott, Boyd, & Colquhoun, 2014), especially in terms of overall student wellbeing in the natural environment. The resulting increase in sensory regulation seen in the natural learning environment supports Sensory Integration Theory, which states that sensory processing is a neurobehavioral process impacting human development in social, emotional, and physiological aspects (Ayers, Robbins, and McAtee, 1979). The findings of this study indicate that the social-emotional growth seen over the course of the outdoor sessions was influenced by the student's ability to regulate their sensory processing. In analyzing the baseline data and comparing it with the data collected in the outdoor sessions, it was clear through the students' interactions with sensory stimuli (taking shoes off, dropping rocks into

puddles, smelling leaves, running toes in grass/sand) that they were able to manage and have agency over their sensory regulation with more frequency in the natural environment. The data from this study indicate that unfriendly sensory elements of the traditional classroom environment are contributing to the sensory dysregulation seen in baseline data. This was also observed in prior studies regarding sensory dysregulation in the traditional classroom and school setting (Ashburner, Ziviani, & Rodger, 2008; Hilton et al., 2010; Howe & Stagg, 2016).

Within the classroom environment, this dysregulation typically manifested in maladaptive behaviors such as aggression (toward self or others), verbal outbursts, tantrums (three or more behaviors at one time), and elopement. As one study pointed out, specific classroom stimuli (sounds, lighting levels, confinement) contribute to sensory dysregulation and stress (Fernandez et al., 2015). Another study found that sensory processing difficulties had substantially negative social impacts on school-aged children (Hilton, 2010). This evidence, when combined with the findings of this study, indicate that the classroom environment can be a potentially unfriendly environment for students with sensory processing challenges.

Many of the findings regarding the social/emotional benefits of nature and the classroom environment's impact on sensory dysregulation have been observed and documented throughout prior research (Baker, Lane, Angley, & Young, 2008; Baranek, Foster, & Berkson, 1997; Bowler, 2006; Crane, Goddard, & Pring, 2009; Fernández-Andrés, Pastor-Cerezuela, Sanz-Cervera, & Tárraga-Mínguez, 2015). Some findings, however, were not noted in prior research and introduce a few unique perspectives in terms of the natural learning environment

and sensory processing challenges. One of these unique findings was the increase in academic participation among the students throughout the outdoor sessions. Because the students were able to regulate their sensory input, they were in a better condition to receive and retain information. Academic time was met with more positive attitudes, a decrease in negative target behaviors, increased motivation, and more participation than within the classroom environment.

Another unique finding was that a natural learning environment had an impact on this specific population of students. As stated in the literature review, there has not been any substantial research with regard to the natural learning environment as an alternative to the traditional learning environment specifically for students with Autism/Sensory Processing Disorder. Many prior studies with participants with Autism or sensory processing challenges centered around outdoor play or exposure, without the added educational context (Chang & Chang 2010). This study has assisted in filling this gap in the scholarship by adding a new population of participants to the prior research on natural learning environments.

The findings in this study have introduced some new insights to the conversations surrounding natural learning environments. One of these insights is the notion of educational equality versus educational equity in terms of Least Restrictive Environment for students with Autism/Sensory Processing Disorder. The traditional classroom is historically unfriendly and potentially detrimental to students with sensory processing challenges as seen in this study and others (Fernandez et al., 2015, Howe & Stagg, 2016). A natural learning environment

proved to be a much more successful learning environment when compared to the traditional classroom. Students benefited from exposure to fresh air, natural lighting, and the sensory freedom which comes from being in nature (Louv 2005, 2008). In turn, the students were able to regulate their sensory input and were not distracted or overwhelmed by sensory processing challenges. This indicates that a natural learning environment could be a potentially successful context for developing sensory self-regulation more conducive to a positive learning experience both socially and academically.

Implications for Policy and Practice

Although the Least Restrictive Environment legislation is represented as a means of educational equality, making it possible for all students to experience learning in the same structure and setting, it does not necessarily promote equity. This approach can be damaging for certain groups of students such as those with ASD/SPD who may be already disenfranchised simply because of the environment in which they are being educated. For students who may be negatively impacted by the traditional classroom setting, it seems not only necessary but also conducive to the well-being of such students that alternative learning environments be considered by education policy makers on the state and local levels.

When decision makers make classroom/program placement decisions for students with ASD/SPD, it would be beneficial to have a conversation in terms of what the Least Restrictive Environment means for such students. An environment which can overwhelm student's regulatory system may not be an

environment in which learning can take place. In order to foster educational equity, it would be advantageous to consider a natural learning environment for students with sensory processing challenges. Students who can regulate their sensory processing will have a greater opportunity to be educated in a modality most appropriate for their needs.

Schools which are equipped to transport students to and from campus may find it beneficial to utilize this ability by taking students to natural learning environments to engage in academics. If a school site so allows, this researcher recommends that educators consider creative ways to work on academic and IEP goals in the natural learning environment. While the traditional classroom may appear to give educators a more controlled environment in the case of maladaptive behaviors, a preemptive approach is more appropriate in preventing the maladaptive behaviors from occurring. Taking students with sensory processing challenges into natural learning environments is taking them away from unfriendly classroom stimuli and approaching their sensory regulation needs in a proactive way.

Although districts may have accessibility issues which would prevent the introduction of outdoor classrooms or nature excursions, (budget, transportation, access to nature), there are steps that can be taken to give students a chance to experience a (more) natural learning environment. One example could be establishing a rotating schedule for teachers to take students to on-campus outdoor spaces (playground, sports fields, grassy areas, school gardens, blacktop) to engage in a class read-aloud, class discussion, writing, art project, or hands-on science lesson. Additionally, the classroom can be turned into a more

sensory friendly environment with the introduction of more natural lighting, windows that can be opened, indoor plants, better insulation, and more flexible seating. If there are any opportunities for schools to place classroom seating outdoors, it would be advantageous to do so.

The same is recommended for parents of children with ASD/SPD, to help minimize the distress caused by sensory dysfunction. Ensuring your child can access outdoor environments is crucial for sensory regulation. Adding outdoor seating, water features, sandboxes, and other small changes to outdoor home environments can create a more sensory-friendly environment which can benefit a child with sensory processing challenges.

Students who so desire could utilize outdoor seating areas to complete individual schoolwork, quiet reading, or use the area to take short breaks from the classroom. Any steps which make the learning environment friendlier for students with sensory processing challenges are steps to educate students in an equitable manner.

The outdoor sessions took place over the course of four weeks, taking students into natural learning environments twice per week. It would have been advantageous to extend the outdoor sessions over a longer time period to determine if the effect of the learning environment carried over into other areas of student development. Additionally, by extending this period of time, a greater understanding of the long-term effect of nature may have been noted.

A more diverse population of participants would have been more beneficial as the students in this study only ranged in age from 12-14, were primarily white, from middle-class families, and consisted of more males than

females. The age range of student population may have influenced the study as well, as the sensory impact of the natural learning environment may differ with age. Elementary and high-school aged students may have yielded differing results than seen in this study. The population of paraprofessionals was relatively fixed as well, with all paraprofessionals being white, middle-class females between the ages of 22-26 that are comfortable and familiar with outdoor environments. Perhaps data collection and observations recorded by a more diverse population of paraprofessionals would have resulted in varying results.

Directions for Future Research

With the noted benefits of the natural learning environment for this population of students, it is important to examine the potential for future research in this field. One significant consideration for future research is the idea of the learning environment and whether the benefits of the natural learning environment are connected to nature itself or simply the fact that the students are not in the traditional classroom. Other alternative learning environments (place-based learning, computer based-learning, independent study programs) should also be examined for populations of students with ASD/SPD to determine if perhaps simply being out of the traditional classroom is beneficial in the same ways as seen in this study.

Additional future research could analyze the effects of improving the traditional classroom to make it more conducive to students with sensory processing challenges. Areas to explore include ways to incorporate sensory-friendly aspects into the traditional classroom, and ways to bring elements of the

natural learning environment (plants, fresh air, natural lighting) into the traditional classroom to promote equity among students, improve overall learning, and make the traditional classroom a less restrictive environment.

Because the students in this study showed positive improvements in the areas of social behavior, communication, and participation, it would be of interest to research the potential positive impacts of a natural working environments for adults with Autism/Sensory Processing Disorder. Perhaps vocations which provide greater opportunity for nature exposure (park ranger, arborist, dog walker, hiking trail or beach maintenance) yield improvements in productivity, engagement, and overall well-being for adults with sensory processing challenges.

There are many pathways to explore with regard to the environmental impact on the educational, occupational, social, and emotional well-being of individuals with sensory processing challenges. Research which further enhances quality of life for these populations will assist in advancing equity for a historically marginalized population and is crucial to promote social justice in the areas of educational and occupational access.

Chapter 6: Conclusion

The time children spend in the classroom adds up over the years, accounting for a sizable portion of their lives. Because the things a child learns in the classroom are so pivotal for their development, both individually and societally, the environment in which they learn should not be a source of frustration, anxiety, or distress (Fernández-Andrés et al., 2015). Children with Autism and/or Sensory Processing Disorder experience their environments in more intensified and exaggerated ways, so the classroom environment can be overwhelming, overstimulating, or cause sensory dysregulation. When these students experience sensory dysregulation, they are not in a state where learning can occur and often experience academic, behavioral, and social deficits due to these sensory processing challenges.

The classroom environment should be a place which fosters equitable access to education, rather than merely equal access. The classroom environment can function well for many neurotypical children, with learning and development taking place naturally, unhindered by this environment. However, this environment (if left unchanged or unmodified) does not equally serve students with sensory processing challenges. This indicates that there are significant populations of students who are experiencing difficulty with their academic, social, emotional, and regulatory success. Therefore, it is of vital importance to ensure that a student's learning environment is not contributing to their sensory dysregulation, in order to cultivate equity in educational access.

A natural learning environment is a potential strategy to mitigate the inequitable nature of the traditional classroom, and this study, albeit limited by its size, has indicated that there is potential for such an approach. Natural environments have many benefits to humans in terms of emotional and mental regulation, reduced stress levels, and an increased connection to the world around them (Hart, 1969; Louv, 2005, 2008; Moore, 1986). For children with intellectual disabilities, exposure to nature improved behavior and increased self-efficacy, sociality, and overall motivation (Davis-Berman & Berman, 1989; McAvoy, Smith, & Rynders, 2006; Zachor et al. 2016). Taking these benefits into account, the natural learning environment is worthy of consideration for educators.

The benefits of the natural learning environment were observed in all seven students participating in this research. When in nature, students were more motivated and engaged in both individual and group academic activities, retaining more information and participating in more activities than the observed in the traditional classroom setting. Additionally, the natural learning environment decreased sensory processing distress, enabling students to fully experience the benefits from nature. In turn, student sociality increased and students communicated more with their peers, demonstrated more self-efficacy and self-advocacy, and had greater control over their sensory regulation. Because the students had less sensory distress and were able to experience the benefits of nature exposure, there was a clear reduction in the negative target behaviors outlined in their individual educational plans (IEPs), especially target behaviors

that result directly from sensory dysfunction. The natural learning environment proved to be a less restrictive environment for this population of students and yielded increased social communication, participation, and improved behavioral outcomes.

Because the natural learning environment proved to be such a beneficial environment for students with ASD/SPD, educators should consider introducing nature/natural learning environments into their practices. Taking students with sensory processing challenges into natural learning environments is, of course, ideal. However, this is not always realistic due to budgetary, liability, and other concerns that face educators, schools, and districts. Educators should objectively examine their teaching environment and evaluate the various sensory considerations existing which may negatively impact sensory sensitive students. If potentially unfriendly stimuli are found, it would be advantageous to remove or otherwise alleviate the problem area(s). Whether this means that students are removed from the classroom and taught in outdoor spaces on or off campus, or that the classroom environment is altered to help eliminate unfriendly sensory elements, creating a friendlier learning environment is crucial for the equity and success of this learning population.

Perhaps the most important discovery throughout this research is the roles with which these students play within their learning environments. Students who are severely influenced by their environments are forced to rely on various strategies to support their learning, adopting particular roles in their sensory regulation. This research introduces the concept that the roles that the sensory

sensitive students play in the traditional classroom environment are seeker and avoider. Students in the traditional classroom seek sensory strategies to help them cope with unfriendly stimuli. This can come in the form of noise-eliminating/cancelling headphones, weighted vests, fidgets, flexible seating, and other strategies to help cope with the harsh conditions afforded by the traditional classroom environment. In the avoider role, students avoid unfriendly sensory stimuli in whatever mechanism possible, sometimes choosing to elope into dangerous situations, harming themselves or others, verbal/physical outbursts, and other negative behaviors. These roles are disruptive to the classroom and negatively impact the learning of all students. Additionally, these roles do not cultivate student integration (a crucial desired outcome of Least Restrictive Environment in I.D.E.A.) as they further alienate an already marginalized population of students from their neuro-typical peers.

However, students participating in the natural learning environment take on the role of receiver and explorer of sensory stimuli. In the role of sensory receiver, students received natural sensory input in the form of natural light, fresh air, and natural elements such as trees, grass, dirt/sand, breezes, and ocean waves. This stimuli is organic, relaxing, soothing, and regulating to students who are often overwhelmed by un-natural stimuli. In the role of sensory explorer, students explored the various forms of sensory input/output and decided how, where, when, and if they would engage with this stimuli. In choosing the extent of engagement with their learning environment, students in the explorer role have more agency over their sensory regulation and, in turn, their education. The role

students with sensory processing challenges play in their learning environment determine how and to what extent their sensory input/output will influence their ability to learn both academically and socially/emotionally.

By giving a historically marginalized population of students the ability to have agency over their sensory needs within the context of their learning environment, they are more adept to self-efficacy and advocacy within their education. Students with sensory processing challenges benefit from a learning environment which does not simply maintain them but allows them to grow and thrive. Natural spaces are not always accessible for all educators, but the traditional classroom can be altered to support both neurotypical and neurodiverse students in more effective way. In taking students outdoors or bringing the outdoors into the classroom (in the form of fresh air, natural lighting, flexible seating, and indoor plants), the benefits of the natural learning environment can play a role in the successful education of all students. These small changes could lead to a greater understanding of the impact that learning environment has on the overall educational well-being of students both with and without sensory needs.

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