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Effects of a Sensory Diet on Attention and Participation in Children With Autism

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Effects of a Sensory Diet on Attention and Participation in Children With Autism

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Approval Page

This applied dissertation was submitted by Leighanne Smith under the direction of the persons listed below. It was submitted to the Abraham S. Fischler College of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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Abstract

Effects of a Sensory Diet on Attention and Participation in Children With Autism. Leighanne Smith, 2019: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education. Keywords: pre-kindergarten, sensory processing, sensory processing disorder, sensory diet, autism, participation, attention, circle time

This applied dissertation was designed to provide initial knowledge regarding sensory diets and sensory-based interventions. The need for classroom-based sensory interventions are not always considered, especially with the high number of students diagnosed with ASD at the researcher's school. Often sensory intervention may not be considered educationally relevant, especially in the prekindergarten level. With the proper training and materials, as well as the guidance of the school-based occupational therapist, teachers, other therapists, classroom assistants, parents, and school-based staff might be able to utilize sensory-based activities like sensory diets to increase participation, positive behaviors, and attention.

The following applied research study utilized a quantitative single subject ABAB reversal experimental design that was implemented in an ESE blended prekindergarten classroom for three students. Together the researcher and school-based occupational therapist used The Sensory Processing Measure – Preschool (SPM-P) to develop an individualized sensory diet for children with autism and sensory impairments.

A sensory diet was administered before and/or during the designated morning circle time by the researcher and classroom assistant. Attention and participation were observed for each participant during the 15-minute morning circle for 8 weeks. Visual data was graphed and then utilized to determine if and to what extent a sensory diet has an effect on attention and participation, as well as the degree the removal of the sensory diet has on both attention and participation behaviors for the individual student during daily morning circle instruction.

The results for three participants were not significant enough to show that the use of a sensory diet increases attention or participation. In addition, the results of this study were not significant enough to determine that the removal of a sensory diet will impact attention or participation once introduced. The use of a sensory diet was reviewed as a favorable intervention, yet the scattered improvements of attention or participation for each student could be attributed to variables unrelated to the sensory diet.

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Chapter 1: Introduction

Statement of the Problem

The following study addressed the effects of an individual sensory diet on the unique learning style of prekindergarten students with Autism Spectrum Disorder (ASD). The ability to attend, participate, and acquire new skills during group circle time is a critical skill for all young children and, particularly, for those on the autism spectrum. Learning, attending, and participating in educational activities are functional everyday tasks for young children. Children are expected to learn and grow, while also adapting to the environment. Children with ASD have a difficult time adjusting to changing situations and environmental differences; the ability to understand and regulate sensory intake is impaired (Pfieffer, Koenig, Kinnealy, Sheppard, & Henderson, 2011).

The topic. A sensory diet is a carefully designed, individualized daily schedule of sensory equipment, activities, and strategies to help an individual stay focused and organized throughout the day (Swearingen, 2007). This study investigated the effects of a sensory diet on the individual student's ability to attend and participate during classroom morning circle time.

The research problem. The problem addressed in the following applied dissertation is that children with autism have difficulty attending to and participating in morning circle time. The researcher questioned if the difficulty at this time of the school day may be from their inability to regulate their sensory input. Further research into the development of children with autism needs to identify and investigate whether attention and participation can be enhanced through a sensory intervention, specifically a sensory diet.

Background and justification. According to The Autism and Developmental Disabilities Monitoring (ADDM) Network in the 2014 surveillance year, as reported through the Centers for Disease Control and Prevention (2018), it is estimated that 1 in 59 children in the United States has a diagnosis of ASD (Baio et al., 2018). The ADDM is a surveillance system that uses clinical reports from health or specialized clinics, educational documentation, and a professional clinical comparison of behaviors within the *Diagnostic and Statistical Manual of Mental Disorders, IV-Text Revision* to provide estimates of the prevalence of autism spectrum disorder (ASD) among children aged eight years whose parents or guardians reside in (a) Arizona, (b) Arkansas, (c) Colorado, (d) Georgia, (e) Maryland, (f) Minnesota, (g) Missouri, (h) New Jersey, (i) North Carolina, (j) Tennessee, and (k) Wisconsin, which are the 11 ADDM sites in the United States (American Psychiatric Association, 2013a).

As stated in the CDC (2018), ASD occurs in all racial, ethnic and socioeconomic groups, but is four times more likely in boys than girls. The term ASD was previously a general term describing a group of Pervasive Developmental Disorders (PDD) that were classified in the DSM-IV, TR (2000). Under the PDD category were (a) Autistic Disorder, (b) Pervasive Developmental Disorder-Not Otherwise Specified, (c) Asperger's Disorder, (d) Rett's Disorder, and (e) Childhood Disintegrative Disorder. In May 2013, the *Diagnostic and Statistical Manual of Mental Disorders* was revised and released as the DSM-5 (American Psychiatric Association, 2013b). The term ASD is now the actual diagnostic name in the DSM-5 and combines three previously separate disorders into one condition, with different levels of severity. The definition of ASD in the DSM-5 encompasses the previous categories of Autistic Disorder, Asperger's Disorder, and

Pervasive Developmental Disorder-Not Otherwise Specified. The ASD diagnosis is now characterized by symptoms in two core domains, (a) deficits in social communication and social interaction, and (b) restricted repetitive behaviors, interests, and activities (RRBs) (American Psychiatric Association, 2013b). If RRBs are not evident, the diagnosis of a Social Communication Disorder is made. The DSM-5 now allows for recognition of sensory differences within the symptoms of ASD.

The diagnosis of ASD is often made within the first few years of life, and the current intervention practices are encouraging early intervention for ASD (American Psychiatric Association, 2013a). Today more people are being diagnosed with ASD due to the broader definition and the better efforts to diagnose. Deficits in individuals with ASD may include impaired nonverbal and verbal communication, sensory impairments, and limited interests and/or stereotypic or repetitive behaviors, which then impact reciprocal communication and social interaction. Individuals may also exhibit high sensitivity to change, difficulty building friendships, and an intense focus on inappropriate items or interests (American Psychiatric Association, 2013a).

Dysfunctions in perceptual and sensory processing, as well as in communication, may lead to limitations in functional behavior (Watling, Deitz, Kanny, & McLaughlin, 1999). It is believed that sensory processing problems in those diagnosed with ASD may be an underlying factor for behavior-related problems (Case-Smith, Weaver, & Fristad, 2015). Interventions related to ASD may include (a) early intervention approaches, (b) discrete trial training or other behavioral approaches, (c) speech therapy, (d) dietary modifications, and (e) occupational therapy (Watling et al., 1999). Sensory integration

approaches are often utilized in occupational therapy; however, the current literature questions their effectiveness (Pfeiffer et al., 2011).

In early 2012, it was projected that sensory integration disorders would be added to the 5th edition of the DSM; however, in December 2012 the American Psychiatric Association made the decision to exclude sensory processing disorders (Miller, 2012). The Sensory Processing Foundation reported that even though the knowledge and research surrounding sensory processing disorders has grown since the early 2000s, there continues to be a need for collaborative, evidence-based research and practices (Miller, 2012). With the current expectation for evidence-based practices, therapists and educators are limited in the current availability of research and evidence in the area of sensory integration.

Weitlauf, Sauthe, McPheeters, and Warren (2017) completed a systematic review of published research between the years of 2000 to September 2016. They then evaluated 24 studies for the effectiveness and safety of sensory-focused interventions on children with autism. The 24 interventions were categorized into the type of intervention, (a) sensory integration-based, (b) environmental enrichment-based, (c) auditory integration-based, (d) music therapy-based, (e) massage therapy-based, and (f) other/additional, which may include weighted blankets, tactile tasks, and other interventions not fitting into one of the broader categories. With the limited evidence, small number of interventions and populations sampled, and lack of consistency of interventions and settings, the efficacy of sensory-based interventions continues to be questioned.

Deficiencies in the evidence. There is a limited amount, although a recently increasing trend, of peer-reviewed research literature that investigated the effects of

sensory interventions on varying skills and classroom functioning (Baranek, 2002; Rodgers & Short, 2010; Schaff & Mailloux, 2015). Cascio, Woynarosky, Baranek, and Wallace's (2016) commentary serves as a current document addressing the need for an interdisciplinary understanding of sensory function. The researchers suggested that those working in the areas of sensory processing, sensory integration, and ASD collaborate to have shared perspectives and frameworks for evaluations and treatments. Cascio et al. also stated that with the current interest in sensory function in ASD, the "controversy over the strength of empirical support for the efficacy of sensory-based interventions in children with ASD" (p. 5); studies need to be able to be replicated, limitations in the methodology need to be decreased, treatments need to be more controlled, and studies need to be carried out by broad interdisciplinary teams.

Early anecdotal and clinical reports estimate that the prevalence of sensory impairments or sensitivities among individuals with ASD is between 30% and 100% (Dawson & Watling, 2000; Iarocci & McDonald, 2006). More recent literature suggests that sensory problems are relatively high in the population of individuals with ASD. In 2012, the literature suggested an average of 69-80% of those diagnosed with ASD present with sensory deficits (Caminha & Lampreia, 2012). Currently, although it is challenging to measure clinically, sensory processing impairments may affect 88% or more of the individuals diagnosed with ASD (Weitlauf et al., 2017).

In 2009, the National Autism Center released the National Standards Project (NSP) report, which was the result of a multi-year project. This report has been used to establish a set of standards for effective, validated educational and behavioral interventions for children diagnosed with ASD. It identifies (a) established treatments, (b)

emerging treatments, (c) unestablished treatments, and (d) ineffective/harmful treatments. The NSP has classified sensory integration as unestablished. There were seven studies reviewed involving the sensory integrative package. These studies were defined as, "treatments that involve establishing an environment that stimulates or challenges the individual to effectively use all of their senses as a means of addressing overstimulation or under-stimulation from the environment" (National Autism Center, 2009, p. 48). In 2015, the NSP published the National Standards Project Phase 2 (NSP2), which provides information on the effectiveness of interventions for ASD from 2007 to 2012. Sensory intervention continues to be classified as an intervention with unestablished evidence. The components of a sensory diet may include activities like massage therapy, exercise, and music therapy, which all fall into the emerging level.

In addition to the NSP, the National Professional Development Center (NPDC) on Autism Spectrum Disorders (2007, 2014) has identified 27 practices that have sufficient evidence of efficacy for children with ASD. The NPDC on ASD does not include sensory integration as one of the 27 evidence-based practices for children and youth with ASD. In 2015, Wong et al. published an online document titled *Evidence-Based Practices for Children, Youth, and Young Adults With Autism Spectrum Disorder*. A number of researchers have touched on sensory-based interventions, yet somehow, their conclusions are unable to be generalized, are too limited in sample size, or lack fidelity. The research by Fazlıoğlu and Baran (2008) concluded that sensory-based activities integrated into a child's routine would help him or her throughout the day. The research by Pfeiffer et al. (2011) used sensory integration and fine motor interventions to enhance sensations, specifically, tactile, proprioceptive and vestibular, to increase active participation and

adaptive interaction. Both areas of research, sensory diet and sensory integration, continue to be classified as being treatments with insufficient data (National Autism Center, 2011; National Autism Center, 2015; Wong et al., 2014).

The Autism Internet Modules (AIM), which was created in 2007 and continues to be updated by professionals and parents, is designed to provide information to help individuals supporting, instructing, working with, or living with someone with ASD. AIM does include a module titled *Sensory Differences*, which provides a basic introduction and overview of the senses and how an individual's daily living is impacted by sensory information (Rogers & Short, 2010). The module defines the senses and the differences that a person with ASD may present, as well as the impact on their day-to-day functioning. It reviews what a sensory processing disorder is, the effect of sensory input, and what the research is saying. Overall, the research has identified many pieces to the puzzle in relation to sensory processing difficulties as they relate to ASD; however, the effectiveness of sensory intervention strategies and specific contributions of sensory processing continue to require more work.

Audience. The results of the following research provide beneficial information regarding sensory integration and sensory diets to those working with children diagnosed with sensory impairment and ASD. Professionals within the school setting may include (a) speech-language therapists, (b) occupational therapists, (c) physical therapists, (d) classroom teachers, (e) administrators, and (f) classroom assistants. The findings provide insight for families of children with sensory impairments, especially those with a diagnosis of ASD. More importantly, the results and interventions directly benefit individual students. In addition, the results provide direction for future research in the

area of sensory diets as well as the influence of the sensory diet on attention and participation within the classroom.

Setting of the Study

The applied research study took place in a prekindergarten classroom designed to serve students who are language-impaired alongside typically developing students. The current blended classroom, services preschool-aged children with language impairments as well as additional exceptionalities including children with developmental delays and ASD. The current blended classroom model consists of a classroom teacher and a child development associate (CDA) for 20 children. The population of students with autism in the county in which the research took place continues to expand, especially at the prekindergarten level. At the beginning of the 2015-2016 school year, there were two to six prekindergarten students diagnosed with autism in the blended units (S. Erickson, personal communication, March 18, 2016).

The demand for inclusive services has been growing, as is the population of students with autism needing a blended classroom model. The county where the applied research study took place has determined that the blended program serves exceptional students who are identified as having moderate-to-severe delays in language skills, as well as delays in cognitive skills, motor skills, and/or social-emotional skills at the prekindergarten level, as determined by a prekindergarten assessment team. The language-based curriculum provided in the classroom is used to expand and develop language concepts and communication skills within group settings. The current trend in the county is full general education inclusion with supports as needed. The county's goal

for the blended classrooms is to better prepare students for kindergarten while providing an opportunity for inclusion with typical peers (Pinellas County Schools, 2018).

Researcher's Role

The researcher is a practicing speech-language pathologist teaching a blended prekindergarten classroom for students with language impairments, including ASD. The researcher holds a State of Florida Professional Educators Certificate in Speech Language Impaired for Grades K-12, Prekindergarten/Primary Education for Age 3 through Grade 3, and an Autism Spectrum Disorders Endorsement. The researcher does not provide one-on-one or small group language therapy to the children; only whole group or small group teaching is carried out daily. As more children are being recognized as having ASD with sensory-related classroom and learning concerns, anecdotal evidence has shown that developing working sensory interventions assists in the ability to attend and participate in classroom activities throughout the day (Reynolds et al., 2017; Swearingen, 2007). The researcher's role in the applied research study was to assist in implementing an individual sensory diet for preschool children, who have a medical diagnosis of ASD, may have an educational eligibility of ASD, or are going through the education eligibility process for ASD. Very few of the prekindergarten students receive outside or school-based occupational therapy, so providing resources to the student in the blended or general education classroom is the most beneficial approach. Together, the researcher and the school-based occupational therapist evaluated the individual student's needs and created individual sensory diets, which were implemented within the daily classroom activities.

Purpose of the Study

The purpose of this applied research study was to determine the effects of a sensory diet on attention and participation during morning group circle time in a blended ESE classroom with prekindergarten children with ASD.

Definition of Terms

Circle time. This activity consists of whole group activities in which educators incorporate individual student and curriculum goals. Prekindergarten circle times can last 15-25 minutes and often include calendar; a review of the day's schedule; early math, literacy, social studies and science concepts. There are four scheduled circle times throughout the day, one enriching language and literacy.

Sensory diet. A sensory diet is a carefully designed, individualized daily schedule of sensory equipment, activities, and strategies to help an individual stay focused and organized throughout the day (Swearingen, 2007).

Sensory integration. Sensory integration reflects the ability of the brain to take the information that an individual's senses provide and organize one's behavior to interact effectively with the world. The senses include (a) auditory (hearing), (b) gustatory (tasting), (c) tactile (touching), (d) olfactory (smelling), (e) visual (seeing), and (e) vestibular (balance and movement) and proprioception (muscle and joint movement) (Koomar, Kranowitz, & Szklut, 2007).

Sensory Integration Disorder or **Sensory Processing Disorder.** This condition represents a disordered ability to process the sensory information received in the brain. This can include oversensitivity or under-sensitivity to (a) touch, (b) movements, (c)

smells, (d) sights or sounds, (e) coordination problems, (f) high or low activity levels, and (g) disorganization of body movements and thoughts.

Chapter 2: Literature Review

Introduction

In 1979, an occupational therapist named Jean Ayers postulated that children with educational disabilities have deficits in the brain areas responsible for processing sensory input and motor output (Schechtman, 2007). In 1981, Jane Ayres hypothesized that the rate of language development would change when occupational therapy, using sensory integration procedures, was introduced (Ayres & Mailloux, 1981). The areas of sensory processing that are involved in sensory integration therapy include (a) visual, (b) tactile, (c) auditory, (d) gustatory, (e) olfactory, (f) vestibular, and (g) proprioceptive (Ayres, 2005; Rogers & Short, 2010). Sensory integration is a term that refers to the way that the nervous system receives messages from the senses and translates the message into motor and behavioral responses (Sensory Processing Disorder Foundation, 2012). According to Mauer (1999), sensory integration refers to "the ability to organize, integrate, and use sensory information from the body and the environment" (p. 383).

Sensory integration is a form of a non-biological intervention; it does not specifically relate to studies of nutrients or supplements, but to the basics of the body (Schechtman, 2007). Pollock (2009) stated that sensory integration is a theory; it is a neurological process that enables the ability of the body to register, modulate, organize, and interpret information from the senses to the brain. The body requires sensory integration to process sensations so that it can successfully complete daily functional activities like taking a bite of a sandwich, reading a book, and listening to music (Sensory Processing Disorder Foundation, 2012). Sensory integration activities may include (a) jumping on a trampoline, (b) rolling the body, (c) riding a scooter board, (d) balancing

activities, (e) brushing body parts, (f) wearing weighted vests, (g) receiving a massage, (h) using lotions, (i) feeling textured toys, (j) performing oral motor activities, or (k) manipulating the environment (Schechtman, 2007). Sensory integration theory and intervention have been used in the treatment of children with various learning and developmental challenges (Pollock, 2009).

Understanding Sensory Processing

Sensory integration is an unconscious process of the brain (Ayres, 2005). The brain organizes information by using the senses of (a) taste, (b) hearing, (c) sight, (d) touch, (e) smell, (f) movement, (g) gravity, and (h) position. Sensory integration is the ability to process and integrate information from the environment. It is the process of organizing sensory inputs from the brain so that the body can respond through movement, perceive, feel and think. Sensory integration gives meaning to what is experienced by taking in all of the information around a person and selecting what to focus on, how to react or behave (Biel & Peske, 2009). The ability to take sensory information and integrate it allows individuals to act or respond to a situation in a purposeful manner, which is known as an adaptive response. An adaptive response is a purposeful, goal-directed response to a sensory experience (Ayres, 2005). With each new adaptive response, a new challenge is mastered, and sensory integration unconsciously occurs; then organization and the possibility to master more complex skills will be present throughout life.

Sensory integration forms the underlying foundation for academic learning and social behavior. The brain is a *sensory processing machine* until a child reaches 7-years old (Ayres, 2005). “Learning and behavior are the visible aspects of sensory integration”

(Ayres, 2005, p. 27). Once a child begins school, the basic sensory processing systems have to be able to take on more complex processes, so a strong foundation of sensory integration needs to be developed in the early childhood years. Without a strong sensory processing foundation, a young child may demonstrate difficulty with simple tasks like holding a pair of scissors or moving from one task to another, while older children may demonstrate difficulty with core academics like reading, writing, and mathematics. The child is unable to talk about these difficulties and cannot understand what is going on; often teachers and even parents mislabel the child.

In order to understand sensory integration, a foundation of the structure and function of the nervous system needs to be established. The nervous system includes (a) two large cerebral hemispheres, (b) a small cerebellum, (c) a brain stem, (d) a spinal cord, and (e) a number of nerves that spread out to each part of the body (Ayres, 2005). Each body structure contains a number of nerve cells called neurons. Ayres (2005) described the sensory process as, the neurons that carry electrical impulses from the body to or within the brain are the sensory neurons; the neurons that carry electrical impulses from the brain to the muscles and internal organs are motor neurons. The task of neurons is to tell an individual about his or her body and the environment, while also producing and directing actions and thoughts. Each part of the body has sensory receptors that pick up energy from a specific body part; the eyes receive light waves, the nose receives smells, and so on. Each receptor changes the energy received into electrical impulses that flow throughout the sensory nerve fibers to the spinal cord and then the brain. The body's nervous system uses the sensory input from the receptors to produce awareness, perception, knowledge; as well as the body's posture and movements; the planning and

coordination of movements, emotions, thoughts, memories, and learning. Sensory integration sorts, orders, and puts sensory input together into a whole brain function (Ayres, 2005).

The Senses

The senses give the body information needed to function and survive while also keeping it safe, and they help us to learn to be active and social (Kranowitz, 2005). Senses are both internal and external. The external, or environmental, senses include (a) tactile, (b) olfactory, (c) gustatory, (d) visual, and (e) auditory senses. The tactile sense provides information about touch, which is received through contact with the skin. The olfactory and gustatory senses provide information about smell and taste through the nose and mouth. The sense of vision is also known as sight and is provided through the eyes. The sense of hearing through the ears is known as the auditory sense (Kranowitz, 2005; Rogers & Short, 2010).

The internal senses include the interoceptive sense, the vestibular sense, and the proprioceptive sense. These "*body-centered senses*" are always unconsciously working (Kranowitz, 2005). Interoception provides the body with information from the internal organs and regulates functions like (a) hunger, (b) thirst, (c) body temperature, (d) sleep, and (e) mood. The interoception sense also provides conscious messages to the brain like having to (a) eat, (b) drink, (c) use the bathroom, or (d) adjust to the temperature of the room. The vestibular sense provides the body with the position of our head in relation to the earth. Sensations from the inner ear provide the brain with input about the location and movement of the body as well as balance (Ayres, 2005). The proprioceptive sense

provides the brain with information about body position and movement of the body parts (Kranowitz, 2005).

Tactile. The tactile sense, or touch, is provided through the skin and plays a vital role in behavior both mental and physical (Kranowitz, 2005). The skin has many different receptors used to receive (a) touch, (b) pressure, (c) texture, (d) temperature, (e) pain, and (f) movement. The tactile system is the largest sensory system, and without tactile stimulation, the nervous system becomes "*unbalanced*" (Ayres, 2005). The sensations through the skin will either send information directly to the brain stem or through the spinal cord; then up to the brain stem (Ayres, 2005). The information received within the brainstem detects that something is painful, hot, cold, sharp, and the like. The details of the sensation are then sent throughout the brain while being processed within the cerebral cortex (Ayres, 2005).

Olfactory. The olfactory or sense of smell is provided through the nose. Smell is processed directly through the limbic system (Ayres, 2005; Kranowitz, 2015). It does not have to travel through the brain stem to be detected. Smell can activate many emotions and memories, as well as guide food preferences. Smell is so powerful that it connects an infant to his/her mother (Ayres, 2005).

Gustatory. The gustatory sense is the sense of taste and the tongue provides the chemical makeup of particles that touch it (Ayres, 2005). Taste can be (a) sweet, (b) sour, (c) bitter, and (d) salty and is critical in enjoying food as well as preventing ingestion of harmful items.

Visual. The visual sense, or sight, begins with the retina of the eye receiving light waves, which then are processed in the brain stem (Ayres, 2005). The brain stem then

sends information to other processing areas to assist with moving the eyes, head, and neck. The impulses may also send information to help with organizing, refining, and integrating other sensations (Ayres, 2005). The visual sense is used to see meaning in the environment.

Auditory. Hearing or the auditory sense uses the sound waves in the air received by the auditory receptors in the inner ear (Ayres, 2005). These waves become impulses, which are received and organized in the auditory centers of the brain stem. The auditory sense must integrate with the vestibular sense, muscles, and visual processing, as well as the other senses (Ayres, 2005).

Interoceptive. The interoceptive sense or visceral input, are the receptors in the internal organs and blood vessels. Interoceptive activity, blood flow, and blood chemical contents, stimulate receptors, which provide information to the brain stem that are needed to keep the body healthy. Visceral input helps (a) breathing, (b) digestion, (c) regulates blood pressure, and (d) other functions of the nervous system (Ayres, 2005).

Vestibular. The vestibular sense uses the inner ear for head movement, balance, and gravity awareness. It is the unifying system, meaning it forms the basic relationship of a person to gravity and the physical world (Ayres, 2005). If the vestibular sense is the framework for the other senses and if it is not functioning consistently or accurately, the interpretation of other senses will be impaired, and the entire nervous system may have trouble getting started (Ayres, 2005).

Proprioception. The proprioceptive sense refers to position and movement. It is the sensory information received from (a) muscles contracting and stretching, (b) parts of the body bending, (c) straightening, (d) pulling, and (e) joints between bones

compressing (Ayres, 2005; Bundy, Lane, & Murray, 2002). The sensations from the body travel up the spinal cord to the brain stem and cerebellum. They are then sent to regions of the brain that do not produce conscious awareness. With a decreased sense of proprioception, the body movements may be slower, clumsier, and require more effort (Ayres, 2005). It may be difficult to button and unbutton, use small tools, open and close containers, or complete successful movements with the trunk of the body or legs, like walking up or down stairs, or playing a sport (Ayres, 2005). When proprioception is poorly organized, visual information is required, and most will not complete movements if they cannot see it (Ayres, 2005).

Sensory Integration

With each experience, the senses work together, or integrate, to produce certain end products. These end products provide individuals with the ability to concentrate, organize themselves, as well as develop and maintain self-esteem, self-confidence, and the ability to learn academics and behavior (Ayres, 2005; Schaaf & Mailloux, 2015). Together, the senses assist in developing the capacity for abstract thought and reasoning (Ayres, 2005). They also play a vital role in specializing each side of the body and brain. Sensory integration is a developmental process and is based on the environment around an individual. Different sensory likes and dislikes affect everyday activities like (a) play, (b) work, (c) learning, and (d) social interactions (Biel & Peske, 2009). When the senses do not work together, there is a disconnect which causes parents and educators to begin to see an over-reaction, under-reaction, or sensory-seeking behaviors (Ayres, 2005).

Sensory Processing Disorders

These over-reactions, under-reactions, or sensory-seeking behaviors may indicate that the brain is not functioning in a natural, efficient manner (Koomar, Kranowitz, & Szklut, 2007). Sensory impulses are either not being processed by the brain in an organized way, or the brain is not directing behavior effectively. When there is an impairment in the brain, it is like a *traffic jam* within the neurons and sensory receptors (Ayres, 2005). It is typical to have some sensory issues; however, children with sensory dysfunction have more trouble with sensory processing (Biel & Peske, 2009). Another broader way to describe a sensory integration disorder is that the central nervous system is ineffectively processing the information coming from the senses; therefore, causing the child to have a difficult time functioning throughout his or her day (Kranowitz, 2005).

Teachers and parents may not realize that the learning and behavior problems in the child are neurological and out of the child's control. Children may be hyperactive or distractible; they may be disorganized, unable to follow more than 1-step directions, or demonstrate behavior problems. Sensory integration disorders are often evident in children with speech and language delays; language and speech are dependent on sensory integrative processes and delays impact interpersonal communication, problem-solving, and multitasking or executive functioning skills (Ayres, 2005). These problems not only affect the children in a few situations, but they negatively impact and interfere with everyday events (Abraham, 2002). The sensory impairments may affect them within the classroom environment. Various visual and auditory stimuli may affect learning. A child's attention and readiness to participate may be influenced by the sensory-based aspects currently around him or her and those that were previously around him or her,

meaning he or she noticed a change of some kind (Reynolds, 2017). Appropriate modifications to the environment are believed to support participation, enhance or reduce sensory stimulation, promote regulation and attention, and improve behavior. Some examples may include (a) ball chairs, (b) air cushions, (c) compression clothing, (d) headphones, (e) visors, (f) fidgets, (g) light covers, (h) weighted tools, and more (Biel & Peske, 2009).

The literature on sensory processing disorders, including Abraham (2002), Ayres, (2005), Biel and Peske (2009), Koomar, Kranowitz, and Szklut (2007), and Kranowitz (2005), collectively described various implications of sensory impairments. A child with a sensory processing disorder may be over-sensitive or under-sensitive (Kranowitz, 2005). They may have varying degrees of impairments with (a) touch, (b) visual differences, (c) sounds, (d) movement, (e) tastes, or (f) smells. Those with a sensory impairment may be highly distractible or could have problems paying attention and staying focused (Ayres, 2005). They may exhibit unusually high or low levels of activity that depend on the setting, time, or environment around them (Schaff & Mailloux, 2015). At times, they may be socially withdrawn, or they could be overly affectionate. Behaviors could include intense, strong reactions to challenging situations and unfamiliar environments or situations. At times, others may demonstrate impulsive or limited control over their behaviors and reactions to situations, changes, or pretty much anything (Ayres, 2005; Schaff & Mailloux, 2015). Often those who have a sensory impairment demonstrate difficulty transitioning from one situation to another, and they may seem rigid or inflexible. Often, they are the children who are clumsy or appear careless in their actions when observed (Kranowitz, 2005). As the children get older, they may begin to

feel uncomfortable in group situations, or demonstrate social or emotional difficulties. In later grades, those with sensory impairments may have developmental and learning delays (Ayres, 2005; Biel & Peske, 2009; Kranowitz, 2005). They may act silly or appear immature, awkward or insecure, and often demonstrate difficulty in handling frustrations with everyday activities (Biel & Peske, 2009).

Children with a sensory processing disorder have a tendency to tantrum longer and/or more intensely than other children do, and/or may demonstrate more difficulty returning to a calm state (Biel & Peske, 2009). They may also demonstrate difficulty falling asleep, waking, doing quiet activities after being very active, and transitioning from alert, active states to calm states (Biel & Peske, 2009). Children who demonstrate muscle tone and coordination problems have disconnections in the tactile, vestibular, and proprioceptive systems (Ayres, 2005). Children with a sensory impairment may demonstrate difficulty (a) learning new skills, (b) organizing themselves, (c) regulating their attention, (d) participating in everyday school and play activities, and (e) engaging in positive social experiences (Pollock, 2009). Sensory integration disorders often manifest in learning difficulties in school and difficulty in the adolescent and adult years (Ayres, 2005).

In 2005, Ayres began describing the intervention of sensory integration as active engagement of the client in a range of sensory-based activities that challenge the individual to respond to environmental cues; register, perceive, and integrate sensation; and produce appropriate and adaptive cognitive, emotional, physical, and social responses. The activities must emphasize the tactile, proprioceptive, and vestibular sensations that are useful to the individual child (Ayres, 2005). Activities related to

sensory integration in early intervention and school-based practices are often an essential part of occupational therapy (Mori et al., 2017).

Sensory Integration Interventions

The main purpose of sensory interventions is to provide the child with sensory information, which will assist in organizing all senses so that he or she can develop higher functioning abilities to adapt to daily expectations; like attention, language, interaction, and motor abilities (Baranek, 2002; Mauer, 1999). A sensory integration approach to therapy is beneficial in a sensory-rich environment (Sensory Processing Disorder Foundation, 2012). Interventions are based on an emphasis on sensory stimulation and active participation, as well as direct activities for environmental stability (Pfieffer et al., 2011). For example, a child may have a need for deep pressure on the shoulders, so he or she will be allowed to wear a weighted vest to improve attention during classroom lessons.

Occupational therapists (OT) often are the professionals responsible for developing sensory integration therapy plans to help provide the right amount of sensory input for readjusting the individual's neurological system and help him or her function at one's best (Biel & Peske, 2009; Mori et al., 2017). Case-Smith and Arbesman (2008) completed an evidence-based literature review on the effectiveness of sensory interventions used in occupational therapy in children and adolescents with ASD. In 2015, Case-Smith, Weaver, and Fristad conducted an updated systematic review examining the research evidence for sensory interventions, sensory integration therapy, and sensory-based interventions for children with ASD and concomitant sensory processing disorders. Of 19 articles found, five of the research teams utilized sensory

integration therapy in their studies, while 14 of the studies were completed using sensory-based interventions since 2000. Four of the five sensory integration therapy articles that were based on the foundations of Ayres' original work reported high fidelity (Case-Smith et al., 2016). The 14 sensory-based interventions included 13 studies that used single subject designs: seven studied the effects of weighted vests, two utilized therapy balls, one measured the change with a brushing protocol, and three utilized multiple-sensory strategies.

Overall, the results provided very little evidence towards positive change. Only one study using multisensory approaches through the use of a sensory diet found strong effects related to sensory-based interventions and behavioral changes. The concluding findings of the review by Case-Smith et al. (2015) found that sensory integration therapy for children with ASD and sensory problems may lead to positive outcomes if research utilized larger samples, randomized trials, and blind evaluations. Sensory-based interventions need much more focus on the functional performance of the child and his or her participation in daily activities within the home, school and the community in order to become a more widely accepted therapy approach.

Occupational therapy often combines sensory integration interventions with play activities to enhance the child's social-emotional growth (Case-Smith & Arbesman, 2008). Often in younger children with ASD, the OT focuses on (a) sensory processing, (b) social-behavioral performance, (c) self-care, and (d) play (Case-Smith & Arbesman, 2008). Often, an OT may use a parent questionnaire, a version of the Sensory Profile (SP) (Dunn, 1999) or the Sensory Processing Measure (SPM) (Glennon, Miller-Kuhaneck, Henry, Parham, & Ecker, 2010) to assess sensory processing impairments in children

with autism. The SP was developed by Dunn in 1999 to assist in assessing and characterizing children by their responsiveness to (a) sensory input, (b) sensory seeking, (c) emotional reactivity, (d) low endurance/tone, (e) oral sensitivity, (f) inattention/distractibility, (g) poor registration, (h) sensory sensitivity, (i) sedentary, and fine motor/perceptual (Pearson Education, 2015).

The SPM and the SPM-Preschool were created by a team of occupational therapists and include both a home form and a school form. The assessments are unique in that they were the first to show how sensory processing problems develop and continue to increase in various settings (Therapro, 2012). The assessment provides norm-referenced standard scores for integrative functions, social participation, and the five sensory systems (visual, auditory, tactile, proprioceptive, and vestibular). It also provides clinical information on (a) processing, (b) vulnerabilities, (c) under- and over-responsiveness, (d) sensory-seeking behavior, and (e) perceptual problems. These tools are relatively new; however, they are currently the main assessment instruments used to guide treatment for clinicians (Case-Smith & Arbesman, 2008).

Sensory Diets

Once an evaluation has been completed, appropriate sensory strategies are put into place to support the child's performance and participation in his or her educational setting (Glennon, Kuhaneck, & Herzberg, 2011). For the purpose of this applied dissertation, the intervention utilized a sensory diet. Sensory diets are used with children who have a sensory processing disorder, which is defined as having a difficult time adjusting to everyday environmental stimulations (Swearingen, 2007). The term *sensory diet* was first used by Patricia Wilbarger in 1984 to explain how certain sensory

experiences can be used to enhance performance if contributed to the activities of daily living (as cited in Bundy et al., 2002). Originally, Wilbarger developed a sensory diet for families of infants who had previously been in the neonatal intensive care units. Now the concept encompasses various ages, underlying health concerns, or functioning. Creating a successful sensory diet is based on the timing, duration, and frequency of an individual's sensory experiences and/or needs. This allows for an optimal level of arousal for functioning in various situations (Biel & Peske, 2009; Bundy et al., 2002).

The development of a sensory diet by Patricia Wilbarger was built around the foundation of Jane Aryes' research that somatosensory and vestibular processes play a significant role in the development of daily skills, states of alertness and sleep, and adaptation. Wilbarger developed the sensory diet as a therapeutic strategy; a carefully constructed individualized activity plan designed to meet the specific sensory needs of each individual (Bundy et al., 2002). The specific sensory diet may vary according to the individual's goals, preferences, resources, and limitations. When beginning a sensory diet, the professional, often the OT, evaluates the child's sensory needs through observation and evaluation (Biel & Peske, 2009). The OT may also use a parent/teacher questionnaire, like the SPM, to gather information related to daily situations and schedules.

Developing a sensory diet requires a carefully designed plan of personalized activities that provide an individual with the sensory input to stay focused and organized throughout the day (Biel & Peske, 2009). Baranek (2002) described a sensory diet as a modernized version of a sensory integration program. During the sensory diet, the child is provided with a home or classroom program of sensory-based activities aimed at meeting

the child's sensory needs. A set of activities designed to meet the child's sensory needs are integrated into the child's daily routine. Each child has a set of individualized, unique sensory needs and a sensory diet provides activities that either arouse or calm the child (Ayres, 2005). Over time, a sensory diet may help a child so that he or she can tolerate challenging sensations and situations, regulate his or her alertness, increase his or her attention span, limit sensory seeking and/or avoiding behaviors, and assist in handling transitions with less stress (Biel & Peske, 2009).

Kranowitz (2006) defined a sensory diet as "the multisensory experiences that one seeks on a daily basis to satisfy one's sensory appetite" (p. 305). The sensory diet is a planned and scheduled activity program that an occupational therapist develops. It is used to help a person become more self-regulated and get to an optimal state of arousal (Kranowitz, 2006). A sensory diet should be developed with a few well-chosen activities that are specific to meeting set goals. A landmark example from Shellenberger and Williams (1994) used a sensory diet for children with difficulty in organization behaviors. They discovered that specific activities stimulated focus when used both before and during tasks. The researchers concluded that a sensory diet could be used to address self-regulation difficulties in the school setting.

Making the sensory diet a workable plan in various settings is the key and often the activities require some creativity. In school, simple stretch breaks, a quiet area, twisting, doing pushups on the wall or chair may help. Furthermore, a child may use an inflated seat cushion or hand fidgets like a stress ball or stretchy worm. If the student likes to put things in his or her mouth, he or she may need a chew necklace or a chewy. The child may need to be assigned tasks to keep him or her active or be given various

tools while seated to keep him or her busy. While various environmental modifications can be put into place to help a child focus and learn, those working with the child need to be aware of sensory differences and needs (Biel & Peske, 2009).

The Research Surrounding Sensory Integration

Though sensory differences are not only related to those diagnosed with ASD, for the purpose of this applied dissertation, the researcher limited the criteria of the study to those already diagnosed or currently being evaluated for an educational eligibility of ASD. In addition, it has been reported that 99% of occupational therapists use sensory integration in therapy with children with ASD (Schaaf & Mailloux, 2015). After the evaluation, therapists and those working with the children found that with participation in sensory activities, the children were able to focus better and even handle stressors within the environment with more control (Swearingen, 2007). The research by Case-Smith, Weaver, and Fristad (2015) stated that, "sensory processing problems in ASD are believed to be an underlying factor related to behavioral and/or functional performance problems" (p. 134). These problems may also affect functional performance in daily activities, including (a) eating, (b) sleeping, (c) bath time, (d) bedtime, and (e) other daily routines (Schaaf et al., 2011).

There are limited empirical studies about sensory and motor development in children with autism when compared to studies of other developmental domains (Baranek, 2002). Those that exist suggest limited intervention planning and lack scientific knowledge including methodological limitations. Sensory diet interventions are commonly used in therapy; however, there are very few empirical research studies surrounding the use of sensory diets. Baranek (2002) found one study by Stannitti,

Raison, and Ryan (1999), which concluded that the child was cured of his sensory defensiveness and his symptoms of autism resolved with the use of a treatment program using brushing, joint compressions and sensory activities dispersed throughout the day during daily activities and routines. The case study was completed using Wilbarger and Wilbargers' techniques for sensory defensiveness, which includes a sensory diet or environmental modification as well as direct interventions. The direct interventions involved (a) a sensory summation technique, (b) vigorous brushing protocol, (c) specific behavior interventions, and (d) oral defensiveness intervention. As part of the study, treatment lasted 9 months; at the conclusion of the research, the research team stated that the individual child was cured of his sensory defensiveness syndrome and "in his case the effectiveness of the technique was almost miraculous" (Stannitti, Raison, & Ryan, 1999, p. 186).

Case-Smith and Bryan (1999) completed a single subject experiment in which general improvements were noted in play, engaging behaviors, and adult interactions with 10 weeks of a sensory integration intervention. The effectiveness of a preschool program was examined that included occupational therapy with a sensory integration approach (Case-Smith & Bryan, 1999). Various equipment was made available in the classroom for the children to receive vestibular, tactile, and proprioceptive input. Some of the classroom environmental changes that were recommended to the teacher included slides, beanbag chairs, rocking equipment, and a sensory table. An Engagement Checklist to measure mastery of play, non-engaging behavior, and improvements with interactions with adults and peers (Case-Smith & Bryan, 1999). The results, although they have limited external validity, began to support the belief that changes in classroom behavior

can occur in preschool-aged children with autism during interventions using a sensory integration approach (Case-Smith & Bryan, 1999).

Ayres and Tickle (1980) found that children with hyper-responsiveness to tactile and vestibular stimuli have better responses to sensory integration treatment than the hypo-responsive participants. Results indicated that (a) language, (b) awareness of their environment, (c) purposeful movement, (d) self-stimulation, and (e) social-emotional behavior were impacted by sensory integration treatments. It was noted that there were no significant changes in peer interactions. Increases in social interactions, responses to movement and affection, and an increase in approaching new activities were noted in research (Linderman & Steward, 1999). All studies regarding sensory and motor development were associated with positive changes in social interaction, purposeful play, and decreased sensitivity (Case-Smith & Arbesman, 2002).

In 2015, the American Occupational Therapy Association (AOTA) developed a document titled *Occupational Therapy for Children and Youth Using Sensory Integration Theory and Methods in School-Based Practice* to assist school-based therapists with various sensory integration theories and methods. As part of the document, articles related to various occupational therapy focus areas were listed. There were two articles referenced under the projected outcome of increasing on-task behavior through classroom modifications, sensory strategies, sensory breaks, and sensory diets integrated within the school routine (AOTA, 2015).

Kinnealey et al. (2012) completed a single subject design related to sensory changes within the classroom environment, which consisted of sound absorbing wall and variation in light bulbs. At the conclusion of the study, the four male, middle school-aged

students showed improvement in attention and engagement through having a sensory comfortable classroom. In 2001, VandenBerg, utilized weighted vests on four children diagnosed with attention deficit hyperactivity disorder to provide deep pressure and measure on-task behavior. The weighted vests were worn for 15-minute periods while engaging in classroom fine motor activities. The results indicated a "clinically significant increase in on-task behavior in all four students while wearing a vest totaling 5% of their individualized body weight" (VandenBerg, 2001, p. 626). The articles referenced in the 2015 AOTA document targeting on-task behavior addressed different sensory needs (a) lighting, (b) sound, (c) classroom adaptations, (d) proprioceptive feedback, and (e) individual feedback of weight and pressure; however, the results indicated a shared need for incorporating universal designs of sensory friendly environments to assist with learning and student self-regulation (Kinnealey et al., 2012).

Research Questions

This study answered the following research questions:

1. To what extent does the provision of a sensory diet increase attention during circle time in prekindergarten children with ASD?

2. To what extent does the provision of a sensory diet increase participation in the circle time activity in prekindergarten children with ASD?

3. To what extent does attention in circle time continue when sensory interventions are removed?

4. To what extent does participation in circle time continue when sensory interventions are removed?

Chapter 3: Methodology

Participants

The participants included three children and the CDA in the classroom. The target populations of this study included children who were enrolled in a prekindergarten exceptional student education (ESE) blended classroom. Convenience sampling was used to identify participants. Convenience sampling was considered because all participants attend the prekindergarten ESE blended classroom in which the researcher teaches (Schaff & Mailloux, 2015). The researcher has worked with the participants in the classroom setting as the participants' special education classroom teacher. The children were identified as exhibiting characteristics of sensory-processing disorder based on evidence found in the participants' individualized education plans (IEPs) and in their classroom performance. For example, the IEPs may have noted problems with sensory processing that included (a) difficulty attending to tasks, (b) sensory-seeking behaviors, (c) difficulty regulating behaviors and emotional responses, (d) sensory avoiding behaviors, and (e) difficulty transitioning. This information was found under the parental input section, the current functioning of the student that includes strengths and effects of the disability, and the conference-notes section of the IEP. The participants either already have a medical diagnosis of ASD and/or educational eligibility of ASD, or they were going through the education eligibility process for ASD.

Student A. The first participant was a 4-year and 10 month old male. Student A was currently being evaluated in the school setting for a language impairment and possible ASD eligibility. Typical behaviors during the school day, especially circle time included (a) staring into space, (b) limited initiation of tasks, (c) repetitive movements

that include smelling hair and hands, (d) avoiding touch and various textures including food, (e) being unaware of those around him, and (f) limited interests.

Student B. The second participant was a 5-year-old male. Student B entered the prekindergarten classroom with a medical diagnosis of ASD. He receives consultation services from the school-based OT and language therapy 60 minutes per week in school setting from a speech-language pathologist. Typical behaviors in the classroom setting included (a) unable to calm body movements, (b) touching others, (c) very rough playing and actions, (d) sensitive to sounds, (e) unaware of being dirty, and (f) makes various sounds/noises during morning circle time.

Student C. The third participant was a 4 year 10-month-old male and he has both a medical and educational diagnosis of ASD. Student C does not currently receive OT services, however he receives language therapy 60 minutes per week in the school from a speech-language pathologist. Typical classroom behaviors included (a) difficulty calming the body, (b) crawling in circles during instructional time, (c) often standing at his table spot, (d) demonstrating difficulty interacting with peers, (e) unaware of his body in the world around him, (f) often banging into others, (g) limited food interests, (h) avoided various touches and textures, (i) demonstrated a sensitivity to light and sounds, (j) he become overwhelmed and agitated with too much noise, and (k) he required a visual schedule.

Instruments

The Sensory Processing Measure-Preschool. The SPM-P is based on the sensory integration theory of Jean Ayres and provides standardized rating scales with distinct sensory system categories (Glennon, Kuhaneck, & Herzberg, 2011). The 75

questions are used to assess the areas that are causing sensory processing challenges in the individual. Within a community sample, 3.4% to 15.6% of 4-year-olds were found to experience sensory processing concerns (Glennon et al., 2011). The SPM-P provides eight norm-referenced scaled scores in the areas of vision, hearing, touch, body awareness, balance and motion, planning and ideas, social participation, and a total sensory system score (Glennon et al., 2011). The SPM-P is often used by occupational therapists to assess the sensory processing challenges and abilities of children in home and school environments. The measure was created by a team of occupational therapists using a sample of 652 typically developing children and an additional 242 children receiving occupational therapy (Glennon et al., 2011). The scales for rating range from *never, occasionally, frequently,* to *always*, is fairly easy for therapists, teachers, and caregivers to complete. The Interpretive Range allows for sensory impairments to be defined as *typical*, *some problems*, or *definite dysfunction*. The SPM-P also helps to identify sensory vulnerabilities including (a) under-responsiveness, (b) over-responsiveness, (c) sensory-seeking, (d) perception, (e) ocular motor and postural control, (f) motor planning, and (g) ideation (Miller-Kuhaneck et al., 2010).

Student A. SPM-P descriptors from Student A included (a) over-responsive to tactile, (b) under-responsive to hearing, (c) under-responsive to proprioceptive input, (d) over responsive vestibular, (e) under-responsive to visual input, and (f) under-responsive to taste and smell. Some sensory differences identified on the SPM-P for Student A were (a) never participating appropriately at circle time, (b) never interacting with peers, especially in pretend play, (c) distressed when hands and/or face are dirty, (d) demonstrated difficulty moving body to rhythm, beats, and patterns, and (e) repetitive

playing with same items or at the same center. Based on the information from the SPM-P, the sensory diet activates for Student A included, (a) animal walking at outside playground, (b) wheel barrel walking, (c) whole group, (d) whole body calming breathing technique at the beginning of circle time, (e) weighted lap pad, (f) access to fidget box with various tools, textures, and items, (g) visual pictures, (h) a wiggle cushion, (i) a Theraband for around the knees, (j) access to headphones, (k) sensory bottle of visual awareness, and (l) being seated directly in front of the teacher.

Student B. SPM-P descriptors from Student B included, (a) under-responsive to tactile, (b) over-responsive to hearing, (c) under-responsive to proprioceptive input, (d) under- responsive vestibular, (e) over-responsive to visual input, (f) under-responsive to taste, and (g) over-responsive to smell. Some sensory differences identified on the SPM-P for Student B were (a) definite dysfunction in the areas of hearing, touch, and body awareness, (b) showed distress to loud sounds, (c) avoided touch by others yet bumps into peers, (d) has a high tolerance to pain, and (e) demonstrates difficulty paying attention during instructional times. Based on the information from the SPM-P, the sensory diet activates for Student B included (a) climbing on playground equipment, (b) swinging, (c) access to a trampoline, (d) animal walking at outside playground, (e) wheel barrel walking, (f) whole group body calming and breathing techniques, (g) compression vest, (h) weighted lap pad, (i) access to fidget box, (j) visual pictures, (k) wiggle cushion, (l) Thera-band for around knees when seated at circle or in a chair, (m) seated with limited distraction (peers) near teacher, and (n) access to weighted blanket at rest time.

Student C. SPM-P descriptors from Student C included (a) under-responsive to tactile, (b) over-responsive to hearing, (c) under-responsive to proprioceptive input, (d)

under- responsive vestibular, (e) over-responsive to visual input, and (f) under-responsive to taste and smell. Some sensory differences identified on the SPM-P for Student C were (a) dysfunctions in the areas of social participation, touch, hearing, body awareness, balance and motion, and planning and ideas, (b) high tolerance of pain, and (c) enjoyed head and arm compressions when overstimulated. Based on the information from the SPM-P, the sensory diet activates for Student C included, (a) swinging, (b) access to a trampoline, (c) animal walking at outside playground, (d) wheel barrel walking, (e) whole group body calming and breathing techniques, (f) a weighted lap pad, (g) access to fidget box, (h) visual pictures, (i) a wiggle cushion, (j) access to a Thera-band for around knees, (k) seated directly with limited distraction (peers) near ESE teacher, (l) body squeezes, (m) arm or head compression, and (n) assess to a cube chair.

Data collection tools. For the purpose of the applied research study, only sensory processing challenges in the school environment were addressed. The researcher and OT developed an individual sensory diet based on the impairments noted on the SPM-P school form completed by the classroom CDA for each participant. Attention and participation were measured using direct observation using interval recording. Using the observers' personal timer, participation and attention behaviors of the participants were observed and documented on the data form as occurring or not occurring, every 3 minutes for the 15-minute morning circle time, for a total of five observations a day. Data collection sheets for each participant were used to document individualized definitions of participation and visual observations of attentive behaviors (see Appendix A).

Interobserver agreement. For reliability, inter-observer agreement was calculated. The first observer was the researcher and the second observer was the ESE

associate for the blended prekindergarten classrooms. Agreement was defined as both raters recording the same observations of attention and participation for the student. A disagreement was defined as both raters recording differing observations of attention and participation for the student. The formula below was used to calculate interobserver agreement (Cooper, Heron, & Heward, 2007).

$$\text{Interobserver Agreement} = \frac{\text{Agreement}}{\text{Agreements + Disagreements}} \times 100$$

The calculations documented the percent of agreement between observers for at least 40% of the observations. Acceptable interobserver agreement was defined as 80% agreement (Schaff, & Mailloux, 2015). IOA for Student A was 84.2% for attention and 94.7% for participation. IOA for Student B was 85.3% for attention and 91.2% for participation. IOA for Student C was 90% for attention and 80% for participation.

Fidelity checklist. At the end of each week a fidelity checklist was completed by the CDA (see Appendix B). Criteria for the weekly fidelity score for each of the observers was between 80-90% (Schaff & Mailloux, 2015). The use of a fidelity checklist is important in documenting the effectiveness of treatments and/or interventions and communication between observers (Horner et al., 2005; Parham et al., 2007). The key elements to evaluating fidelity, especially in the area of sensory integration, are ongoing documentation of the delivery of the intervention including the observable characteristics, which comprised of (a) the of number of participants, (b) the length of time, (c) the training of those providing intervention, (d) the environmental features, and (e) the processes, which may include the qualities to the therapies or treatment events (Horner et

al., 2005). The fidelity was collected in 40% of the sessions and the range of fidelity was between 80% and 100%, with the average being 95%.

Social validity. In the area of special education, including research for those diagnosed with ASD, evidence-based practices are encouraging researchers to determine the social validity of the interventions and goals (Callahan et al., 2017). In research, social validity requires the researchers to use a comprehensive analysis of the interventions to determine if they have considered both the internal and external influences (Case-Smith & Arbesman, 2008). Social validity is considered the acceptance and approval of the goals, interventions, and results with the stakeholders and overall population (Callahan et al., 2017). In current evidence-based practices, Callahan et al. (2017) shared that it is important to establish social validity and fully examine the efficacy of the intervention to help parents, educators, therapists, and others access research that has goals, interventions, and outcomes that are effective and valid.

At the conclusion of the applied research study, a brief 15-question social validity measure using a Likert scale was provided to the CDA to determine if the goals, interventions, and outcomes were considered acceptable, effective, and valid throughout the study (see Appendix C). Furthermore, the conclusion of the study indicated that the score on the social validity questionnaire was a 4.2 (agree). The responses shared were that most teachers, without knowing what is expected of them, would not be open to trying a sensory diet. Often, adding more techniques is questioned because the teacher feels that it is adding to his or her daily workload. Once educated on the implications and use of sensory diets, teachers may be more open to try the intervention. Overall, the feedback from the classroom-based CDA was positive. She strongly agreed that the

student's behavior warranted sensory interventions and that the activities were a fair way to handle the sensory differences. She also stated that with the researchers' interventions, she would provide sensory interventions to the students when she observes attention or participation to be decreased.

Procedures

Design. The following applied research study used a quantitative single-subject experimental design. An A-B-A-B reversal design was used. In the area of educational research and determining evidence-based practices, single-subject research designs are growing in popularity (McClain, Otero, Haut, & Schatz, 2014). Participants are utilized as their own control, which allows researchers to compare variables prior to, during, and after an intervention (McClain et al., 2014). The A-B-A-B design is the most frequently used single-subject design in behavioral research (Gast, 2015). It permits a clear and convincing demonstration of experimental control because it requires repeated introduction and reversal (withdrawal) of an intervention (Gast, 2015). The A-B-A-B design also allows for a small group of participants to each have a baseline and treatment, or independent variable, measured on two different occasions. The A-B-A-B reversal design reduces internal threats, improves internal validity, and is favorable since it ends during the treatment phase (Horner & Spaulding, 2010). The use of an A-B-A-B reversal design allows for the opportunity to observe and measure the possible effects of a sensory diet on the attention and participation of a student during morning circle time during two different intervention phases and two different baseline phases.

Intervention. Prior to beginning the intervention, the researcher obtained university Institutional Research Board (IRB) and school district research board approval.

The researcher verbally communicated the research intent and obtained written consent from the caregivers. Once consent was received, the classroom CDA completed the SPM-P school form for each of the three participants based on the observations during the school day. When the SPM-P forms were completed and returned, the researcher and school-based OT identified the primary areas of sensory-based concerns through online input of scores into the SPM-P Online Evaluation System. The SMP-P raw scores were plotted on the paper-based SMP-P form and added to the final document. The intervention phase began the week after initial consent was obtained.

The sensory-based intervention strategies took place over a course of eight weeks with the individual sensory diet alternating every two weeks. The sensory diet was administered before and/or during the designated circle time by the researcher. Attention and participation were documented for each participant during morning circle, which is approximately 15 minutes. Each day, morning circle, which was instructed by the classroom CDA, included a calming technique, the pledge of allegiance, daily calendar, counting, songs, daily weather, and the weekly themes. Attention, for the applied research study, was operationally defined as looking eyes, listening ears, and sitting with a still body. Participation, for the applied research study, was operationally defined as singing and actively moving to the music and responding when expected to, either through whole group responses or individual responses when the opportunity allowed.

The researcher and the paraprofessional collected the data through visual observations that were recorded on the data collection sheet (see Appendix A). The paraprofessional was trained by the researcher and the OT prior to the initiation of the research on the individual sensory diet for each participant. During weeks one and two,

participation and attention were measured and observed during morning literacy circle to determine a baseline. During weeks three and four, individual treatment of the sensory diet was implemented daily at outside playtime prior to morning circle as well as during morning circle, and data on participation and attention continued to be measured during morning circle. During weeks five and six, individual sensory diets were removed, and another baseline was obtained. After the second baseline was obtained, during weeks seven and eight, treatment of the individual sensory diets prior to morning circle at outside playtime and during morning circle were implemented, and participation and attention were again measured during morning circle time.

Data analysis procedures. The analysis of the applied research study was completed through visual line-graphs documenting the observations of attention and participation for each research participant from daily morning circle time. The systematic comparison allowed for experimental documentation of all baseline and intervention phases, as well as documentation of the relationships between the change in the dependent variables and the manipulation of the independent variables (Horner et al., 2005). A line graph representation of data shows trends in behaviors and assists in clinical decision-making regarding the interventions and their effectiveness (Schaff & Mailloux, 2015).

Individual participant data documented weekly effects of the sensory diet on attention and participation, as well as the combined IOA comparison for the measurement of treatment reliability, and the weekly fidelity results for documentation and measurement of the effectiveness of the sensory diet. The finalized line graphs for each participant provided a visual representation of the effects of the sensory diet, as well as

the effects of the removal of the sensory diet on the participant's attention and participation during morning circle time. The Social Validity questionnaire at the conclusion of the research provided feedback related to the feasibility of a using sensory approaches and feedback on the implementation of a sensory diet during at set time in a blended prekindergarten classroom.

Chapter 4: Results

Introduction

This applied dissertation used a single subject A-B-A-B reversal design. The purpose of this applied research study was to determine the influence, if any, that a sensory diet has on attention and participation during morning group circle time in a blended ESE classroom with prekindergarten children with ASD. Three students were invited to participate in the study. Once consent was obtained, the classroom CDA completed the SPM-P for each of the participants. Using those results, the researcher and the school-based OT created a sensory diet with choices of activities and items for the participants. A baseline measure of the participants' attention and participation during morning circle was established during weeks one and two. The sensory diet was introduced at the beginning of week three. The overall timeframe for this study was eight weeks, with a maximum possibility of 37 observations.

The percent of intervals that each participant attended and participated during circle time was calculated through observations every three minutes from the classroom assistant and the researcher. The results are illustrated in Figures 1, 2, 3, 4, 5, and 6 in percentages below. Fidelity was calculated to be 95% by the classroom CDA and IOA was completed by the researcher and the classroom assistant. IOA for Student A was 84.2% for attention and 94.7% for participation, whereas IOA for Student B was 85.3% for attention and 91.2% for participation and IOA for Student C was 90% for attention and 80% for participation. Social validity was measured by a questionnaire completed by the CDA at the conclusion of the study and the social validity score illustrated 4.2 out of 5.

Data Analysis

Research Question 1. The first research question addressed in this study was, to what extent does the provision of a sensory diet increase attention during circle time in prekindergarten children with ASD? Figures 1, 2, and 3 illustrate the results for each participant.

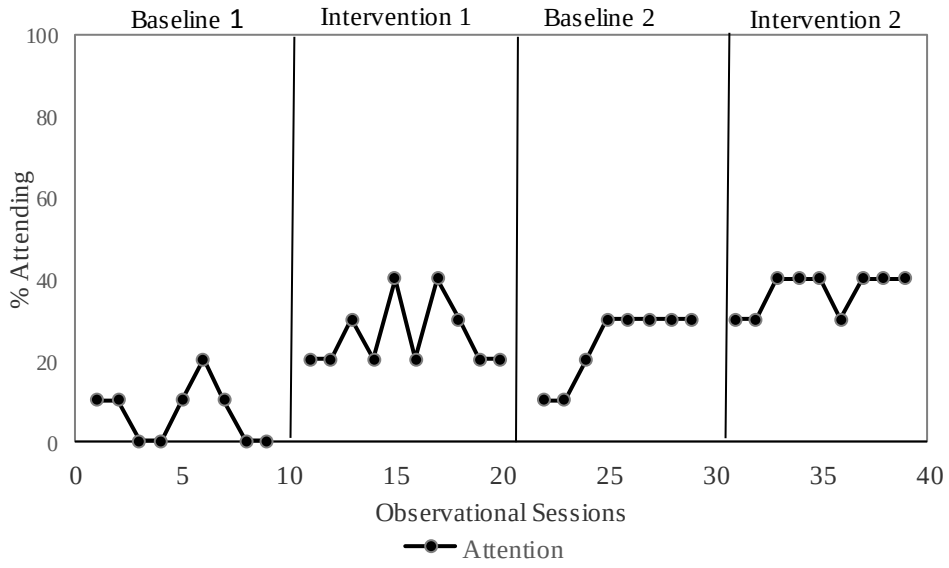

Figure 1. Attention data for Student A.

Student A. As shown in Figure 1, Student A demonstrated an increase in attending between the first baseline and the first intervention phase. In the first baseline phase Student A attended at 20% or less, and in the first intervention, Student A attended in 20-40% of the intervals. During the second baseline, the measurement of attention for Student A did not return to the original baseline level. Overall, Student A showed a slight increase in attention during the second intervention phase, but his performance continued to overlap with the second baseline.

Student B. As shown in Figure 2, Student B did not demonstrate a consistent

increase in attending during the two intervention phases. He began the first intervention phase with performance matching baseline for most of the sessions. Student B began to show an increase in attending towards the end of the first intervention. It was further revealed that attending did go back to baseline during the second baseline. However, attending during the second intervention phase showed inconsistent performance ranging from 40% to 80% of the intervals measured.

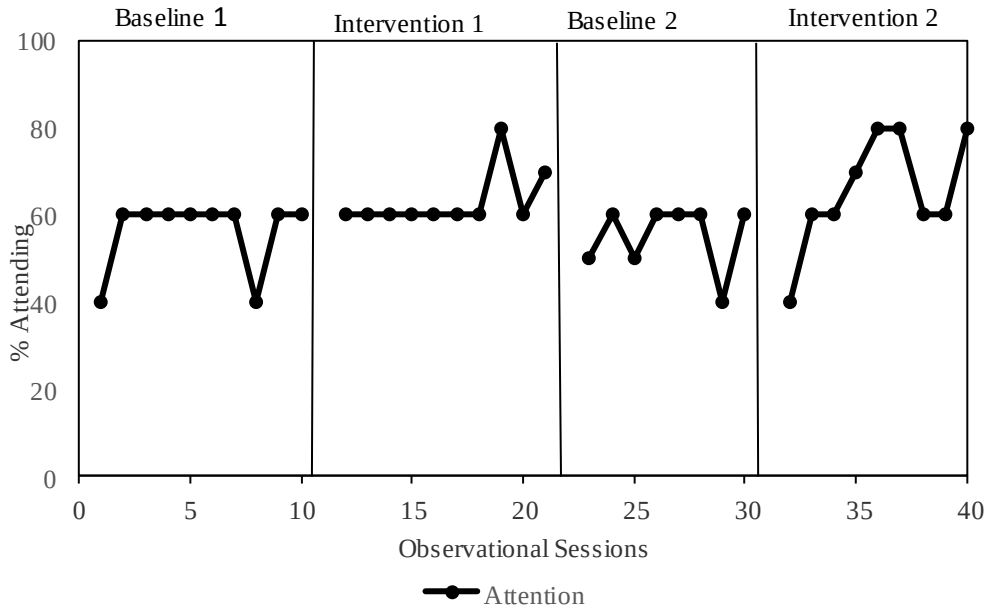

Figure 2. Attention data for Student B.

Student C. As shown in Figure 3, Student C did not exhibit a stable baseline measure below the attending performance during Intervention 1. He showed a slight increase in attending during the first intervention phase; however, the Intervention 1 measure overlapped with the Baseline 2 measure. Overall, Baseline 2 did not decrease to previous levels and performance was close to what was seen during Intervention 1. During Intervention 2, Student C showed a slight increase in attending behavior.

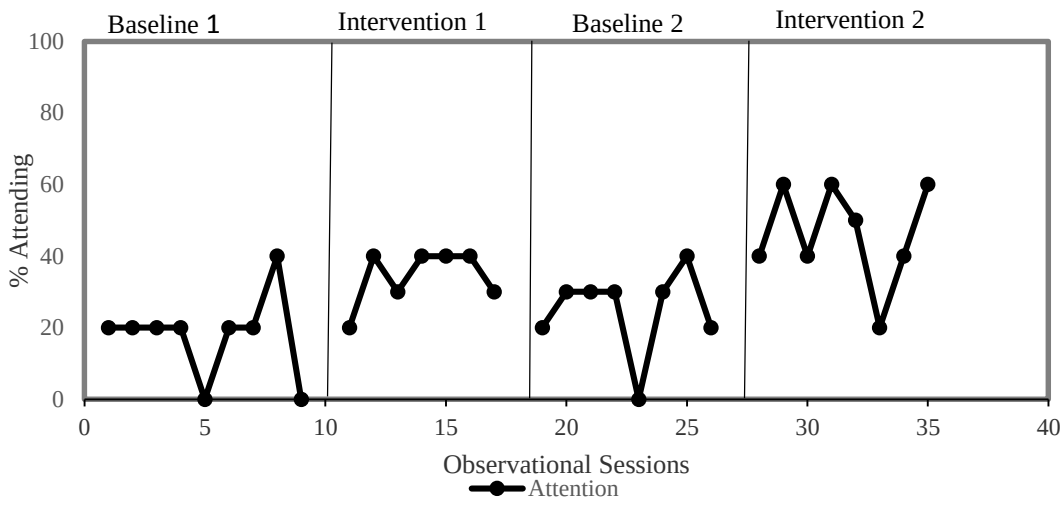

Figure 3. Attention data for Student C.

Research Question 2. The second research question addressed in this study was, to what extent does the provision of a sensory diet increase participation in the circle time activity in prekindergarten children with ASD? Figures 4, 5, and 6 illustrate the results for each participant.

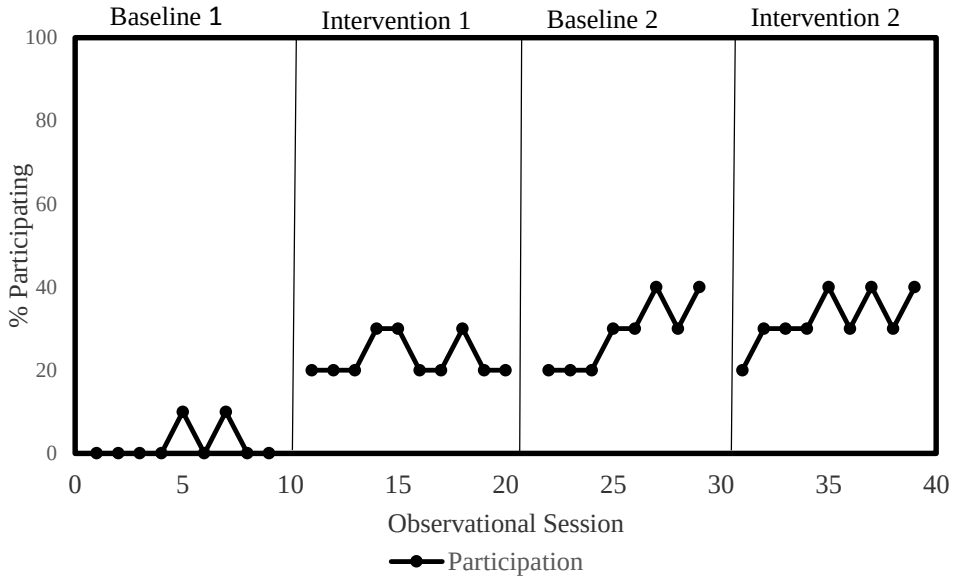

Figure 4. Participation data for Student A.

Student A. As shown in Figure 4, during Baseline 1, Student A participated during 0 to 10% of the intervals measured and there was an increase during the first intervention phase. During Baseline 2, Student A did not return to the previous baseline level and performance stayed the same at the Intervention 1 level. It was further demonstrated that during the second intervention phase, participation did not increase. Through Intervention 1, Baseline 2, and Intervention 2, Student A participated 20% to 40% of the time.

Student B. Participation during the first baseline phase ranged from 20% to 80% and participation was at 60% for a majority of the Intervention 1 measures. Baseline 2 did not decrease; the level of participation overlapped with the results of the first intervention phase. The Intervention 2 measure was inconsistent but did slightly increase. If additional Baseline and Intervention phases were implemented, Student B might have demonstrated an increase in his participation.

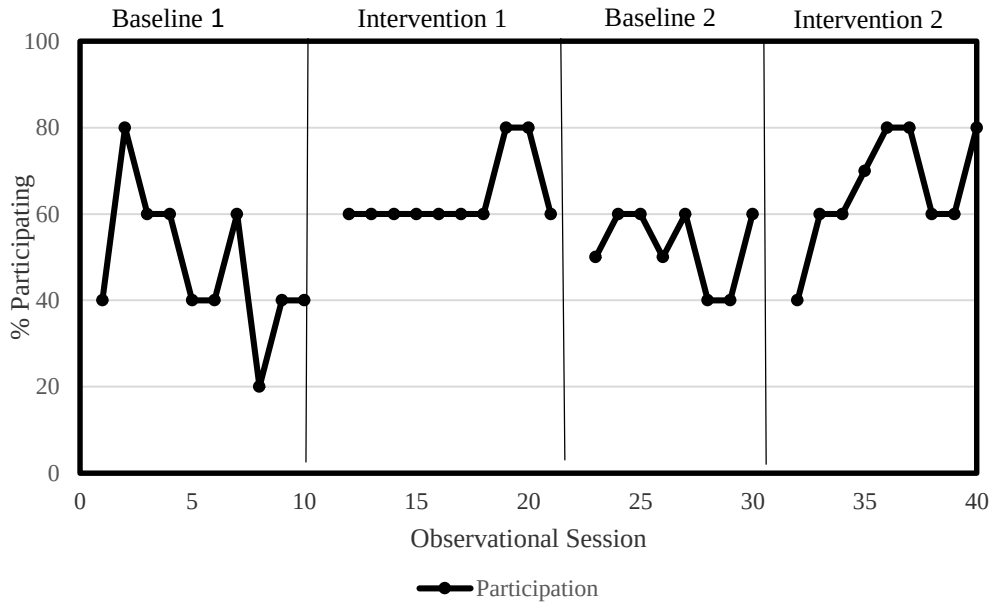

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Figure 5. Participation data for Student B.

Student C. The Baseline 1 measure and Intervention 1 measure overlapped, with only a slight increase in participation after the first few sessions. The second baseline did not return to the level of the first baseline and overlapped with the results during the first intervention phase. Therefore, Student C demonstrated a slight increase in participation with inconsistent measurements of participation during Intervention 2.

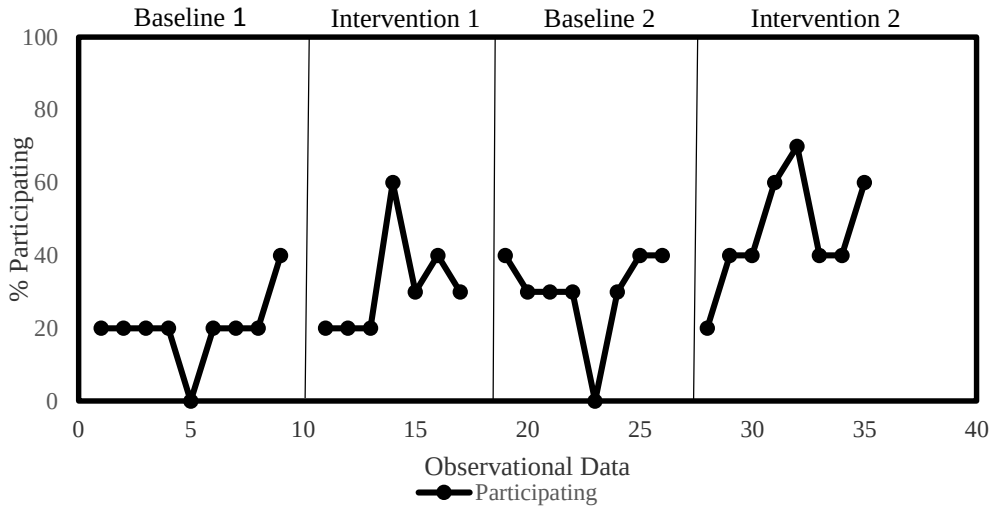

Figure 6. Participation data for Student C.

Research Question 3. The third research question addressed in this study was, to what extent does attention in circle time continue when sensory interventions are removed? Figures 1, 2, and 3, represent the changes in attention during the baseline and intervention phases. During the second baseline for Student A, it can be assumed that attention was maintained only because the student was the helper for the second week. Student A was made to attend by leading a portion of the calendar time, which depicted an overlap of attending behaviors between Baseline 2 and Intervention 2 measurements. Student B did not demonstrate a change in attending behaviors when the sensory interventions were removed. The measurement of attention for Student C when the

sensory interventions were removed overlapped with the intervention measurements.

Research Question 4. The fourth research question addressed in this study was, to what extent does participation in circle time continue when sensory interventions are removed? Figures 4, 5, and 6, represent the changes in participation during the baseline and intervention phases. Student A had an overlap of participation skills between Intervention 1 and Baseline 2 measurements. The data from Student B did depict a slight decrease in participation when the sensory diet was removed. It was further illustrated that the removal of the sensory diet for Student C was not significant. The level of participation for Student C, with and without the implementation of the sensory diet, varied only slightly.

Chapter 5: Discussion

Introduction

The purpose of this applied dissertation was to determine the effects of a sensory diet on attention and participation during morning group circle time in a blended ESE classroom with prekindergarten children with ASD. Using the SPM-P, with the assistance of the school-based OT, the research indicated the need for a daily sensory diet for three students with a medical or educational exceptionality of ASD. The classroom assistant and the researcher observed attention and participation of Student A, Student B, and Student C for the first 15-minutes of morning circle for 8 weeks. The first two weeks established a baseline and the sensory diet was implemented during weeks three and four. The sensory diet, including specific outside morning activities, were removed during weeks five and six and introduced again during weeks seven and eight. The overall results of this study were not significant enough to show that the use of a sensory diet increases attention or participation. In addition, the results of this study were not significant enough to determine that the removal of a sensory diet impacts attention or participation once introduced.

Summary of Findings

The results and visual representations demonstrate that implementing a sensory diet are varied and scattered. Student A made some growth in attention during the morning circle over the course of the two months. In addition, Student B and C demonstrated difficulty with some recommended items, which is depicted in the visual data. During the first intervention phase, the floor spot for Student A was changed to the center front, which can be assumed to have impacted his level of attention. The increase

in participation for Student A can be attributed to his expectation to help lead parts of the circle time. Student B had four additional absences and was under the weather for a majority of the study; he was later out for a week with pneumonia. In addition, the level of participation for Student A was affected by his expectation to be the calendar and the weather helper for the second week of the second baseline phase and the second intervention phase. The level of participation for Student B increased slightly at the conclusion of the research. It was further observed that at times Student C demonstrated an increase in impulsivity and movement. The expected differentiation between baseline phase and intervention phase data is not evident, and this may be attributed to changes in (a) circle time spot, (b) activities that overstimulated the senses, (c) illness, (d) a distraction from sensory items presented, (e) unrelated behaviors, (f) circle time jobs, and (g) as well as many other factors.

Interpretation of Findings

Overall, the results provided insight to the researcher, OT, and CDA. Each student demonstrated various skills with and without the sensory diet. Using the results of the SPM-P to gather sensory tools and activities that were individualized to each student was extremely worthwhile. The ability for the students to utilize those tools was useful in their body awareness and ability to learn. Student A benefited the most from the weighted lap pad, visuals, seat change, and the sensory bottle. He decreased the amount of time he was staring into space and increased his social participation. Furthermore, he began interacting alongside peers on the playground during both outside times. In addition, he increased his verbal communication and engagement in the majority of classroom activities; which may be related to the research interventions, but this may be due to

increased exposure to an educational setting, other interventions within the classroom setting, or maturity over the two months of the study.

Student B illustrated the most progress with animal walking, access to fidgets, deep compression squeezes, and the weighted items. However, Student B became distracted with the wiggle cushion and was frustrated during wheel barrel walking. He did begin to advocate for himself after the sixth week of research. Moreover, he decreased the amount of touching others and was more comfortable with touches/compressions, as well as sounds. Student C demonstrated the most difficulty with the sensory diet, as he often utilized the items incorrectly, which distracted his peers and posed a safety concern (i.e., swinging fidgets, throwing the weighted lap pad, rolling on the wiggle cushion). He benefited from the close proximity of an adult, body squeezes, arm and head compressions, and the cube chair to maintain his posture. According to pre-intervention parent feedback, Student C did carry over the breathing and calming body techniques to the home setting.

Context of Findings

The findings of the research study were noted as not being significant; however, the feedback from the social validity questionnaire completed by the classroom-based CDA provided encouraging anecdotal information related to the implementation of a sensory diet. Data from current researchers have concluded that sensory integration interventions often do not indicate an increase in attention, in-seat behaviors, or participation; however, feedback from teachers and OTs are favorable and the intervention or tools continue to be utilized in the classroom setting (Piller & Pfeiffer, 2016; Umeda & Deitz, 2011; Zimmerman, Ledford, & Severini, 2018).

The study by Umeda and Deitz (2011) utilized therapy cushions to promote in-seat and on-task behaviors in kindergarten students with ASD and sensory processing impairments in an integrated classroom. Umeda and Deitz stated that school-based OTs often use sensory-based strategies to increase students' level of attending, on-task behavior, and performance. The results of the study were not substantial enough to reveal an increase in on-task behaviors or changes in sitting patterns. The feedback from the classroom teacher was positive in that he was willing to utilize therapy cushions as an alternate seating choice to all students.

Another study conducted by Zimmerman et al. (2018) had similar feedback from the classroom teacher, which measured the effectiveness of utilizing a weighted blanket for a kindergarten student diagnosed with ASD. The description for the study of a weighted blanket included, and was not limited to, a weighted vest or a weighted lap pad. The results indicated that the use of the weighted blanket did not result in a therapeutic behavior change and the engagement of the student was lower during the intervention phases than in the baseline phases (Zimmerman et al., 2018). At the conclusion of the study, the anecdotal results indicated that the general education teacher reported that the weighted tools continued to be used often in the classroom, as there was an increase in the student's attention.

In 2016, Piller and Pfeiffer completed a qualitative study examining the viewpoint of teachers and occupational therapists on the sensory-related aspects of the environment needed to increase participation. Participation was defined as active involvement with others to perform a task within a given environment (Piller & Pfeiffer, 2016). Through 13 interviews with teachers and occupational therapists, two essential components were

identified to increase participation in children with ASD in classroom activities, which were to provide consistent routines and the importance of modifying the environment or task and offering sensory supports. The results of the different limitations and various enhancements varied by child and were dependent on the sensory impairments of a particular child (Piller & Pfieffer, 2016).

Implications of Findings

Research surrounding the area of sensory integration and sensory diets continues to be emerging. The effectiveness of sensory approaches and activities, especially in the general education setting, continue to be questioned. Using sensory-based interventions may not be as effective due to a mismatch between the intents and the goals of the intervention, as well as the implementation and training of those providing the interventions (Case-Smith, Weaver, & Fristad, 2015). The findings surrounding the current applied research study are descriptive of inconsistent gains in attention and participation, requiring many more intervention changes and adaptations. The observations and data provided the researcher, OT, classroom assistant, CDA, and caregivers with important and relevant information regarding the sensory differences in the participants.

Limitations of the Study

As with all research, there are limitations to this study. One of the limitations is the small number of participants. The study is a multiple-case-study design with a small sample size, which often limits the ability to generalize results to a larger population (Case-Smith & Bryan, 1999). However, Horner et al. (2005) stated that single subject designs are used to test conceptual theories and identify or validate effective clinical

interventions. Horner et al. also indicated that "strong experimental control can be demonstrated when the design documents three different experimental effects with at least three participants, across three different points in time" (2015, p. 168). The above criteria were met in the proposed research study, so internal validity of the applied research was strong; however, with the study meeting individual sensory needs of each student, it may be difficult to generalize the specific sensory diet findings to other students, even others with similar sensory integration disorders. The use of a sensory diet is an individualized plan; the specific sensory-based interventions will not be able to be used in the same way with another student, as each student will need his or her own sensory diet to obtain the most benefit from the interventions.

Another limitation of the study is that both attention and participation *look different* for each participant. Having definite expectations and definitions as the students get older will assist in validating further research. Student absences, school events, or other inconsistencies contributed to the limitations of the proposed study. The short baseline and intervention timelines, which were eight weeks total, limited the overall results of the study. A possibility of a larger sample size with participants in various grade levels, as well as a longer timeframe might create stronger support for sensory-based interventions during various educational activities. Expanding to different schools within the county would add to the validity of the results.

Future Research Development

Anecdotal evidence of the effectiveness of sensory integration therapy is widespread, and there continues to be a great interest, as well as need, in establishing evidence-based research for this area (Simpson, 2005). Before 2000, sensory integration

therapy approaches were being used; both therapy and research results were positive; however, the findings were not data driven. There was no fidelity behind the research, and the results were unable to be generalized across settings (Case-Smith et al., 2015; Reynolds et al., 2017). As previously mentioned in Chapter 1, the National Standards Project (NSP) in 2015 continued to find treatments within the sensory integrative package to be unestablished. Collaboration between therapists using sensory integration is becoming widespread; however, there is very little evidence proving its effectiveness (Case-Smith et al., 2015; Dunn, Saiter, & Rinner, 2002). Sensory interventions have been inconsistently defined when referred to in the literature and in practice (Case-Smith et al., 2015). Researchers may be utilizing different sensory modalities, such as vestibular, proprioceptive, and visual. In addition, researchers may be using a variety of methods such as massage, swinging, and brushing as well as targeting different behaviors, while the participants all vary in their needs. The research surrounding sensory integration interventions also is applied in different contexts and with different conceptualizations.

The question of whether specific sensory and/or motor abnormalities are associated with other behaviors and/or diagnostic characteristics needs to be addressed. Carefully controlled studies need to be completed to determine the types of interventions that are most effective for addressing the sensory and motor abnormalities or impairments in children with autism. Sensory and motor impairments affect virtually all aspects of adaptive, cognitive, social, and academic functioning (Dunn et al., 2002). Without the proper, individualized strategies and tools, individuals with sensory processing impairments may be limited in their attention to and participation in academic as well as social settings (Dunn et al., 2002). Interventions in the area of sensory-motor functioning

do not represent the full scope of therapeutic/educational services; however, they should be addressed and be worked into the educational and life skills of every child that requires support in this area.

There has not been a correlation established between sensory interventions and behavior; however, researchers continue to link the relationship between sensory impairments and behavior concerns. Depending on the severity and differences of the sensory symptoms, participation in activities throughout daily experiences is decreased (Schaaf & Mailloux, 2015). Children with tactile over-stimulation may avoid touching various textures, have difficulty coloring or cutting, avoid eating or only eat specific items (Biel & Peske, 2009; Kranowitz, 2015). Evidence related to the efficacy of sensory integration therapy in the population of children with ASD is currently emerging (Cascio et al., 2016; Case-Smith et al., 2015).

Often the problem with the evidence is that the sensory-based interventions are frequently child-directed. Occupational therapists address how the sensory differences impact daily life and may involve helping the individual client maintain attention, regulate emotional responses to sensory input, or coordinate sensory input in functional activities during play or self-care times (Cascio et al., 2016). The outcomes are measured by clinical observations, individualized treatment plans, and caregiver reports. Often sensory-based interventions are child-focused, parent-focused, or used to support the environment or for adaptations (Reynolds et al., 2017). Reynolds et al. (2017) provided preliminary evidence through their guide for combining all three sensory-based interventions.

There is an organization of worldwide representatives that in 2008 formed the International Coalition for Education in Sensory Integration (ICESI). They are now in the process of changing the name to the International Coalition for Education in Ayres Sensory Integration (ICEASI). In 2016, they and other organizations began establishing international guidelines for education in ASI. These guidelines are not specific to occupational therapists; but include physicians, speech-language pathologists, physical therapists, and others (Mori et al., 2017). These guidelines have been put in place to help to maintain consistency over the understanding and use of sensory integration. They also provide assistance with developing a stronger foundation for evidence-based practice.

The most current systematic review of Ayres Sensory Integration intervention concluded that the intervention does meet Council for Exceptional Children (CEC) criteria for evidence-based practice for children with ASD (Schoen et al., 2019). With the guidelines set by the ICESI, shared goals from the CEC and other organizations, Cascio et al. (2016) envisioned a successful multi-disciplinary collaboration to lead to better and more empirical findings for clinical practice surrounding improved sensory assessments and interventions. Research should continue to be well controlled and continue to measure the early effects and late effects of sensory integration activities on one's participation in life activities.

References

Abraham, M. C. (2002). Sensory integration: Practical strategies and sensory motor activities for use in the classroom (Addressing Learning Differences). Pennsylvania State University, PA: LDA.

American Occupational Therapy Association. (2015). Occupational therapy for children and youth using sensory integration theory and methods in school-based practice. *American Journal of Occupational Therapy, 69*(Suppl.3), 6913410040. Retrieved from http://dx.doi.org/10.5014/ajot.2015696s04

American Psychiatric Association. (2000). Pervasive developmental disorders. *Diagnostic and statistical manual of mental disorders* (4th ed. text rev.). Washington, DC: Author.

American Psychiatric Association. (2013a). Autism spectrum disorder. *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

American Psychiatric Association. (2013b). Highlights of changes from DSM-IV-TR to DSM-5. *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Ayres, A. J. (2005). *Sensory integration and the child* (25th ed.). Torrance, CA: Western Psychological Services.

Ayres, A. J., & Mailloux, Z. (1981). Influence of sensory integration procedures on language development. *American Journal of Occupational Therapy, 35*(6), 383-390. doi:10.5014/ajot.35.6.383

Ayres, A. J., & Tickle, L. S. (1980). Hyper-responsibility to touch and vestibular stimuli as a predictor of positive response to sensory integration procedures by autistic

children. *The American Journal of Occupational Therapy, 34*, 375–381. doi:10.5014/ajot.34.6.375

Baio J., Wiggins L., Christensen D. L., Maenner, M. J., Daniels, J., Warren, Z.,…Dowling, N. F. (2018). Prevalence of autism spectrum disorder among children aged 8 years - Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2014. *Morbidity and Mortality Weekly Report. Surveillance Summaries, 67*(6), 1-23. Retrieved from http://dx.doi.org/10.15585/mmwr.ss6706a1

Baranek, G. T. (2002). Efficacy of sensory and motor interventions for children with autism. *Journal of Autism and Developmental Disorders, 32*(3), 397-424. doi:0162-3257/02/1000-0397/0

Beck, C. (2018). *Classroom sensory strategies toolkit.* Retrieved from www.theottoolbox.com

Biel, L., & Peske, N. (2009). *Raising a sensory smart child*. New York, NY: Penguin Books. Retrieved from http://www.sensorysmarts.com/index.html

Bundy, A. C., Lane, S. J., & Murray, E. A. (2002). *Sensory integration: Theory and practice* (2nd ed.). Philadelphia, PA: F. A. Davis.

Callahan, K., Hughes, K. L., Mehta, S., Toussaint, K. A., Nichols, S. M., Ma, P. S.,…Wang, H. (2017). Social validity of evidence-based practices and emerging interventions in autism. *Focus on Autism and Other Developmental Disabilities, 32*(3), 188-197. doi:10.1177/1088357616632446

Caminha, R. C., & Lampreia, C. (2012). Findings on sensory deficits in autism: Implications for understanding the disorder. *Psychology & Neuroscience, 5*(2), 231-237. doi:10.1590/S1983-32882012000200014

Carroll, R. A., & St. Peter, C. C. (2014). Methods for assessing social validity of behavioral intervention plans for children with attention deficit hyperactivity disorder. *Acta de Investigación Psicológica, 4*(3), 1642-1491.

Cascio, C. J., Woynaroski, T., Baranek, G. T., & Wallace, M. T. (2016). Toward an interdisciplinary approach to understanding sensory function in autism spectrum disorder. *Autism Research, 9*, 920-925. doi:10.1002/aur.1612

Case-Smith, J., & Arbesman, M. (2008). Evidence-based review of interventions for autism used in or of relevance to occupational therapy. *American Journal of Occupational Therapy, 62*(4), 416-429. doi:10.5014/ajot.62.4.416

Case-Smith, J., & Bryan, T. (1999). The effects of occupational therapy with sensory integration emphasis on preschool-age children with autism. *American Journal of Occupational Therapy, 53*(5), 489-497.

Case-Smith, J., Weaver, L. L., & Fristad, M. A. (2015). A systematic review of sensory processing interventions for children with autism spectrum disorders. *Autism, 19*(2), 133-148. doi:1177/1362361313517762

Centers for Disease Control and Prevention. (2018). *Autism spectrum disorders: Data & statistics.* Retrieved from http://www.cdc.gov/ncbddd/autism/data.html

Cooper J. O., Heron T. E., & Heward W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Dawson, G., & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration in autism: A review of the evidence. *Journal of Autism and Developmental Disorders, 30,* 415-421. doi:10.1023/A:1005547422749

Dunn, W. (1999). *Sensory profile.* Retrieved from http://harcourtassessment.com /HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1638-008&Mode =detail&Leaf=avpproducts

Dunn, W., Saiter, J., & Rinner, L. (2002). Asperger syndrome and sensory processing: A conceptual model and guidance for intervention planning. *Focus on Autism and Other Developmental Disabilities, 17*(3), 172-185. doi:10.1177 /10883576020170030701

Ecker, C., & Parham, D. (2010). *The sensory processing measure – Home form.* Los Angeles, CA: Western Psychological Services. Retrieved from https://www.wpspublish.com/store/p/2991/sensory-processing-measure-spm

Fazlıoğlu, Y., & Baran, G. (2008). A sensory integration therapy program on sensory problems for children with autism. *Perceptual and Motor Skills, 106*(2), 415-422. doi:10.2466/pms.106.2.415-422

Gast, D. L., & Ledford, J. R. (2015). *Single subject research methodology: Applications in special education and behavioral sciences* (2nd ed.). New York, NY: Routledge.

Glennon, T. J., Miller-Kuhaneck, H., & Herzberg, D. (2011). The Sensory Processing Measure-Preschool (SPM-P)—Part One: Description of the tool and its use in the preschool environment. *Journal of Occupational Therapy, Schools & Early Intervention, 4*, 42-52. doi:10.1080/19411243.2011.573245

Glennon T. J., Miller-Kuhaneck, H., Henry, D.A., Parham, L. D., & Ecker, C. (2010). *The Sensory Processing Measure-Preschool (SPM-P).* Torrance, CA: Western Psychological Services.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Council for Exceptional Children, 71*(2). 165-179. doi:10.1177 /001440290507100203

Horner, R. H., & Spaulding, S. A. (2010). Single-subject design. In N. J. Salkind (Ed.), *Encyclopedia of research design* (pp. 1387-1395). Thousand Oaks, CA: Sage. Retrieved from http://dx.doi.org/10.4135/9781412961288.n424

Iarocci, G., & McDonald, J. (2006). Sensory integration and the perceptual experience of persons with autism. *Journal of Autism and Developmental Disorders, 36*(1), 77-90. doi**:** 0162-3257/06/0100-0077/0

Kinnealey, M., Pfeiffer, B., Miller, J., Roan, C., Shoener, R., & Ellner, M. L. (2012). Effect of classroom modification on attention and engagement of students with autism or dyspraxia. *American Journal of Occupational Therapy, 66*, 511-519. http://dx.doi.org/10.5014/ajot.2012.004010

Koomar, J., Kranowitz, C., & Szklut, S. (2007). *Answers to questions teachers ask about sensory integration.* Arlington, TX: Future Horizons Publications.

Kranowitz, C. S. (2005). *The out-of-sync child: Recognizing and coping with sensory processing disorder.* New York, NY: Penguin Group.

Kranowitz, C. S. (2006). *The out-of-sync child has fun: Activities for kids with sensory processing disorders.* New York, NY: Penguin Group.

Linderman, T. M., & Stewart, K. B. (1999). Sensory integrative-based occupational therapy and functional outcomes in young children with pervasive developmental disorders: A single-subject study. *The American Journal of Occupational Therapy, 53*(2), 207-213. doi:10.5014/ajot.53.2.207

Losinski, M., Cook, K., Hirsch, S., & Saunders, S. (2017). The effects of deep pressure therapies and antecedent exercise on stereotypical behaviors of students with autism spectrum disorders, *Behavioral Disorders, 42*(4), 196-208. doi:10/1177 /0198742917715873

Mauer, D. M. (1999). Issues and applications of sensory integration theory and treatment with children with language disorders. *Language, Speech, and Hearing Services in Schools, 30*(4), 383-392. doi:0161-1461/99/3004-0383

McClain, M., Otero, T., Haut, J., & Schatz, R. (2014). Single subject design in educational research: The use of effect size measures in analysis and interpretation. *Sage Research Methods Cases.* doi:10.4135 /97814462730501453417 3

Miller, L. J. (2012). *Final decision for DSM-5.* Sensory Processing Disorders Foundation. Retrieved from http://www.spdfoundation.net/dsmv1.html

Miller-Kuhaneck, H., Henry, F. D. A., & Glennon, T. J. (2010). *The Sensory Processing Measure – School Form.* Los Angeles, CA: Western Psychological Services. Retrieved from https://www.wpspublish.com/store/p/2991/sensory-processing -measure-spm

Mori, A. B., Koester, A. C., Holland, D., Fernandes, P., Rogers, R. G., Roley, S. S., …VanJaarsveld, A. (2017). Building competency in SI: Evidence-based

guidelines for occupational therapy using Ayres Sensory Integration®. *OT Practice, 22*(12), 8-13.

National Autism Center. (2009). *National standards project findings and conclusions.* Randolph, MA: Author.

National Autism Center. (2011). *Evidence-based practices and autism in the schools.* Randolph, MA: Author.

National Autism Center. (2015). *Findings and conclusions: National standards project, phase 2.* Randolph, MA: Author.

Olson, C. H., Henry, D. A., Kliner, A. P., Kyllo, A., Munson Richter, C., Charley. J.,...Walworth, J. (2016). Effectiveness and usability of the Sensory Processing Measure-Preschool Quick Tips: Data-driven intervention following the use of the SPM-Preschool in an early childhood, multiple-case study. *Journal of Occupational Therapy, Schools, & Early Intervention, 9*(2), 142-162. doi:10.1080 /19411243.2016.1152933

Parham, D. L., Cohn, E. S., Spitzer, S., Koomar, J. A., Miller, L. J., Burke, J. P., … Clare A. Summers, C. A. (2007). Fidelity in Sensory Integration Intervention Research. *The American Journal of Occupational Therapy, 61*(2), 216-227. doi:10.5014 /ajot.61.2.216

Pearson Clinical. (2015). *Sensory Profile 2.* Retrieved from http://www.pearsonclinical.com /therapy/products/100000822/sensory-profile -2.html

Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. *American Journal of Occupational Therapy, 65*(1), 76-85. doi:10.5014/ajot.2011.09205

Piller, A., & Pfeiffer, B. (2016). The sensory environment and participation of preschool children with autism spectrum disorder. *OTJR: Occupation, Participation and Health, 36*(3), 103-111. doi:10.1177/1539449216665116

Pinellas County Schools. (2018). *Prek ESE*. Retrieved from http://www.pcsb.org/page /850

Pollock, N. (2009). Sensory integration: A review of the current state of the evidence. *Occupational Therapy Now, 11*(5), 6-10. Retrieved from http://www.caot.ca /otnow/sept09/sensory.pdf

Reynolds, S., Glennon, T. J., Ausderau, K., Bendixen, R. M., Kunaneck, H. M., Pfeiffer, B., ...Bodison, S. C. (2017). Using a multifaceted approach to working with children who have differences in sensory processing and integration. *American Journal of Occupational Therapy, 71*(2), 1-10. doi:10.5014/ajot.2017.019281

Rogers, J., & Short, J. (2010). Sensory differences: Online training module (Columbus, OH: Ohio Center for Autism and Low Incidence). In Ohio Center for Autism and Low Incidence (OCALI), *Autism Internet Modules*, Retrieved from www.autisminternetmodules.org

Salkind, N. J. (2010). *Encyclopedia of research design.* Thousand Oaks, CA: Sage. doi:10.4135/9781412961288

Schaff, R. C., & Mailloux, Z. (2015). *Clinician's guide for implementing Ayres Sensory integration: Promoting participation for children with autism.* Bethesda, MD: American Occupational Therapy Association.

Schechtman, M. A. (2007). Scientifically unsupported therapies in the treatment of young children with autism spectrum disorders. *Psychiatric Annals, 37*(9), 639-645. Retrieved from http://search.proquest.com.ezproxylocal.library.nova.edu /docview/217056798?accountid=6579

Schoen, S. A., Lane, S. J., Mailoux, Z., May-Benson, T., Parham, L. D., Roley, S. S., & Schaaf, R. C. (2019). A systematic review of Ayres Sensory Integration intervention for children with autism. *Autism Research, 12*(1), 6-19. https://doi.org/10.1002/aur.2046

Sensational Brain. (2018). Brain works. Retrieved from www.SensationalBrain.com

Sensory Processing Disorder Foundation. (2012). *About SPD.* Retrieved from http://www.spdfoundation.net/about-sensory-processing-disorder.html

Shellenberger, S., & Williams, M. S. (2002). "How does your engine run?"™: The Alert Program® for self-regulation. In A. G. Fisher, E. A. Murray, & A. C. Bundy (Eds.), *Sensory integration: Theory and practice* (pp. 342-345). Philadelphia, PA: F.A. Davis.

Simpson, R. L. (2005). Evidence-based practices and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 20*(3). doi:10.1177/10883576050200030201

Stannitti, K., Raison, P., & Ryan, P. (1999). Sensory defensiveness syndrome: A paediatric perspective and case study. *Australian Occupational Therapy Journal, 46*, 175-187.

Swearingen, A. (2007). *Using a "sensory diet" with children with sensory processing disorder*. Greenville, SC: Super Duper Publications. Retrieved from http://www.superduperinc.com/handouts/pdf/132_Sensory_Diet_090212.pdf

Therapro. (2012). *Sensory Processing Measure* (SPM). Retrieved from http://www.therapro.com/Sensory-Processing-Measure-SPM-P321417.aspx

Umeda, C., & Deitz, J. (2011). Effects of therapy cushions on classroom behaviors of children with autism spectrum disorder. *The American Journal of Occupational Therapy, 65*(2), 152-159. doi:10.5014/ajot.2011.000760

VandenBerg, N. L. (2001). The use of a weighted vest to increase on-task behavior in children with attention difficulties. *American Journal of Occupational Therapy, 55*(3), 621-628.

Watling, R., Deitz, J., Kanny, E. M., & McLaughlin, J. F. (1999). Current practice of occupational therapy for children with autism. *American Journal of Occupational Therapy, 53*(5), 498-505. doi:10.5014/ajot.53.5.498

Watkins, M. W., & Pacheco, M. (2000). Interobserver agreement in behavioral research: Importance and calculation. *Journal of Behavioral Education, 10*(4), 205-212. doi:1053-0819/00/1200-0205

Weitlauf, A. S., Sauthe, N. S., McPheeters, M. L., & Warren, Z. E. (2017). Interventions targeting sensory challenges in autism spectrum disorder: A systematic review. *Pediatrics*, e20170347. doi:10.1542/peds.2017-0347

Wilbarger, J., & Wilbarger, P. (1991). The Wilbarger approach to teaching sensory defensiveness. In A. C. Bundy, S. J. Lane, & E. A. Murray (Eds.), *Sensory integration: Theory and practice* (pp. 335-341). Philadelphia, PA: F. A. Davis.

Wong, C., Odom, S. L., Hume, K. A., Cox, C. W., Fettig, A., Kurcharczyk, S., . . . Schultz, T. R. (2014). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders.* Advance online publication. doi: 10.1007/s10803-014-2351-z

Zimmerman, K. N., Ledford, J. R., & Severini, K. E. (2018). Brief report: The effects of a weighted blanket on engagement for a student with ASD. *Focus on Autism and Other Developmental Disabilities, 1*(5), doi:10.1177/1088357618794911

Appendix A

Data Collection Sheet

Data Collection Sheet

Participant: _____ Date/Week #_____

Participation looks like:
_____

Attention looks like:
_____

Sensory Diet techniques used:
_____

Participation

Time	Mon	Tues	Wed	Th	Fri	Notes
3 min						
6 min						
9 min						
12 min						
15 min						

Attention

Time	Mon	Tues	Wed	Th	Fri	Notes
3 min						
6 min						
9 min						
12 min						
15 min						

$$\text{Agreement} = \frac{\text{Interobserver Agreement}}{\text{Agreements + Disagreements}} \times 100 = \boxed{}$$

Appendix B

Fidelity Checklist

Fidelity Checklist

	Yes	No	Comments/Observations
1. Is the circle time based on a routine (the students will not be surprised or upset with changes or unexpected events)?			
2. Is the researcher providing a safe environment for the students?			
3. Do the students have adequate space during circle time?			
4. Do the students have access to his/her necessary tools?			
5. Are there a variety of tools available for each student for the different areas of impairment?			
6. Are there different seating arrangements based on the needs of the children?			
7. Do the participants have weighted tools and various textures available?			
8. Were there environmental adaptations made?			
9. Did the sensory-based interventions appear to be child-centered			
10. Did the sensory tools distract the peers?			

Fidelity score (%) - _____

Appendix C

Social Validity Questionnaire

Social Validity Questionnaire

Directions: Using a 1 to 5 Likert scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree", please respond to the question by putting a circle around the number that you feel is appropriate.

The sensory diet was an acceptable intervention for the child.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

Most teachers would find a sensory diet an appropriate intervention to support increasing attention and/or participation.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

A sensory diet should prove effective in changing the child's attention and/or participation.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

I would suggest the use of a sensory diet to increase attention and/or participation during circle time.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

The child's behavior problem is severe enough to warrant a sensory diet.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

Most teachers would find sensory diets suitable for support of increasing attention and/or participation.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

I would be willing to use a sensory diet in the classroom setting.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

A sensory diet would be appropriate for a variety of children.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

A sensory diet would ***not*** result in negative side effects for the child.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

A sensory diet is a consistent intervention with those I have used previously in the classroom setting.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

The sensory diet was a fair way to handle the child's attention and/or participation during morning circle.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

The sensory diet was reasonable to address attention and/or participation during morning circle.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

I liked the procedures used in this intervention.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

The sensory diet was a good way to handle these children's problem behavior.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree

Overall, the sensory diet was beneficial for the child.
1- Strongly disagree 2- Disagree 3- Neutral 4- Agree 5- Strongly Agree