Supporting Sensory Development:
The Efficacy of Sensory Integrative Approaches to School-Based Occupational Therapy

A Senior Project submitted in partial fulfillment of the requirements for the Bachelor of Science Degree in Psychology by

Rebecca Heilbrun

Psychology and Child Development Department
College of Liberal Arts
California Polytechnic State University
San Luis Obispo

Fall Quarter, 2015

Faculty Advisor: Taylor Smith

© 2015 Rebecca Heilbrun
Acknowledgments

I would like to thank Karyl Babayova for involving me in the process of designing and constructing her therapy rooms. Since 2013, Ms. Babayova has provided me with numerous opportunities to further my education and understanding of occupational therapy. The inspiration for this project came from my experiences with Ms. Babayova and I am grateful for her continued mentorship and support.
Chapter 1

Introduction

Human development begins in the womb, an environment with minimal sensory input. Fetal development occurs in a dark, quiet environment, with minimal tactile stimulation. Upon birth, infants are suddenly thrust into an entirely opposite environment. Since most births in the United States occur in hospitals, most infants in the United States are born into noisy, bright, and urgent atmospheres, surrounded by doctors, nurses, and family members (MacDorman, Matthews, & Declercq, 2014). The newborn infant’s task is to process and integrate this new overload of sensory input, strengthening neural connections and pruning others as they learn about their world.

For most infants this challenging process is carried out relatively smoothly. For others, their sensory integration processing is more tumultuous, perhaps due to disorders, inadequate environments, or simply genetics. Neurodevelopmental disorders such as Autism Spectrum Disorder, and Attention-Deficit/Hyperactivity Disorder are two of the many challenges related to atypical sensory processing in children. Furthermore, environmental impact plays a significant role in an individual’s successful sensory integration. Environments that are over stimulating (too bright, too noisy, etc.) as well as environments that are under stimulating (too quiet, lacking colors, etc.) can have detrimental effects on the development of sensory integration in children. Other children are simply genetically predisposed to difficulties in integrating their sensory inputs.

Although sensory processing difficulties in childhood can potentially create challenges for an individual into adulthood, there are many possibilities for intervention. A child’s education
system plays a significant role in identifying developmental delays and providing support to help a child overcome challenges. School based occupational therapy can help assess the developmental needs of a child with developmental delays, then provide a therapy plan to help the child improve skills related to sensory processing and motor output. Ultimately, the goal of occupational therapy in schools is to help students access their academic curriculum and realize their full academic potential.

As sensory integration is so closely related to one’s environment, an adequate occupational therapy clinic is essential to providing optimal therapy services to children. However, with budget challenges in the California public school system, constructing appropriate and useful clinics is a challenge for educational occupational therapists. As such, I had the opportunity to work with school based Occupational Therapist Karyl Babayova, OTL/R, with the Sulphur Springs School District to convert two elementary school classrooms into sensory integration clinics. So as to overcome the challenges of a low budget, we obtained supplies from donors, made purchases at stores willing to provide charitable discounts, designed and constructed various aspects of the clinics, and created a Donor’s Choose profile — a website which allows donors to select and fund educational projects benefiting young students.

This paper seeks to explain the role of occupational therapy services for young children with sensory processing deficits and delays, the relationship of successful sensory integration to learning, and discuss the efficacy of sensory integrative approaches when addressing sensory processing difficulties. Furthermore, this paper will explore the shortcomings and limitations of sensory integration research and implications for the use of sensory integrative therapies. I will begin with a literature review pertaining to the neurological processes and ideology behind
sensory integration, presented sequentially from fetal development through adulthood. Following
will be a second literature review, covering atypical sensory integration in children, with
particular regard to neurodevelopmental disorders. Topics explored will analyze the effects of
sensory processing challenges on children’s learning and social interactions, and examine how
adult supporters can provide optimal environments and activities for improving sensory
integration skills. This paper will conclude with a discussion of my experience participating in
the construction of sensory integration clinics and the insights afforded to me by this opportunity.
This discussion will emphasize the role of school based occupational therapists and the merits of
multi-sensory environments in elementary schools.
2.1 Ideology of Sensory Processing

An understanding of the underlying neurology and theories surrounding sensory processing is imperative when examining occupational therapy approaches to addressing sensory processing difficulties. At the core of its complex neurology, neurotypical sensory processing can be understood as a simple input-output system, wherein sensory receptors throughout the body are alerted to environmental stimuli, triggering the transmission of input signals from sensory receptors to the brain. (Munger & Ide, 1988). The information is then integrated in the brain, resulting in an adaptive behavioral output which may either be habituating or sensitizing. Habituation occurs when the central nervous system (CNS) becomes familiar to a stimuli and decreases nerve cell responsivity. In contrast, sensitization occurs when the CNS attends to interesting or threatening stimuli, subsequently increasing neuronal response. However, discrepancies in this pattern denoting the apparent heterogeneity of sensory symptoms prompted scientific exploration seeking insights into the infinite complexities of sensory processing. (Schaaf & Miller, 2005).

Leading the quest for knowledge was occupational therapist A. Jean Ayres, PhD, OTR. A pioneer in sensory integration research, perhaps one of Ayres’ most influential contributions was her Sensory Integration Theory, which sparked an exponential growth of research in the field (Schaaf et al., 2005). While Ayres produced a trademarked therapy entitled Ayres Sensory Integration® (ASI), many other therapy models have emerged which also utilize a sensory
integrative approach. Although important to note the distinct singularity of these different approaches, each has roots in Ayres’ original theory, thereby warranting an appreciation of the underlying principles.

A multidisciplinary conception, Sensory Integration Theory builds on assumptions derived from several fields of study, including neurology, psychology, occupational therapy, and education. Sensory Integration Theory can be summarized by the following three elemental principles: (1) learning relies on the ability to process and integrate environmental stimulation and movement to produce appropriate responses; (2) individuals with sensory processing challenges may have subsequent difficulties producing appropriate responses to stimulation, which could hinder learning and adaptive behavior; and (3) participation in focused sensory activities would therefore improve ability to process sensory input, thus increasing learning and desired behaviors (Ayres, 1972; Glennon, 2013; Schaaf et al., 2005). Sensory Integration Theory is derived from the idea that learning and brain plasticity are inherently interrelated, driven by experiences and interactions with one’s environment (Schaaf et al., 2005; Squire, Buonomano, & Johnson, 2009). Several sensory modalities are pertinent to the shaping of the mature brain, including the vestibular, tactile, visual, proprioceptive, auditory, and olfactory systems (Hensch, 2004; Su & Parham, 2014; Windhorst, 2009). Although previously thought to function independently of one another, more recent research seems to indicate brain function and plasticity are driven by the interaction of these modalities, such that an established sensory pattern beyond merely sensory stimulation is necessary to influence brain plasticity (Gotgay et al., 2004; Shimojo & Shams, 2001). Hence, a holistic perspective of sensory systems
development is integral to attaining reliable research and formulating effective sensory based therapies.

Discussion regarding the typical trajectory of sensory systems maturation allows for a better understanding of the developmental tasks faced by the elementary aged child. Recognizing the phenomenal plasticity of the brain, sensory experiences throughout development are directly related to brain circuitry and functioning (Mezzera & Lopez-Bendito, 2015; Schaaf et al. 2005; Squire et al., 2009). Furthermore, development of the sensory systems begins in the womb and continues throughout the lifespan, albeit with less vitality and greater effort than in childhood (Scholz, Klein, Behrens, & Johansen-Berg, 2009). Thus periods of critical development, beginning in utero and continuing throughout childhood and adolescence, have vast implications for cognitive and motor functioning in adulthood.

The following sections will present research pertaining to sensory processing, brain plasticity and human development. Given that several of the studies presented utilize neuroimaging technology in their research, a brief overview of neuroimaging technologies lends itself to enhanced clarity of subsequent sections.

2.2 Neuroimaging Technology

Scientific developments in neuroimaging have greatly enhanced our ability to map the human brain and have consequently provided vast insights into the neurological mechanisms of sensory development (e.g., Gotgay et al., 2004; Macaluso & Driver, 2005). One such study conducted by a team researchers affiliated with the National Institutes of Mental Health and the University of California School of Medicine used neuroimaging technology to track the brain development of thirteen healthy children over the span of eight to ten years. A collection of
magnetic resonance imaging (MRI) scans obtained from each participant every two years was combined into a time lapse sequence, allowing researchers to visually observe a decade of brain development in one concise sequence. One significant finding of the study revealed cortices associated with higher order functioning develop only after somatosensory and visual cortices develop. The study found the frontal cortex develops front to back, beginning with the primary motor cortex and ending with the prefrontal cortex. When comparing the results of this study to brain scans of children with Autism, the brain scans of children who were diagnosed with Autism before age three initially showed global cerebral hyperplasia, followed by larger grey matter volumes of the frontal and temporal lobes at four years of age, and slowed growth rates of the frontal and temporal lobes by age seven (Gotgay et al., 2004). Although not yet able to determine causality, this study may allude to the discourse from typical patterns of cortical development as a potential underlying factor of Autism. The ability to pinpoint plausible causes for divergent neurological patterns allows us to formulate hypotheses pertaining to more typical patterns of neurology. Thus an understanding of the maturational patterns of cortical development provides a framework for which to explore both neurornormative as well as atypical development.

2.3 Prenatal, Infant, and Early Childhood Sensory Development

Even before birth, the cycle of integrating sensation and outputting responses is set in motion. Studies revealing the ramifications of sensory deprivation or overstimulation occurring at various stages of development indicate certain periods of heightened sensitivity (e.g. Berardi, Pizzorusso, & Maffei, 2000; Hensch, 2004; McMahon, Wintermark, & Lahav, 2012; Meredith, 2015). The developmental period during which interruption of the sensory development trajectory occurs is believed to effect the resulting neural plastic adaptations, according to the
analysis of sensory deprivation in non-human vertebrates by Mezzaera & Lopez-Bendito (2015). Further studies confirm the idea that sensory deprivation occurring in infancy and even in utero can impact the development in the elementary years and beyond.

Sensory development begins in the womb and develops rapidly throughout the first year of life. Human brains grow more within that first year than they ever will again within the span of one year, with the brain reaching approximately 80% of its adult weight by the second year (Casey, Giedd, & Thomas, 2000; Montagu, 1978). Because of the large size of human brains, infants are born in a much less developmentally mature state than the young of other mammals. If human fetuses developed to a similar level of maturity as those of other mammals, the head of the infant would be too large at birth to pass through the narrow human pelvis (Boyce & Zeveloff, 1982). Thus human infants are essentially born in an altricial state, requiring continued development of tasks and processes seemingly better suited to a uterine environment. This pattern of slow maturational growth continues throughout the lifespan, with significant implications for sensory development (Bjorklund, 1997; Clancy, Darlington, & Finlay, 2001).

Research highlights the adaptive role of prolonged maturational development as an agent for neural plasticity (Bjorklund, 1997). Throughout childhood and adolescence, but especially in infancy, competition amongst the sensory systems elicits strengthening and pruning of neural connections. Ideally, the infant’s environment provides enough input for continued development without overstimulating the nervous system. However, all infants will inevitably encounter unpredictable and sometimes unfavorable sensory stimuli, potentially resulting in maladaptive emotional and behavioral responses. Neuroplasticity of the nervous system prevents permanency
of disadvantageous learned responses and acts to maintain sensory equilibrium (Bjorklund, 1997).

Despite the many benefits to development, neuroplasticity is not without limitations. The challenges of an altricial existence are exponentially heightened for preterm infants, impacting development of all sensory modalities. Although all sensory systems can be effected, for the sake of brevity, this section will use the auditory system as an illustration of the role developmentally critical periods play in regard to subsequent stages of growth. Several studies have found that infants as young as four days old are able to recognize their native language, with some findings suggesting this ability may be present mere hours after birth. This not only confirms the development of the auditory system during gestation, but may also indicate that processes of learning and memory begin in the womb (Mehler, Jusczyk, Lambertz, Halsted, Bertoncini, & Amiel-Tison, 1988; Moon, Lagercrantz, & Kuhl, 2013). Consistent with this finding, studies have indicated that deprivation of language exposure as well as overstimulating levels of ambient noise in the neonatal intensive care unit (NICU) can delay a child’s language acquisition and may potentially be associated with hearing loss (McMahon et al., 2012; Pineda et al., 2014). Premature births represent a disruption in the typical trajectory of sensory development, thus the auditory processing challenges commonly observed in preterm infants can be generalized to other sensory modalities. This assertion is supported by studies comparing preterm preschoolers to control groups of same-age, full-term peers. A study conducted by a team of Stanford Neonatal and Developmental Medicine researchers found preterm birth to be a strong predictor of sensory symptoms during the preschool stages of development (Adams, Feldman, Huffman, & Loe, 2015). Additional findings revealed preterm preschoolers commonly exhibit executive
functioning impairments, although the research does not lend any assertions as to the potential interrelationship of sensory symptoms and executive functioning. While most studies on sensory integration in preterm infants limit discussion to implications for preschool, the significance lies in the ability of findings to vividly depict the effects of one sensory developmental period on a latter stage of growth (Adams et al., 2015; Crepeau-Hobson, 2009). Following further research, generalizations could potentially extend to the relationship between preschool and elementary sensory development, based on corollary findings between infant and preschool stages of development.

Beyond preterm birth, various other sensory deficits experienced in infancy can impact later stages of child development. While preterm birth represents one cause, other reasons for sensory integration challenges are often less transparent. Ironically, atypical sensory processing tends to be the norm, as most children will experience sensory processing difficulties at some point during childhood (Cheung & Siu, 2009). As the research by Gotgay, et al. (2004) revealed, cortical development follows a specific trajectory of maturation. Regardless of cause, disruption to the typical sensory development pattern will likely cause subsequent challenges. To clarify, neuroplasticity is not a mechanism itself, but rather describes the high responsivity of the central nervous system as a characteristic property, ideally in favor of adaptive behaviors. Neuroplasticity essentially provides a figurative buffer, maintaining stability of reactions elicited by sensory input. However, when disruptions in typical development are such that the mechanisms acting on neuroplasticity fail to produce adaptive responses, the addition of effective therapies and/or educational activities can serve as a catalyst for neuroplasticity, eliciting a restructuring of neuronal connections consistent with desired behavioral outcomes.
2.4 The Role of Elementary Education

The elementary school years are perhaps one of the most tumultuous periods of sensory development. In addition to the multitude of sensory difficulties which commonly emerge in the formative preschool years, sensory challenges will continue to arise and disappear throughout the elementary years. Furthermore, the transition from preschool to elementary school marks a unique challenge in and of itself (Ahtola et al., 2011; Ladd & Price, 1987). Preschoolers are often accustomed to less structured, play-based curriculums which typically present a variety of sensory experiences throughout the day. In contrast, elementary school places increasingly higher demands on the abilities of children to exercise self control, exhibit awareness and regard for others, and attend to their curriculum. While much of the recent research has focused on the child’s cognitive readiness, attending to the emotional needs of the child is also imperative. Despite an apparent cognitive readiness for school, some students may experience a lack of socioemotional readiness. Although particularly anticipated during times of transition, sensory processing difficulties and developmental delays amongst students will continuously arise and disappear throughout the elementary years. A basic understanding of students’ sensory needs affords teachers significantly more resources in managing disruptive behavior. For instance, because sensory over-responsivity in children is implicated as a likely cause of heightened anxiety, incorporating sensory integrative activities into the classroom could potentially promote more effective coping skills in response to everyday stressors, likely improving behavioral responses (Lane, Reynolds, & Dumenci, 2012).

In addition to promoting mental wellbeing, sensory integrative activities may prove similarly beneficial to physical health and academic success. The addition of “dynamic
physical activity” into elementary curriculum is associated with improved body awareness of children (Elena, Georgeta, Cecila, & Lupu, 2014). Research indicates gross motor control, a skill improved by body awareness, is associated with higher levels of academic achievement, although causality has not been determined (Lopes, L., Santos, Pereira, Lopes, V., 2013). Not only are elementary schools optimal environments for instilling lifelong healthy living habits in students, but research findings correlate the physical health of students with improved academic success. A national trend toward public health promotion along with the positive findings on academic performance provide elementary school systems increasingly more incentive to implement physical and body awareness activities as part of their curriculum. (Lopes, L. et al., 2013; Pyle, Sharkey, Yetter, Felix, Furlong, & Poston, 2006).

2.5 Implications for Adulthood

Undeniably, the education received by a child has vast implications for the future. As the United States education system typically utilizes a curriculum that builds upon previous educational standards, there is little flexibility for elementary students to fall behind. Failure to succeed in elementary school can have social ramifications in childhood as well as educational and career implications lasting into adulthood (e.g., Hughes, Dyer, Luo, & Kwok, 2009). Sensory processing delays and deficits commonly arise in elementary school and pose a potential threat to academic achievement. However, interventions and other school based supports are largely successful in yielding positive results, due to the high neuroplasticity of children’s brains.

In concluding this section, I wish to emphasize the indiscriminate nature of sensory challenges. Sensory processing most often occurs as a largely unnoticed neurological mechanism, yet each individual has a unique set of preferences and inclinations surrounding
sensation which are central to one’s identity. At every moment of consciousness and even in sleep, continuous sensory input is received and processed. Inevitably, sensory processing will present challenges at times throughout every person’s life — a concept that affords a certain level of empathy and understanding toward others, which is often lacking in other areas of neurodevelopmental challenges. Consideration of one’s own relationship to sensory processing provides a useful perspective from which to begin the exploration of more atypical models of sensory development discussed in the following chapter.
3.1 Sensory Processing Difficulties

Sensory processing difficulties is an umbrella term describing a wide range and variety of atypical and problematic patterns of sensory integration (Engel-Yeger & Ziv-On, 2011). Individuals experiencing sensory challenges can be hypersensitive or hyposensitive to sensory input. Hypersensitive individuals will have a tendency toward sensory avoidance whereas hyposensitive individuals will tend to exhibit sensation seeking behaviors (Engel-Yeger et al., 2011). Both sensation avoidant and sensation seeking behaviors can be disruptive and inhibit the elementary student’s ability to access curriculum and tap into the child’s full potential. Sensory processing difficulties are evident in many neurodevelopmental disorders including Autism Spectrum Disorder and Attention-Deficit/Hyperactivity Disorder. Furthermore, there has been debate as to the existence of Sensory Processing Disorder or whether sensory processing difficulties are exclusively symptomatic of other disorders. At present, the American Academy of Pediatrics does not support diagnosis of Sensory Processing Disorder and the disorder was not included in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (Critz, Blake, & Nogueira, 2015). Especially following the exclusion of Sensory Processing Disorder from the DSM-5, it is important to note that sensory processing delays and deficits can effect neurotypical children as well, with most children between the ages of six and twelve experiencing sensory processing challenges at some point during their development (Cheung & Siu, 2009).
This chapter will explore the typical symptoms and diagnostic criteria of two of the most prevalent disorders commonly associated with sensory processing difficulties — Autism Spectrum Disorder and Attention Deficit/Hyperactivity Disorder. Furthermore, this chapter will include a brief exploration of other causes for sensory processing difficulties in elementary aged children. An analysis of interventions and treatments with a focus on sensory integrative approaches will follow.

3.2 Autism Spectrum Disorder

3.2.1 Diagnosis and presented challenges. Before evaluating intervention and treatment options for children with Autism, a comprehensive understanding of Autism and criteria for diagnoses is necessary. Because Autism is a spectrum disorder encompassing several disorders and syndromes, with impairments ranging from mild to severe, criteria for diagnosis presents many challenges. Therefore, despite ample research seeking to assess symptoms characterizing Autism Spectrum Disorder (ASD) versus differential diagnoses, much debate among the scientific community still continues as to what constitutes an Autism Spectrum Disorder. Universally accepted defining characteristics of Autism spectrum disorders include communication deficits, social skills deficits, and ritualized or repetitive behaviors — the severity of which vary amongst individuals with ASD (Matson & Goldin, 2014).

As discussed in Chapter 2, brain structure can be altered by the process of integrating sensory input. When there is a discrepancy between the sensory stimuli an individual receives and that person’s ability to integrate the input, repercussions manifest in a variety of ways, which complicates the ease of diagnosing developmental delays (Lenroot & Giedd, 2006). An additional challenge to medical professionals in diagnosing young children, is determining
whether the child in question is presenting with learning delays or a lifelong neurodevelopmental disorder such as ASD. Even within the realm of ASD, infinite variations occur from person to person. The severity of the discrepancy between environmental stimuli and one’s ability to process input greatly contributes to the severity of an individual’s Autism, reinforcing Autism as a spectrum disorder. Furthermore, high rates of co-occurrence of other disorders add yet another challenge to the diagnosing of Autism (Matson et. al., 2014).

Unlike many other disorders, studies have indicated that the characteristic symptoms of Autism appear much earlier than those of other disorders. A literature review by Saint-Georges et al. (2010), analyzing all prior studies on home movies of infants later diagnosed with ASD, revealed that the characterizing symptoms of ASD are often evident in children under the age of twenty four months. Regardless of intervention type, most researchers agree the earlier intervention is initiated, the greater the success of outcomes. As such, recent years have brought a push for diagnosing ASD in early childhood as opposed to elementary school (Matson, et al., 2014). While the positive outcomes of early intervention for ASD are widely regarded, the type of intervention also plays a key role in the outcome of intervention.

### 3.2.2 Interventions for Autism Spectrum Disorder

Vast amounts of therapies and treatments are available to children with ASD including diet modifications, medications, behavioral therapy, social skills training, speech therapy, and sensory integration. A study by Goin-Kochel, Myers, and Mackintosh (2007) reported that the average family has tried between seven and nine treatments for their child with ASD. Much of the research on ASD treatments is inconclusive, largely due to the subjective nature of measures used to assess behavior and the diversity of symptomatology amongst children with ASD (Goin-Kochel et al., 2007).
Furthermore, no correlation exists between scientific support for a treatment and the selection for use of that treatment by parents of children with ASD. (Matson & Williams, 2015). This discrepancy is a testament to the need for further research so as to better assist parents and care providers in determining the best course of action when treating ASD.

Although medications are available for the treatment of Autism, little research is available to support the effectiveness of these drugs, and researchers disagree as to whether antipsychotics are effective among individuals with developmental delays (Matson et al., 2015).

Beyond the use of medication, Applied Behavior Analysis (ABA) is among the most popular choices for treatment by parents. According to Goin-Kochel et al. (2007), 55.2% of children with ASD surveyed in his study had tried ABA. The term ABA actually represents a large number of treatment models which approach behavior as a function of environmental input (Virues-Ortega, 2010). Generally, Applied Behavior Analysis is a child-centered, highly structured, and intensive method of therapy. One significant strength of ABA is the positive improvements seen in areas of communication (Virues-Ortega, 2010). This finding is particularly noteworthy due to the communication barriers which often present in children with ASD. By nature, ABA is highly focused on distinct areas of delay specific to the individual, but therapists must take caution not to exclude less severe areas of difficulty. For instance, a study by Zachor and Itzchak (2010), specifically highlighting the merits and shortcomings of ABA, found that despite improvement in several areas, study participants showed a decline in motor planning after receiving one year of consistent, intensive ABA therapy. The researchers hypothesize that the ABA therapies may have been focusing too intently on certain areas while neglecting daily living and motor skills (Zachor & Itzchak, 2010). The results of this study emphasize the
importance of a holistic, comprehensive treatment plan. Applied Behavior Analysis is not a panacea for the treatment of Autism, despite its highly touted benefits. Therefore, improving the scope of ABA, using ABA as part of a multimodal treatment plan, or considering other methods of intervention are all options for health care professionals to consider.

3.3 Attention-Deficit/Hyperactivity Disorder

The second neurodevelopmental disorder highly associated with sensory processing difficulties examined in this chapter is Attention Deficit/Hyperactivity Disorder (ADHD). The most prevalent neurodevelopmental disorder in children, ADHD is diagnosed in approximately 5% of children (Pericak, 2015). Like Autism spectrum disorders, ADHD is an incurable, yet highly treatable disorder that is typically diagnosed in childhood and persists into adulthood (Tamm, 2009). Symptoms of ADHD include hyperactivity, impulsivity, and inattention which impair daily functioning (Daley, D. et al., 2014). ADHD is not a spectrum disorder, but rather three types of presentations can occur, with inattentiveness, hyperactivity, and impulsivity manifesting in different combinations and severities. These presentations include the Combined Presentation, Predominantly Inattentive Presentation, and the Predominantly Hyperactive-Impulsive Presentation (Centers for Disease Control and Prevention [CDC], 2015). Diagnostic criteria of ADHD as outlined by the DSM-5 require symptoms to be present for a minimum of six months, and must appear before the age of twelve (Pericak, 2015). Furthermore, in contrast to ASD for which early childhood diagnosis is encouraged, the child must be four years of age or older to be evaluated for ADHD.

3.3.1 ADHD and sensory processing. Sensory processing difficulties in children with ADHD do not constitute a specific subtype or characteristic symptom of ADHD, however
sensory processing difficulties are significantly higher in children with ADHD than in more typically developing children (Ghanizadeh, 2011). Although not yet fully understood, the causal relationship of sensory processing seems to be neurologically different in ASD and ADHD. Whereas in ASD, sensory processing deficits seem to influence the severity of autistic symptoms, the severity of ADHD seems to influence the severity of sensory processing deficits (Lenroot & Giedd, 2006; Ghanizadeh, 2011; Lane et al., 2012). Thus sensory processing presentation in children with ADHD has not been as widely studied as in children with ASD, yet the common co-occurrence of sensory issues and ADHD lends itself to an interesting area of exploration for researchers and therapists alike. Because sensory processing is a fundamental aspect of ASD, but seems to be a potential outcome of ADHD — fundamentally distinct from the disorder itself — a discussion on the sensory-specific ramifications of ADHD-associated difficulties is warranted. Studies have indicated that children with ADHD may be more likely to have weak social skills, struggle with academics, and have higher levels of anxiety (Engel-Yeger & Ziv-On, 2011; Pliszka, 2003; Lane, Reynolds, & Dumenci, 2012; Ghanizadeh, 2011; CDC, 2015).

In regard to social skills, researchers Engel-Yeger and Ziv-On (2011) conducted a study on the relationship between sensory processing difficulties of children with ADHD and their preferred leisure activities, revealing significantly low levels of interest in social activities as compared to a control group of same-age peers. This correlation indicates a need for further research exploring possible causes for low interest in social activity in children with ADHD.

Additionally, approximately 25-34% of children with ADHD also present with a comorbid anxiety disorder. (Pliszka, 2003; Lane et al., 2012). Studies have found a strong
relationship between sensory over-responsivity and anxiety, identifying sensory responsivity as a mediating variable between baseline arousal and outcome anxiety following a sensory challenge (Ghanizadeh, 2011; Lane et al., 2012).

It is important to note the research findings asserting that ADHD-associated academic struggles are due to an inability to attend to and access curriculum, not a result of low intelligence. For instance, children with ADHD tend to exhibit a sensitivity to auditory input as compared to peers without ADHD (Ghanizadeh, 2011). Auditory processing difficulties may present as a hypersensitivity to sound or a hyposensitivity to sound (Ghanizadeh, 2011). Children who are hyposensitive to sound may be irresponsible or confused as to the origin; whereas children who are hypersensitive may attend to sounds otherwise ignored by others, or even experience pain and discomfort (Ghanizadeh, 2011). Both hyper and hyposensitivities to sound can effect academic success, in that children may be inattentive and/or easily distracted (Ghanizadeh, 2011). This example highlights a barrier to accessing academic curriculum, not a deficit in intelligence.

3.3.2 Interventions for ADHD. Unlike ASD, an expansive selection of FDA approved medications are prescribed to treat symptoms of ADHD. Stimulant medications are most commonly prescribed in the treatment of ADHD and are effective in 70-80% of children (Tamm, 2009). These medications act to increase the inhibitory actions of the frontal cortex, thus reducing ADHD symptoms such as inattention, hyperactivity, and impulsivity. These medications are thought to allow children the ability to access self regulation skills they already possess. Although these medications have been largely successful, a wide array of side effects are also associated with stimulant medications. Common side effects include disrupted sleep, anxiety,
irritability, decreased appetite, stomach aches, head aches, and even mild growth suppression (Tamm, 2009). Furthermore, medications only treat ADHD symptoms, but do not provide a cure. The effectiveness of medication depends on consistent, continual use. Stimulant medication for treating childhood ADHD have been successful in helping to improve academics, behavior, and social skills. However, there is not sufficient evidence supporting the longterm effectiveness of stimulant medication on the ADHD prognosis (Tamm, 2009). Because of the potential for negative side effects and the variation of effectiveness amongst individuals, alternative treatments to be used in combination with or in place of medication warrant consideration.

One alternative to stimulant medication is behavioral interventions. The *International Encyclopedia of the Social & Behavioral Sciences* explains that behavior therapy operates such that “behavior [is] a function of its consequences” (Ardila, R., 2015). This means that behavioral changes are elicited by the outcomes of past behavior. According to the American Academy of Pediatric (2011), behavioral interventions involve training parents and teachers in various methods of rewarding and reinforcing positive behaviors and ignoring or punishing negative behaviors in children. The objective of behavior therapies is to increase adaptive behaviors and decrease inappropriate and undesirable behaviors in children with ADHD.

Most of the studies exploring behavioral interventions for ADHD rely on the feedback of evaluators such as parents and teachers who typically cannot be blinded to the interventions used. When raters are not blinded to study variables, reports are typically biased and effects are often overestimated (Polit, Gillespie, & Griffin, 2011). Furthermore, many of these studies failed in ability to generalize intervention effects to multiple settings (e.g., the home versus school settings).
Initial evidence seems to support the use of behavioral interventions for improved academic and social success of children with ADHD. However, more studies need to be conducted with objective reports from blinded raters before the effectiveness of behavioral interventions on managing ADHD symptoms can be concluded with certainty. Despite studies on the direct effects of behavior therapy on managing ADHD symptoms proving largely inconclusive, a meta-analysis of 32 studies on behavioral interventions for children with ADHD by Daley, et al., (2014) found a particularly unique benefit of behavioral interventions to be prevalent throughout the included studies. Parent training on managing the behavior of their children with ADHD was central to the intervention methods used in nearly all of the studies, which resulted in higher parenting self-concept. Given that past studies have found positive parenting self-concept to be a key component of improving strained parent-child relations, the authors of this meta-analysis suggest behavioral interventions could indirectly improve behavior and conduct problems in children with ADHD because of the empowering effect training has on parents (Daley et al., 2014; Johnston, 1996).

3.4 Sensory Integration

3.4.1 Sensory integrative approaches to ASD therapy. Behavioral limitations of Autism result, in part, from a combination of sensory processing deficits and neurological functioning. Research suggests over 80% of children with ASD diagnoses experience sensory processing dysfunction, lending support to the assumption that intensive sensory integration therapy could improve limiting behaviors associated with ASD (Case-Smith, J., Weaver, L.L., Fristad, M.A., 2015).
Two main classes of sensory approaches to ASD treatment have been constructed. Sensory integration therapy (SIT) is a child-centered, play-based approach utilizing enhanced sensation to produce desired behavioral responses in the child. Sensory-based interventions (SBI) are adult directed and incorporate sensation strategies into the child’s daily life to help promote self-regulation. Both SIT/ASI and SBI approaches aim to increase the efficiency of neural processing of sensory information by consistently providing sensory experiences to the individual and target both hypo- and hyper-sensitivities (Barton, Reichow, Schnitz, Smith, & Sherlock, 2015).

**SIT therapy.** SIT is a play-based method in which gross motor activities are used to challenge the child’s highest developmental abilities (Case-Smith et al., 2015; Watling et al., 2015). As the child progresses, ideally the child’s ability to integrate sensory information improves, in turn improving the child’s ability to self-regulate and demonstrate adaptive behavior (Case-Smith et al., 2015). SIT requires the availability of clinical equipment, such as swings and therapy balls, used to stimulate vestibular and proprioceptive sensory systems. This approach views maladaptive behaviors as communicative of sensory processing deficiencies, thus a reframing of undesirable behaviors provides parents, caregivers, and educators with a starting point from which to approach behavioral issues. An extensive review of sensory processing studies found positive effects on the individualized goals of participants after receiving sensory integration therapy in all studies analyzed. (Case-Smith et al., 2015)

**Examining a method of SIT: Ayers Sensory Integration®** The most commonly used and best regulated method of SIT is the Ayers Sensory Integration® (ASI) approach. In an effort to increase the validity and reliability of studies, a fidelity measure was created to ensure all ASI
treatments were consistent and hence allow studies on sensory integration to be replicable (Watling et al., 2015; Parham et al., 2011). The Fidelity Measure created by Parham et al. (2011) lists ten criteria for which interventions must follow so as to be classified as ASI: (1) ensure physical safety; (2) present sensory opportunities; (3) help to maintain appropriate levels of alertness; (4) challenge postural, ocular, oral, or bilateral motor control; (5) challenge praxis and organization of behavior; (6) collaborate with child in activity choice; (7) tailor activity to present a just-right challenge; (8) ensure activities are successful; (9) support the child’s intrinsic motivation to play; and (10) establish a therapeutic alliance with the child. Consistent with the findings of Case-Smith et al. (2015), a systematic review of sensory based interventions by Renee Watling and Sarah Hauer (2015) found the use of ASI in the treatment of children with ASD to be associated with progress on individualized goals, improved sleep, decreased stereotypical Autism behaviors, and reduced caregiver burden.

**SBI therapy.** The theory behind SBIs is that the addition of enhanced sensory experiences to a child’s daily routine can alter the child’s level of arousal to produce more appropriate, adaptive behavior (Case-Smith et al., 2015). Examples of SBIs include weighted blankets, pressure vests, bouncing on therapy balls, and brushing. When used in combination and integrated into the child’s life on a daily basis, the term “sensory diet” is used (Watling et al., 2015). The objective of using various components of a sensory diet is to elicit a calming effect on hyperactive children, however most research pertaining to SBIs has been observation based. Thus no specific criteria or protocol for SBIs have been developed and results of SBI use can be highly subjective. A meta-analysis by Case-Smith, Weaver, and Fristad (2015) examining fourteen studies on the use of SBIs to treat ASD, found the results of the studies to be contradictory and inconclusive.
Consistently, a systematic review of SBIs by Renee Watling and Sarah Hauer (2015) found the literature pertaining to SBI insufficient. However, studies did reveal consequential differences between multisensory SBIs (stimulating two or more senses) and single sensory SBIs. The use of multisensory SBIs was found to be associated with higher scores in cognitive and vocabulary testing, improved ASD behaviors, improved motor control, and increased focus (Watling, et al., 2015). In contrast, the review included seven studies on weighted vests (a single sensory SBI), all of which concluded no observable effect on problem behavior and attention (Watling et al., 2015). The review found vestibular stimulation to be the most promising form of SBI, with one study indicating linear movement such as swinging or bouncing on a ball having a positive effect on learning when used before academic instruction (Watling, et al., 2015). Due to a lack of rigorous studies on SBI efficacy, researchers Watling and Hauer (2015) note that drawing conclusions as to the use of SBI in ASD treatment would be premature.

### 3.4.2 Sensory integrative approaches to ADHD and sensory processing difficulties.

The sensory challenges of children with ASD and ADHD often appear similar and most children between the ages of six and twelve can be expected to experience sensory processing difficulties at some point within that span (Cheung & Siu, 2009). Therefore, although originally researched exclusively for the treatment of children with ASD, sensory processing therapies can be applied when treating a variety of sensory difficulties. Furthermore, providers cannot ignore the high comorbidity rates of ADHD and ASD. Research has identified sensory processing to be a predictor of ADHD symptoms and Autism severity (Sanz-Cervera, Pastor-Cerezuela, Fernandez-Andres, & Tarraga-Minguez, 2015). Therapists can expect that when treating children with ASD, ADHD associated symptoms will often also need to be addressed and vice versa.
Recalling that children with ADHD and sensory processing difficulties often experience related challenges such as anxiety and poor social skills, therapists should consider the use of sensory integrative therapies as part of a multimodal therapy plan. Studies reveal these secondary symptoms to be particularly associated with sensory processing difficulties (Engel-Yeger & Ziv-On, 2011; Cosbey, Johnston & Dunn, 2010).

In addressing social skill deficiencies, therapists should consider a bidirectional relationship between social skills and participation in social activity. The lack of socialization would lead to poor social skills and poor social skills would lead to low preference for social activity. Due to lack of conclusive research on the exact cause of the relationship between ADHD, sensory processing difficulties, and lack of participation in social activities, therapists should consider tactics for increasing social competency as part of a sensory integrative approach to therapy (Engel-Yeger, & Ziv-On, 2011 & Cosbey et al., 2010). Furthermore, occupational therapists must be cognizant of the high comorbidity rates of ADHD and anxiety disorder. Recognizing that sensory overresponsivity appears to be the mediating variable between ADHD and anxiety, therapists should consider sensory integrative therapy as a means of instilling anxiety coping capabilities in children with ADHD (Lane et al., 2012).

3.4.3 Limitations of sensory integration therapy. One limitation of many studies on sensory integration approaches is the failure to link the deficiencies of specific sensory systems (i.e., auditory, vestibular, etc.) to behavioral outcomes in terms of quantifiable results (Baranek, 2002). Researchers need to consider the heterogenous nature of ASD when drawing conclusions regarding behavior resulting from sensory integration therapies, which may limit the generalizability of sensory integration studies (Baranek, 2002).
Furthermore, to date there is no universally accepted protocol for sensory integration therapies, preventing SI therapies from easily being replicated. Although ample studies conclude in support of SI approaches, the lack of protocol for SI therapies prevents SI from being considered an evidence based approach (Barton et al., 2015).

Many of the randomized control studies on SIT produced favorable results. However, according to Barton et al. (2015), most of these studies were based on goal attainment measures, relying on subjective parent and educator responses, who were aware of the study condition.

3.5 Implications for Occupational Therapy Approaches

Much of the research on sensory integration therapy is inconclusive, largely because evaluations of sensory processing often rely on subjective questionnaires. Furthermore sensory integrative methods lack consistency in theories and application, preventing the advancement sensory integrative approaches toward evidence based practices. However, the inconclusiveness of research on sensory integrative approaches does not necessarily indicate that the method is ineffective, but rather indicates a need for further research and fidelity measures. For instance, SIT approaches are associated with positive outcomes, especially when fidelity measures are applied (Watling, et al., 2015). Ensuring the accurate and consistent use of terminology will keep therapists current and informed on the latest research and maintain adherence to the underlying theories behind occupational therapy (Watling, et al., 2015). Providing specialized certification opportunities for occupational therapists has potential to promote consistency across the field, increasing the reliability of research.

Crucial to the development of appropriate treatment plans, therapists and educators should consider the unique role of sensory processing in identifying various disabilities — not
for the diagnosis of a disorder, but for determining appropriate intervention. A study by Ermer and Dunn (1998) on the discriminative ability of sensory diagnostic measures found the type of sensory difficulties experienced by a child tends to be specific to the disability. For instance, the study found children with ASD more often experience oral sensitivities, higher levels of inattention and distractibility as well as fine motor and perceptual deficits than do their more typically developing peers (Ermer & Dunn, 1998). Children with ADHD tend to exhibit sensory seeking behaviors at significantly higher rates than their peers with ASD and exhibit similar patterns of sensory seeking behaviors to neurotypical children, albeit at much higher intensities and rates of occurrence (Ermer & Dunn, 1998). Along with the possibility of comorbid disorders, the neurodiversity even amongst children with ADHD and ASD is expansive. This signifies that potentially any combination of sensory behaviors can present in an individual, promoting a need for occupational therapists to create highly individualized goals and treatment plans based on the unique sensory needs of each student. Furthermore, individualized sensory integrative treatment will enable therapists to best assess the efficacy of sensory integration therapies.

Much of the research on sensory integration interventions seems to operate on the premise that atypical patterns of processing and behaviors are inherently negative, in need of fixing. Therapists should use discretion when creating individualized goals, viewing only disruptive or harmful behaviors as problematic. An appreciation for neurodiversity allows therapists to promote individual wellness rather than misguidedly directing the child toward conformity. The unique attributes of individual children should be nurtured while simultaneously providing intervention for maladaptive behaviors. Currently the Ayers Sensory Integration
therapy model fails to address the role of individuality and neurodiversity in successful outcomes.

Undoubtedly, the quality of sensory integration research will continue to improve as consistency in regard to terminology, methodology, and application of sensory integrative treatments improves. Ultimately, research within the field will always be challenging, as measures of symptoms and behavior in children tend to be highly subjective. When teachers and parents are not blinded to the interventions used, subsequent ratings will inevitably contain certain biases. Furthermore, the neurodiversity of sensory processing make the development of consistent and universal application of sensory integrative interventions challenging. Thus, there is an element of occupational therapy which relies on the intuition and experience of the therapist. These challenges highlight the need for dynamic, well equipped sensory integration clinics in school settings. Multi-sensory environments in the school setting help bridge the gap between clinic based therapy and academic success. Without the necessary tools, an occupational therapists is like a chef without a kitchen. Even the best will be ineffective.
Chapter 4

Service Project

4.1 Methods

For the service component of this project, I worked with Sulphur Springs School District occupational therapist Karyl Babayova, OTR/L, to design and construct sensory integration clinics on two elementary school campuses. I spent a total of 40 hours working with Ms. Babayova and although much progress was made, the construction of these clinics continues to be an on-going project. One of the most significant challenges presented by the task was a lack of funding, therefore requiring a level of creativity in constructing a cost-effective sensory integration clinic. Much of the materials used in constructing the sensory rooms came from community and parent donations of time, money, and equipment. Furthermore, a profile on DonorsChoose.org was created to seek funding for cost prohibitive supplies and equipment. Donors Choose provides a platform for which public school educators can communicate classroom needs necessary for student success. Specific projects are then selected by donors and when funding is achieved, the educator receives a shipment of requested items directly to the classroom. Equipment which was not donated, such as a tire swing, was constructed ourselves with careful efforts to keep material costs as low as possible. The provided spaces for occupational therapy use at both schools were shared with other therapists and educators, presenting many benefits as well as several challenges. Maximizing space proved to be one of the more challenging aspects of a shared workspace, thus the organization of each room required particular attention.
Defining and analyzing the theories behind each individual piece of equipment used in our therapy room is beyond the scope of this paper, however all of the equipment was selected based on published research.

4.2 Purpose

During the 2013-2014 school year, approximately 10% of K-12 students in the state of California had a disability affecting education and California state law mandates that each of these students receive special education services (Legislative Analyst’s Office [LAO], 2015). Yet funding for K-12 education in California has decreased in recent years, presenting challenges in ensuring all needs are met. Thus, the first goal of this project was the creation of a cost-effective space for providing occupational therapy services.

Due to the number of children with sensory processing associated disorders and deficits, as well as the research on the benefits of sensory integrative therapy approaches, a sensory integration clinic seemed to be the most logical use of space. These two elementary campuses needed space in which students could ease anxiety, practice communication and choice making skills, encounter a range of sensory experiences, learn to manage challenging behavior, develop fine and gross motor skills, and engage in relationship building with peers and adults. Studies indicate each of these benefits could potentially be provided by a multi-sensory environment (Carter & Stephenson, 2012).

4.3 Description

We began by studying a completed sensory integration clinic on the campus of another Sulphur Springs School District elementary campus. Figures 9 and 10 in Appendix A show the completed clinic — equipped with items such as a ball pit, trampoline, tire swing, tables for fine
motor skill activities, ball hoops for target practice, therapy balls, and stepping blocks for balance practice.

Upon returning to the empty classrooms we were to transform, our first priority was to organize the room so as to maximize floor space. Cables were hung to contain therapy balls and hooks were installed to hold a collection of donated strider bikes. Tables and cabinets in the rooms were adjusted to make space for a trampoline in one room and an inflatable jumper in the other. Wall space was made available for hanging basketball hoops and other tools for target practice.

Swings are a therapy tool which provide stimulation to the vestibular system and thus an important component of sensory integration clinics. However, swings can be costly so Ms. Babayova chose to construct a swing rather than purchase one ready made. Materials were purchased at a hardware store. Because of the nature of our project, we were awarded a contractor’s discount on supplies purchased. One challenge associated with the swing is the need for specific hardware to be installed in the ceiling from which to safely hang therapy swings. The hardware requires installation by a professional at an additional cost to the school. At the completion of my 40 hours of service, administration had yet to approve the hardware installation, highlighting a challenge of occupational therapists to persuade administrators on the need for specific therapy equipment. This can be mitigated by providing education on underlying theories and predicted outcomes of therapy equipment.

Once the rooms had been organized we discussed the need for more cost restrictive equipment which could potentially be obtained through donation. I then assisted in marketing the
project to potential donors and administrators by editing Ms. Babayova’s Donor’s Choose profile and then photographed students making use of the sensory rooms

4.4 Discussion

The use of sensory integration rooms in elementary schools is on the rise, with approximately 700 elementary schools in North America having sensory integrative spaces as of 2010 (Carter & Stephenson, 2012). Currently, most of what is known about the use of sensory rooms in elementary schools is based on survey results and professional opinions, rather than empirical research. Nevertheless, schools currently using sensory rooms report a multitude of observed benefits and little observed difficulties or detrimental outcomes. A study conducted by Carter and Stephenson (2012) surveyed 50 Australian schools servicing students with severe disabilities. Of those 50 schools, half reported the use of multi-sensory environments, six of the remaining 25 schools were excluded from the study, leaving 19 schools to be surveyed on their use of multi-sensory environments. Survey results found the most commonly reported benefits of multi-sensory environments to include sensory stimulation, opportunities for peer interaction, reduced self-stimulating behaviors, reduced anxiety, and increased independence. Further benefits included improved attention in class and the ability of students to generalize skills learned in the sensory room to the classroom environment (Carter et al., 2012). These commonly observed benefits are consistent with the outcomes we hope to see through the use of sensory integration clinics in Sulphur Springs School District classrooms, validating the efforts of our project.

Because sensory integration rooms are relatively new to the school based therapy scene, there has been little opportunity for research on their use and thus relatively little funding. The
number one problem reported by the schools surveyed by Carter and Stephenson (2012) was the associated costs required to support a multi-sensory environment. Survey results found an average of 17.5 different types of therapy equipment used in sensory rooms, with costs of creating a multi-sensory environment ranging from $1,200 to $80,000. The median cost was $24,000 which is a hefty fee for administrators to shell out for a treatment model that is not evidence-based, despite promising findings. Fortunately, options are available to therapists lacking funding, yet committed to a sensory integrative approach.

Commonly, occupational therapists in schools must share workspace with other specialists. While a lack of space can be challenging, the collaborative benefits of a shared space can overshadow challenges (Silverman & Millspaugh, 2006). First and foremost, sharing space with other specialists cuts costs by facilitating the sharing of materials and equipment. Furthermore, the research presented in Chapter 3 supports a multimodal approach to interventions. Shared workspace allows ease of communication and collaboration between professionals working with the same student. Rather than compartmentalizing therapies and interventions, more seamlessly combining approaches allows the child to better generalize learned skills to other environments (Silverman et al., 2006). For instance, the child may be able to more clearly understand how to use strategies learned in occupational therapy for increased focus in speech therapy. Communication skills learned in speech therapy can alternately be applied to occupational therapy sessions. This in turn could help the child better understand how to combine and apply both sets of skills for optimal success in the classroom.

Not only does a collaborative setting provide invaluable experience to the child, but it establishes a prime environment for education and learning between professionals. Due to a lack
of knowledge or experience regarding occupational therapy, many teachers may be reluctant to embrace occupational therapy strategies in the classroom. Furthermore, administrators may be disinclined to allocate funding toward sensory integrative approaches. When other educators and therapists are exposed to occupational therapy strategies with opportunity to observe desirable outcomes, they can provide additional support and promote understanding throughout the school. (Silverman et al., 2006).

Apart from a collaborative workspace, occupational therapists can assume the responsibility of educating other school employees on sensory integration and occupational therapy strategies. Therapists can invite entire classrooms to the therapy room, allowing teachers the opportunity to witness firsthand the benefits of occupational therapy sessions. Furthermore, therapists can invite school principals to observe sessions, explaining the theories and methodology behind sensory integrative strategies. I witnessed Ms. Babayova run therapy sessions for entire classes, explaining her strategies to aides, teachers, principals, and children alike. Ms. Babayova’s teaching had an empowering effect on her students. Because they were educated on the reasoning behind their own therapy plans, Ms. Babayova’s students were able to self advocate for themselves outside the occupational therapy room, communicating their unique sensory needs to others.

Perhaps the most effective method of generating support for sensory integration therapy is the generation of positive results. As discussed in Chapters 2 and 3, each individual has a unique set of sensory needs and what works for one person may not work for another. Assessment tools can help therapists develop a comprehensive understanding of an individual’s sensory processing patterns and create a highly individualized plan to address those needs.
4.5 Ideas for Further Research and Exploration

This section will examine the potential for furthering my contributions on the subject, as well as possible ways to mitigate confounding factors in current studies. Furthermore, I will discuss methods for generating greater validity and reliability of sensory integration research.

One area left incomplete at the end of my experience constructing the clinics was the installation of swing hardware. This was particularly challenging because it presented a roadblock that could not be overcome by creative problem solving. Focusing on marketing the project could have a significant impact on similar problems. First, promotion of the project beyond the campus could increase donations and community support alleviating the financial burden of the school and maximizing any funds available. Second, marketing the project within the school could persuade administrators of the benefits of these clinics. Time constraints prevented me from seeing culmination of the project. I look forward to my continued contributions and subsequent opportunities to observe the impact of my project on these campuses.

This project also revealed a need for consistency in sensory integration. The creation of fidelity measures will ensure consistent terminology and practice amongst therapists. The current state of inconsistency prevents the advancement sensory integrative approaches toward evidence based practices. Providing specialized certification opportunities for occupational therapists promotes consistency across the field. Studies on sensory integration methods would be more reliable and yield more conclusive results.
Chapter 5

Conclusion

The purpose of this project is to examine the purpose and efficacy of sensory integrative approaches to occupational therapy and compare potential outcomes to those of other interventions. A preliminary understanding of the ideology of sensory processing as well as the etiology of disordered sensory processing, proves to be a prerequisite to the understanding of sensory integrative therapy. I chose to use ASD and ADHD as specific examples because of the prevalence among elementary aged students. Based on the research presented in Chapters 2 and 3, we can conclude that the efficacy of sensory integration therapy appears promising, lending itself to the need for adequate clinical space in which to provide and further study these interventions.

The service project component provided a first hand account of the many struggles and challenges faced by occupational therapists in the public school system. A challenging paradox emerges. Sensory clinics are fundamental for the use and practice of sensory therapies which are necessary for further research on the subject. Research leads to greater knowledge of professionals, who can then pass on understanding to parents, promoting informed parental decision making. However, therapists wishing to take a sensory integrative approach face a lack of funding and administrative support. Therefore, in order to continue researching and cultivating our knowledge of the subject administrators must be persuaded to support sensory integration therapy and the funding of clinics. Because administrators are hesitant to lend support without first witnessing positive outcomes, the challenge is breaking free of this cyclical dilemma. This field needs the continued persistence of creative and resourceful therapists like Ms. Babayova.
This project provided a service to the community while subsequently revealing a need for further community education on the topic of sensory integration. As sensory processing is experienced universally, a majority will have sensory processing difficulties at some point throughout their lives. Therefore, this area of research is relevant to the community at large. The public school system reaches a significant proportion of American children during sensitive periods of development and is charged with the responsibility of providing support to students experiencing developmental difficulties which may hinder their academic success. As discussed in Chapter 2, the ramifications of low academic success can follow one well into adulthood, thus special education services should be held in high regard by our society. Unfortunately, research on sensory integrative therapies is lacking and remains largely inconclusive, resulting in a lack of funding in public schools. Nevertheless, occupational therapists have a responsibility to treat sensory deficits and must find ways to mitigate the discrepancy between inconclusive sensory integration research and the commonly observed beneficial outcomes. This enables therapists to provide the highest quality of services to the children on their case load.

This project aims to assist such an undertaking by presenting an objective overview of the knowns and unknowns within the field of sensory integration. The commentary in Chapter 4 highlights my personal experience regarding the associated challenges of sensory integration development, therapy, and research, particularly within the public school system. My hope is that this paper will serve as a tool for education regarding the complex and fascinating study of sensory integration.
References


doi: http://dx.doi.org/10.1016/j.nurpra.2014.10.001


doi: 10.1097/NNR.0b013e3181ff7309


doi: http://dx.doi.org/10.5014/ajot.2014.012518

617-624. doi:10.1016/B978-008045046-9.00378-8


doi: http://dx.doi.org/10.5014/ajot.2015.018051

Figure 1. Hardware required for swing installation

Figure 2. Equipment Example — Strider Bikes

Figure 3. Equipment Example — Ball Pit

Figure 4. Equipment Example — Tire Swing

Figure 5. Equipment Examples — Therapy Balls
Figure 6. Classroom with equipment; prior to redesign

Figure 7. Classroom with equipment; prior to redesign

Figure 8. Classroom with equipment; prior to redesign

Figure 9. Classroom modified for sensory integrative activity & therapy

Figure 10. Classroom modified for sensory integrative activity & therapy