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# The Sensory Processing Patterns and Activity Choices of a Child with Autism Spectrum Disorder: A Mixed-Methods Case Study

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The Sensory Processing Patterns and Activity Choices of a Child with Autism  
Spectrum Disorder: A Mixed-Methods Case Study

By

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The Sensory Processing Patterns and Activity Choices of a Child with Autism  
Spectrum Disorder: A Mixed-Methods Case Study

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Submitted to the Faculty of the Graduate School of  
Eastern Kentucky University  
in partial fulfillment of the requirements  
for the degree of  
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## DEDICATION

This thesis is dedicated to my husband  
Rich and to my parents, Ron and  
Georgina for their never ending  
support and belief in me.

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## ABSTRACT

It is estimated that up to 95% of children with autism spectrum disorder experience sensory processing problems. Minimal research is available on the relationship between specific sensory processing patterns, activity preference and behavior patterns in children. It is hypothesized that if children participate in play activities that support their sensory needs, they will experience less behavioral problems, more self-regulating behavior and a higher quality of life. This mixed-methods case study examines how a child with autism spectrum disorder participates in activities and looks at if those activities support sensory needs, thus reinforcing self-regulatory behaviors.



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## CHAPTER 1

### **Introduction**

#### Background and Need

Autism spectrum disorder (ASD) is a rapidly growing developmental disorder that now affects 1 in 88 children (Centers for Disease Control and Prevention, 2012). It has long been characterized as a condition that affects one's communication and social skills. Recently it has been postulated that many children who have ASD will also experience some degree of sensory processing problems (Case-Smith & Arbesman, 2008; Lane & Schaaf, 2010; Reynolds, Bendixen, Lawrence, & Lane, 2011; Schaaf & Miller, 2005; Tomchek & Dunn, 2007). Sensory integration is one's ability to register and take in all of the sensory information around his or her self (what they see, hear, smell, etc.), interpret that information and then use the information to respond to or interact with his or her environment. According to Miller, Anzalone, Lane, Cermak and Osten, the term "sensory integration" is used when discussing the theory developed by Dr. A. Jean Ayres in 1965. However, "sensory processing" is the term used to describe the disorder or intervention as it relates to sensory integration theory (2007). For the purposes of this study, the term "sensory processing" will be used. Sensory processing problems occur when there is a breakdown in this system; either the signals do not get interpreted or acted upon efficiently.

Wilbarger first used the term “sensory diet” to suggest that each person had a specified amount of stimulation he or she needs to receive each day to feel satisfied (Champagne & Stromberg, 2004). The idea of a sensory diet is that if one does not receive enough stimulation in a given period of time, he or she may become unresponsive to the environment. Conversely, if a person receives too much stimulation, he or she may become overwhelmed by the sensations experienced. Miller et. al. describe how the qualities of sensation can have differing effects as well. Their clinical reasoning model, known as STEP-SI model (an acronym for Sensation, Task, Environment, Predictability, Self-monitoring and Interaction) challenges therapists to look not only at the stimulation itself (touch for example), but to look at the “duration, intensity, frequency, complexity, and rhythmicity” of the stimuli (p. 438, 2002). Just like a nutritional diet is individualized to a person to maintain homeostasis, Wilbarger’s idea of a sensory diet states that the sensory needs of everyone is individually specific as well (Tomcheck & Dunn, 2007). An individual may experience problems when a mismatch occurs between his or her sensory needs and the quality of sensation that is received from the environment. Thus it is critical that unique sensory needs be identified and “fed” through participation in activities.

Sensory processing encompasses registration and internal processing of the input from the various sensory systems: auditory, tactile, visual, gustatory, olfactory, vestibular and proprioception. These sensory systems can and do work together for one’s interaction in daily routines in a variety of settings. Parham and

Mailloux state that when processing in a system(s) is array, then problems may be seen such as apraxia (a problem with the vestibular and proprioceptive and sometimes tactile systems), speech problems (problems with auditory and vestibular system) developmental delays in the form of hand-eye coordination (problems with vestibular, proprioceptive, tactile and visual systems) extreme aversions to food, sounds, touch, and problems participating in school (2010). People who do not display sensory processing problems either do not experience them or have developed coping strategies for dealing with the mismatch in the environment and their sensory needs. People who display sensory processing problems lack these coping mechanisms, making different types of sensation, such as the touch of clothes, the sound of an overhead fan, or the smell of someone's lunch in the next room, intolerable.

Dunn's model of sensory processing suggests that each person has a certain threshold that he or she needs to reach in order to register a stimulus (1997). If one does not achieve this threshold, he or she may passively act in accordance with the stimulation they receive or they may actively seek or avoid sensation to achieve his or her threshold (Dunn, 1997). This is seen often in children with ASD and in their resulting behavioral manifestations. Occupational therapists are well versed in offering an understanding of behaviors based upon sensory processing difficulties. By focusing on self-regulatory behaviors, occupational therapists can structure situations to foster child participation in various activities that meets the child's sensory needs. As a result, behavioral problems may decrease.

It is hypothesized that behavioral problems in children with ASD, such as self-stimulatory behaviors (hand-flapping, head banging etc.), or avoiding social situations, are attempts to control sensory input received by the child (Baker, Lane, Angley & Young 2008). These stereotypical patterns can severely limit a person's engagement in social or other meaningful occupations. Until recently, little research has explored the sensory needs of those who have ASD. Furthermore, an even smaller amount of research has been performed regarding how different activities can fulfill sensory needs of this population. This case study is designed to understand more about how a child with ASD, who also has sensory processing problems, chooses to engage in activities. Furthermore, this study will look at the preferred activity choices to see if they are supportive of the child's sensory needs.

### Problem Statement

Autism spectrum disorder is a developmental disorder that is quickly growing in prevalence; it now affects an estimated 1 in 88 children (Centers for Disease Control and Prevention, 2012). It is estimated that up to 95% of those with ASD experience sensory processing problems (Case-Smith & Arbesman, 2008; Lane & Schaaf, 2010; Reynolds, et. al., 2011; Schaaf & Miller, 2005; Tomchek & Dunn, 2007). Children with ASD and sensory processing disorder often experience behavioral problems that limit their engagement in various activities. This is probably due to not receiving the proper amount of stimulation to meet their

sensory needs. If children with ASD and sensory processing disorder engage in activities that are conducive to their sensory processing patterns, they may experience less behavioral problems and more engagement in occupations.

### Statement of Purpose

The purpose of this study is to add to the current body of knowledge regarding children with ASD and their choice of typical childhood activities. This study takes builds on the work of Mische-Lawson (2006) to the next level by applying Mische-Lawson's findings to a case study of a child with ASD.

### Research Questions

1. Does a child with autism spectrum disorder participate in activities that support his/her sensory processing needs for engagement in occupation?
2. How may parents' preconceived notions about their child's sensory needs impact the child's ability to participate in activities?
3. How can data from *The Sensory Profile* of a child with ASD help one to understand the child's preferences and participation in childhood activities?



## Definitions of Terms

Activity- “the execution of a task or action by an individual. A set of tasks with a specific end point or outcome that is greater than that of any constituent task”  
(Polatajko, et. al., 2004 and Zimmerman, et. al., 2006 as quoted in Jacobs, 2009, p. 4)

Autism Spectrum Disorder- “a developmental disorder characterized by a severely reduced ability to communicate and emotionally relate to other people” (Jacobs & Jacobs, 2009, p.20).

Communication and social skills- “Actions or behaviors a person uses to communicate and interact with others in an interactive environment” (Fisher, 2006 as quoted in American Occupational Therapy Association, 2008, p.641)

Context- “refers to a variety of interrelated conditions that are within and surrounding the client... [such as] cultural, personal, temporal and virtual.”  
(American Occupational Therapy Association, 2008, p.642)

Occupation- "A specific individual's personally constructed, nonrepeatable experience. That is, an occupation is a subjective event in perceived temporal, spatial and socio-cultural conditions that are unique to that one-time occurrence" (Pierce, 2001, p. 139)

Quality of Life- "A client's dynamic appraisal of life satisfactions (perceptions of progress toward identified goals), self-concept (the composite of beliefs and feelings about themselves), health and functioning (including health status, self-care capabilities) and socioeconomic factors (e.g., vocation, education, income)" (adapted from Radomski, 1995; Zhan, 1992, as quoted in American Occupational Therapy Association, 2008, p.674)

Self Regulation/Modulation- "the ability to modulate the intensity, frequency, and duration of verbal and motor acts in social and educational settings" (Post, Boyer & Brett, 2006, p. 5)

Sensory Integration- "Ability of the central nervous system to process sensory information to make an adaptive response to the environment; also refers to therapeutic intervention, which uses strong kinesthetic and proprioceptive stimulation to attempt to better organize the central nervous system" (Jacobs & Jacobs, 2009, p. 229)

Sensory Processing- “a term that refers to the way the nervous system receives sensory messages and turns them into responses” (Dunn, 2006, p. 4)

Sensory Processing Disorder-“exists when sensory signals don’t get organized into appropriate responses and a child’s daily routines and activities are disrupted as a result” (Dunn, 2006, p.5)

Social Participation- “Organized patterns of behavior that are characteristic and expected of an individual in a given position within a social system” (Mosey, as quoted in American Occupational Therapy Association, 2008, p. 675)

## CHAPTER 2

### **Literature Review**

#### Introduction

Autism spectrum disorder, most commonly referred to as autism, is a pervasive developmental disorder that is marked by a range of impairments with social skills, communication, and marked patterns of behavior or interests. This combination of deficits often leads to difficulty participating in activities that occur in community settings such as at school, work, or even at home (Case-Smith & Arbesman, 2008; Rogers, 2010). ASD has seen a reported steady increase in prevalence since its inception as a separate condition in 1943, and is now one of the most common types of developmental disability (Falvo, 2009). Currently it is thought to be a disorder that results from a disruption to the neurobiology or neurochemistry of the brain and is thought to have a combination of genetic as well as environmental links (Falvo, 2009). ASD is often co-morbid with other conditions such as depression, anxiety or ADHD (Rogers, 2010). Generally, intervention for ASD focuses on increasing social skills, improving language abilities, decreasing behavioral problems and addressing sensory processing problems (Case-Smith & Arbesman, 2008).

This chapter provides information compiled during a comprehensive literature review that was conducted using different resources and methodologies.

Databases such as EBSCOhost and Google Scholar were utilized to perform a broad search. Several resources were used to retrieve research articles relevant to autism spectrum disorder and sensory integration disorder including the following sites: The American Journal of Occupational Therapy, The Journal of Applied Research in Intellectual Disabilities, Infants and Young Children, and the Journal of Autism and Developmental Disorders.

Many search terms were utilized and consisted of combinations of words and concepts related to autism spectrum disorder and sensory processing disorder. Several search terms were used for a general search including: autism, autism spectrum disorder, activity choice, sensory processing disorder, play, sensory integration, sensory modulation, occupational therapy, sensory profile and sensory diet. The author remained focused on literature that was relevant to occupational therapy. Over one hundred articles were screened and evaluated for relevance before being incorporated in the review. Textbooks were also included in the written literature review. Research articles of recent publication that contained information about ASD, sensory processing disorder, activity choice, and sensory profile were also included. Although this review was a holistic effort to look at sensory processing and autism, the information in the literature review below is focused on how children with autism and sensory processing problems may gravitate to certain activities that are supportive of their sensory needs.

## Sensory Processing Disorder: A Brief History

Sensory integration theory, developed by A. Jean Ayres beginning in 1965, explains how problems with interpreting and integrating sensory information from the environment can affect one's behavior and ability to learn (Ayres, A. J., 1965, Mische-Lawson, 2006; Schaaf & Miller, 2005). A person continually monitors stimulation from the environment (usually unconsciously) through the central nervous system. People typically habituate to familiar stimuli (the feeling of a shirt after it's been put on, for example) and will only notice any new or important sensation (Mische-Lawson, 2006). Sensory integration is described as "the organization of sensation for use" (Ayres, A. J., p. 5, 1979). Ayres' sensory integration theory has since been validated in many studies, as evidenced by a meta-analysis completed by Lane and Schaaf regarding the evidence for sensory-based neuroplasticity (2010). Ayres' seminal work has been further refined and continued through the works of protégés like Dunn and Miller who are explored in this section.

Sensory processing disorder is the current term used when a person is unable to correctly integrate or habituate sensory information from the environment (Miller et. al., 2009). For example, if a person (who does not have sensory processing problems) puts on a shirt that has a tag sticking out, he or she will receive that sensory input of the feeling of the tag on their skin. That sensory information will travel to his or her brain where it will be interpreted. The person will decide (perhaps after reaching for it to verify that it is not something else, perhaps a bug), that it is the tag on their shirt and it is unimportant information.

The tag continues to touch the person's skin and sends the sensory signals to the brain, but because the person has decided that it is unimportant information, her or she will no longer be consciously aware of that stimulation. However, for people who have sensory processing disorder, this may not be the case. The person with sensory processing disorder feels the tag on their back, and, like the other person, he or she may decide that it is the tag on their shirt and is not important information. However, due to abnormal brain signaling, they are unable to "shut off" the feeling of the tag on their skin and so, they are forced to complete their daily routine with the distraction of a tag rubbing on their back all day.

In addition to people having trouble "turning off," or habituating, the information coming into their brain, people with sensory processing disorder may also interpret a stimuli to occur at a different magnitude than someone who does not have sensory processing problems. For example, when a person is in a room with fluorescent lighting, he or she is often unaware of any slight flickering that may occur with the lights. However, for someone who has sensory processing disorder, the flicker of lights may be almost as distracting as if they were standing under a strobe light. It is easy to see from this example, how one may have difficulty then completing tasks, such as schoolwork, under these conditions.

Problems with processing incoming sensory information can occur across all senses, and without any other known cause (Baker et. al, 2008). In addition to the five typical senses that one thinks of (taste, touch, vision, auditory and smell), sensory processing problems can occur in a person's vestibular and proprioceptive

systems. The vestibular system is responsible for giving the brain information about where the body is in space; it provides information about where gravity is pulling the person, whether one is moving or not, and in which direction one is moving (Yack, Aquilla, & Sutton, 2002). A properly working vestibular system provides the foundation for the rest of the sensory systems. The proprioceptive system gives the brain information regarding the “position of... body parts, their relation to each other, and their relation to other people and objects” (Yack, et. al., 2002, p. 48). The proprioceptive system receives information through the muscle spindle fibers and connective tissues and helps one to determine, for example, how much force he or she needs to pick up a heavy box, or how to bring a finger that has a contact lens on it directly to the eye. The proprioceptive system is also a foundational system that is necessary for proper sensory processing; it serves as an integrative function to assist with overall sensory processing (Yack, et. al., 2002).

Dr. Ayres’ model provides a hierarchy of skills and how they relate to proper sensory system development. For example, the auditory system as well as the vestibular system are needed to work properly for a person to develop proper speech and language use. Likewise, for hand-eye coordination, proper development of the vestibular, proprioceptive, tactile, and visual system is needed (Ayres, 1979). Sensory integration theory states that proper integration of sensory information must occur in order for the person to participate fully in daily life (Baker et. al, 2008; Schaaf & Miller, 2005). The goal in occupational therapy for sensory processing problems is to help the child to modulate behavior in response to incoming sensory



input across any defective sensory systems. Occupational therapy intervention that teaches modulation of behavior in response to sensory input has demonstrated to be effective for children (Ayres & Tickle, 1980; Schaaf, & Nightlinger, 2007). By learning to self-modulate behavior, one will display more adaptive responses and will be able to participate in more occupations (Case-Smith & Arbesman, 2008).

Miller and colleagues further refined occupational therapy's understanding of sensory processing by their development of a clinical reasoning model called the STEP-SI model (Miller, Wilbarger, Stackhouse, & Trunnel, 2002). The STEP-SI model is an organizational tool that identifies the breadth and depth of dimensions involved in a sensory experience (Miller et. al., 2002). STEP-SI is an acronym for the components that the therapist considers in observations of individuals engaging in an occupation: Sensation, Task, Environment, Predictability, Self-monitoring and Interaction. This model has demonstrated effectiveness as a reasoning model for both assessment and intervention of sensory processing disorder (Miller et. al., 2002). Use of the STEP-SI model can allow an Occupational Therapist to understand the qualities of sensation that a child needs in order to have his or her sensory needs fulfilled. It also encourages the therapist to examine the context in which activities occur to determine their effects on occupational performance. In its entirety, the STEP-SI model examines all of the factors that comprise a sensory experience beyond just the sensory system and related qualities of the sensation. This will be further discussed in Chapter 5; Implications for Occupational Therapy.

Wilbarger, another contributor in the field of sensory processing, first used the term “sensory diet” in 1984 to describe preferred levels of stimulation that each person has (Champagne & Stromberg, 2004). Her work suggests that everyone has a sensory diet, similar to Dunn’s model of Sensory Processing, which he or she needs to meet daily in order to feel satisfied. Problems occur when the external context does not meet the internal characteristics, or sensory needs, of a person (Tomcheck & Dunn, 2007). If someone does not receive enough stimulation, her or she may become bored and restless; if they receive too much stimulation, they may become overwhelmed. Schaaf et. al. discovered that, in children who have sensory modulation disorder, disruptive behaviors may cause difficulty participating in social contexts, communicating and performing daily living skills (2010). May-Benson and Koomar found that by addressing sensory processing problems using a sensory approach, motor skills, social functioning, regulation of behavior and attention improved (2010). This is important when considering children who have ASD, which will be discussed in chapter 5.

Sensory integrative dysfunction has been divided further into different categories. These categories include sensory modulation disorder, sensory-based motor disorder and sensory discrimination disorder (Miller et. al., 2007; Miller et. al. 2009). Sensory modulation disorder is the most common type of sensory integrative dysfunction. Dunn’s new model of sensory processing focuses on how one is able to modulate their behavior according to incoming sensory information.

Dunn's model of sensory processing in 1997 further developed Ayres' idea of sensory modulation. She developed a quadrant that demonstrated the neurological level needed to perceive a stimulus (low- sensitive to high-habituated) and the behavioral response to a stimulus (passively responds or actively responds) (Dunn, 1997 SEE APPENDIX B). It is important to note, however, that responses to sensory input may fluctuate within the same individual (Baker et. al, 2008). Mische-Lawson describes it well in her dissertation when she states that:

A child with a high neurological threshold who responds passively to those thresholds experiences *low registration*. A child with a high neurological threshold who responds actively falls in the quadrant *sensation seeking*. A child with a low neurological threshold and passive responding strategies experiences *sensory sensitivity*; whereas children with a low neurological threshold and active responding strategies are described as *sensation avoiding* (2006, p.10).

One way to understand the sensory processing needs, or sensory diet, of an individual is to administer *The Sensory Profile* (Dunn, 1999). *The Sensory Profile* is an assessment tool developed by Dunn in 1999 to determine the responses that an individual has to common sensory input. The measure is a questionnaire that is completed by a caregiver by using a Likert-scale on 125 items to determine how frequently a child responds to certain sensory input (Dunn, Myles & Orr, 2002). In addition to providing information about the sensory processing patterns of an individual, *The Sensory Profile* can be used to measure the degree to which a person

has difficulty with their level or responsiveness, sensory processing or modulating problems and behavioral or emotional responses (Dunn, et. al., 2002).

Additionally, use of *The Sensory Profile* can allow a therapist to pinpoint a particular system with which the child has sensory processing problems (auditory vs. tactile, etc.) and allows them to better direct intervention (Ermer & Dunn, 1998). *The Sensory Profile* (1999) has undergone a factor analysis and sections of questions have even been pinpointed to be able to separate a person with ASD or other pervasive developmental disability, or ADHD from a child without disabilities (Ermer & Dunn, 1998).

#### Sensory Processing Disorder and ASD--Behavioral Considerations:

As stated above, it is estimated that most children with ASD also experience some degree of sensory processing problems (Case-Smith & Arbesman, 2008; Schaaf & Miller, 2005; Tomchek & Dunn, 2007). Children with ASD have much higher rates of sensory processing problems compared to a neuro-typically developing population (Schaaf, et. al., 2010; Tomcheck & Dunn, 2007). In children with sensory processing disorder, complications occur in a variety of contexts such as participating at school, social participation, and completing ADL's and IADL's (Arbesman & Liberman, 2010).

In children with ASD, sensory processing problems have also been linked to behavioral problems (Baker et. al, 2008; Case-Smith & Arbesman, 2008; Tomcheck

& Dunn, 2007). Children with ASD typically display an exaggerated pursuing or an excessive avoidance of certain sensory input (Ermer & Dunn, 1998; Schaaf & Miller, 2005). Examples of exaggerated pursuing may include an obsession with smells, objects or sights. Conversely excessive avoidance can be seen as fear or avoidance of any situations that may be noisy or in which touching or movement may be involved, for example (Schaaf & Miller, 2005). This seeking or avoiding behavior can become very disruptive to a child and a family's life.

One theory behind stereotyped patterns that children with ASD display (hand flapping, head banging etc.), is that it is related to difficulty in processing sensory information. By performing those behaviors, the child is attempting to regulate the amount of stimulation he or she is receiving from the environment (Baker et. al, 2008). It is important, that when children with ASD display these problematic behaviors, caregivers and therapists work together to try to determine the basis or the trigger of the behavior (Case-Smith & Arbesman, 2008). By attending to the root cause of the sensory problem, rather than just trying to stop a behavior, the child will experience more adaptive responses , thus building the complexity of responses and generalizing across environments.

It has been discussed that one of the reasons that people with ASD have difficulty forming social relationships and functioning in everyday environments is because of the underlying sensory processing problems and the behaviors that may result (Case-Smith & Arbesman, 2008; Reynolds, Bendixen, Lawrence and Lane, 2011). In their systematic review on occupational therapy and sensory processing,

Polatajko and Cantin found that occupational therapy is an effective approach for treating children who have difficulty performing daily activities due to sensory processing problems (2010). Linderman and Stewart demonstrated that, in children with pervasive developmental disorders (such as ASD), sensory integration therapy improved social skills, participation in activities, and adaptive responses to sensory input. Linderman and Stewart also demonstrated that children with developmental disorders had less problematic behaviors and an increase in functional behaviors such as attentiveness after receiving sensory integration therapy (1999). Roberts, King-Thomas and Boccia (2007) also demonstrated that by improving self-modulation of behavior in response to sensory stimuli, a child displayed less behavioral problems and more occupational engagement. Likewise, in their systematic review on sensory integration therapy, May-Benson and Koomar determined that sensory integration therapy was effective at improving socialization and regulating behavior (2010).

Occupational therapists have already developed general ways to modulate the environment so as to diminish or even prevent behavioral problems in children with ASD. By changing the environment or context to support the child's sensory needs, the child will have to do less modulating of behavior, and will be able to participate more with the environment and with peers. Examples include providing consistent structure and routines, teaching ways to communicate effectively and providing experiences that will optimize a child's participation (Case-Smith & Arbesman, 2008) such as providing activities that will support the child's sensory

needs. Additionally, current interventions for sensory processing disorder aim to reduce maladaptive or self-stimulating behaviors by providing therapeutic touch. This can improve focus and attention of a child, thus helping the child to modulate their behavior in response to sensory input (Case-Smith & Arbesman, 2008). Examples of these interventions include the Wilbarger brushing protocol or using deep pressure touch through a weighted vest or belt. Donohue (2011) also cites the use of the Alert Program (Williams & Shellenberger, 1994) or the use of the Exploring Feelings Program (Attwood, 2004) to help with self-regulation in a child ASD.

The idea of self-modulation proposes that an individual needs to find and choose activities or experiences which can help calm, reorient, alert or help him or her to focus when he or she is met with unwelcomed sensory stimulation (Champagne & Stromberg, 2004). In a study completed by Reinhartstein, it was found that by allowing the child with ASD to choose an activity, problem behaviors decreased and encouraged behaviors, such as classroom participation or engagement, increased (2002). Donohue states in her chapter that difficulty with self-regulation can lead to inappropriate social skills, which is one key manifestation of ASD (2011). So, if children with ASD are able to compensate for their sensory processing problems by engaging in certain activities or environments that fulfill their sensory needs, they may experience less behavioral problems, be able to participate more with others and experience a higher quality of life.

### Sensory Processing Patterns and Activity Choice:

Until recently, little research has been conducted on the effects of different sensory processing patterns on activity preferences in children. In 2006, Mische-Lawson completed her research on “The Relationship Between Sensory Processing Patterns and Play Preferences of Young Children.” Mische-Lawson’s research investigated the relationship between sensory processing patterns and play preferences in children. She utilized the Sensory Profile and structured observations to collect data. The study revealed that there were significant differences between toy categories and sensory processing patterns, and that children with certain sensory processing patterns preferred to play with certain toys (2006; Welters-Davis & Mische-Lawson, 2011). A study by Bundy, Shia, Qi and Miller (2007) found that in general, children with sensory processing disorder participated in sedentary activities, and rarely participated in play that required imagination such as pretend play.

It has long been considered that play is the primary occupation of children. Play helps children to develop. When play becomes restricted, due to sensory processing difficulties or other problems, the child’s development becomes restricted. This is what has been demonstrated in children with ASD. Therefore it is vital to understand the sensory processing patterns of the child and to try to promote activities that are conducive to the child’s sensory processing needs.



Additionally, studies have shown that if there is a mismatch between the parent's sensory processing patterns and the child's sensory processing patterns, the child may become limited in activity choice because the activities that the parent presents the child with may not be conducive to the child's sensory needs (Welters-Davis & Mische-Lawson, 2011). Welters-Davis and Mische-Lawson further stated that typically, the adult is the one in charge of choosing activities when playing with a child. Thus, if there is a mismatch in sensory preferences and the child is unable to verbalize what they want to do, the child may not be able to engage in activities that support his or her sensory needs. The parent may be left unable to understand why an activity that they think is fun, is not fun for their child, and thus the child may have to resort in other behaviors to get their sensory needs met (Welters-Davis & Mische-Lawson 2011). This information could be very useful in therapy in order to help the child feel satisfied by participating in activities that fulfill his or her sensory needs. This will also be addressed in more detail in the discussion section.

### Summary

It has been demonstrated that most children who have ASD also experience sensory processing problems. Sensory integration theory was first developed by Ayres in 1965 to describe how a person detects, understands, and then uses sensory information from the environment. People who have sensory processing problems experience a breakdown in this system. Children who have ASD likely experience

behavioral problems due to sensory processing problems, which can limit their participation in occupations.

If children can learn to self-modulate their behavior when there is a mismatch between their sensory needs and the environment, they are less likely to experience behavioral problems. This may lead to an increased participation in occupations and an increase in social skills. The sensory needs of a child may be fulfilled through participation in various activities, thus helping the child to modulate their behavior. It is important to allow a child who has ASD and sensory processing problems to find and participate in activities that will support their sensory needs so they can participate meaningfully in occupations and have a higher quality of life.

## CHAPTER 3

### **Methodology**

#### Research Design

The purpose of this study was to explore and describe the activity patterns and sensory preferences in a child who has ASD. A mixed-methods case study, that yields both quantitative and qualitative data, was used to collect data. Two assessments, *The Sensory Profile* (Dunn, 1999) and *The CAPE/PAC* (Children's Assessment of Participation and Enjoyment-Preferences for Activities of Children) (King, et. al., 2004) were administered to collect information from a child who was referred from the Psychology Clinic on Eastern Kentucky University's campus. The two assessments were administered to understand the sensory processing patterns of the child (*Sensory Profile*) and to understand the child's activity and play preferences (*CAPE/PAC*). The assessments were analyzed and compared with existing literature to determine if the child participates in activities that are conducive to his or her sensory needs.

A mixed-methods case study was chosen as the design in order to promote a more in-depth understanding of the experience of one child with ASD. A case study was deemed the most appropriate way to answer the following research questions:

1. Does a child with autism spectrum disorder participate in activities that support his/her sensory processing needs for engagement in occupation?
2. How may parents' preconceived notions about their child's sensory needs impact the child's ability to participate in activities?
3. How can data from *The Sensory Profile* of a child with ASD help one to understand the child's preferences and participation in childhood activities?

A full review application was submitted and approved by the Institutional Review Board (IRB) at Eastern Kentucky University in February 2012.

### Measurement

The research material was obtained from observations, unstructured interview and data produced by the administration of two standardized tools: *The Sensory Profile* and *The CAPE/PAC*, which were analyzed for this study. Both tools are self-report measures. The researcher was available for questions during the completion of the tools.

*The Sensory Profile* is an instrument used in a variety of settings and populations to determine a person's sensory needs. This assessment, which is completed by the caregiver, consists of 125 questions that are answered by a Likert-scale and takes around 30 minutes to complete (Dunn, Myles & Orr, 2002). Scores can be broken down into Dunn's four quadrants: registration, seeking, sensitivity, or

avoiding. The scores can further be broken down into a more detailed factor analysis: Sensory seeking, emotionally reactive, low endurance/tone, oral sensory sensitivity, inattention/distractibility, poor registration, sensory sensitivity, sedentary and fine motor/perceptual. The score range varies in each category. Each scoring measure was utilized for analysis in this study. *The Sensory Profile* was tested on over 1,200 children across the country with a variety of conditions (Dunn, 2008). It has demonstrated internal consistency, content validity, convergent and discriminant validity (Dunn, 2008). Therefore, *The Sensory Profile* has been deemed a reliable and valid measure in Occupational Therapy.

The assessment used to determine the activity preferences of the subject was, the Children's Assessment of Participation and Enjoyment (*CAPE*) and the Preferences of Activities of Children (*PAC*). *The CAPE/PAC* is comprised of two separate assessments that are almost always administered together, and the assessments themselves are packaged in the same booklet. The *CAPE* looks at what activities the child has done in the past 4 months, how often the child did those activities, how much the child liked those activities, who he completed the activities with, and where he or she completed the activities. The *PAC* asks the child to state how much he or she would like to do a given activity if they were given the opportunity. Answers are given in a smiley face scale that represents "I would not like to do at all," "I would sort of like to do" or "I would really like to do."

The scores of the *CAPE* can be further organized by domain and activity type by using the supplemental summary score sheets found in the *CAPE/PAC* manual

(King, et. al. 2004). The two domains include formal and informal activities. The activity types are qualified as recreational activities, physical activities, social activities, skill-based activities, and self-improvement activities. Examples of activity types as categorized by the *CAPE/PAC* are as follows: Recreational—watching TV, collecting things, doing crafts; Physical—Doing team sports, playing games, doing water sports; Social—Talking on the phone, visiting, going to the movies; Skill-based activities—Horseback riding, taking art lessons, dancing; Self-improvement activities—reading, doing volunteer work, or doing chores. The child's preference for activities (*PAC*) scores can also be further broken down into the same domains and activity types that the *CAPE* scores were. These classifications of *CAPE/PAC* scores were used to help further analyze the results of the assessments. Reliability and validity of the *CAPE/PAC* was established via a longitudinal study that was tested on 427 children who had physical disabilities (King et al. 2004). The *CAPE/PAC* was found to demonstrate test-retest reliability, and construct and content validity as well as internal consistency (King et. al., 2004).

### Additional Observations

The researcher observed the child during 6 group sessions in the autism children's group at the Psychology Clinic at Eastern Kentucky University. Field notes were kept during the sessions and were analyzed for data.

## Subject

The subject in this case was referred by the Psychology Clinic at Eastern Kentucky University (Richmond, KY) in the spring of 2012. Inclusion criteria included that the subject had to be between 7-12 years of age, of either gender, and could be from diverse racial or ethnic backgrounds. The child and caregiver also had to be able to respond to the assessments that were used. Exclusion criterion included that the child could not have any other known physical limitations. A male, aged 7.6 at the time of data collection, was chosen for this study. His formal diagnosis is ASD, which is why he was participating in the Psychology Clinic's group.

## Theoretical Approach

Sensory integration theory was the main theory utilized for this study. Sensory integration, as defined by A. Jean Ayres in 1972, is known as "the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment" (p. 11). Thus, it is processing and then using, or responding to, the information that we receive from the environment in an organized and appropriate way.

Dr. Ayres' theory examines the relationship between what the brain processes and how a person responds behaviorally. Her theory is called sensory integration, but in practice, as a diagnosis, it has been called sensory processing or

sensory processing disorder (this is why the titles are often used synonymously). According to Miller et. al. (2007) sensory integrative dysfunction is broken down into three distinct categories: Sensory Modulation Disorder, Sensory Discrimination Disorder, and Sensory-Based Motor Disorder. For the purposes of this study the researcher was focused on what may be the most prominent form of the disorder; sensory modulation disorder. Sensory modulation disorder is further sub divided into three categories: sensory over-responsiveness, sensory under-responsiveness and sensory seeking/craving. This view of sensory processing disorder is similar to Dunn's model of sensory processing. Further, the STEP-SI clinical reasoning model produced by Miller et. al. (2002), was used to help interpret a more discrete analysis of the case. The STEP-SI clinical reasoning model examines all of the factors that contribute to a sensory experience, thus examining more than the sensation itself. The STEP-SI model was used as an a priori coding mechanism when examining the data.

### Data Collection

After the subject and the caregiver agreed to participate in the study, a date was established for assessment. On the assessment date, the investigator, the subject and the caregiver of the subject met in the Psychology Building on Eastern Kentucky University's campus. This spot was chosen because it was a familiar place for both the subject and the caregiver. One of the conference rooms in the building



was chosen for privacy. After entering the conference room, the researcher explained to the subject and caregiver the purpose of the study again and what the investigator was going to do in the session. The researcher gave the subject and his caregiver time to ask any questions and also stated that they could dismiss themselves from the study at any point should they choose to do so. The consent and assent forms were then provided to the subject and the caregiver as well as read aloud by the researcher. The consent and assent forms were signed and the researcher began administering the assessments. Initials only were used throughout the process to ensure confidentiality.

The caregiver, the subject's mother, completed *The Sensory Profile*. The researcher was present in the room while the caregiver completed the items in case the caregiver had any questions. The researcher took notes of the child's behavior and the caregiver's comments during the assessment process. While the caregiver completed *The Sensory Profile*, the researcher administered the *CAPE/PAC* to the child in the same room although at a distance from the caregiver. The caregiver gave the child some of his favorite food to eat while he completed the *CAPE/PAC* to promote attention and cooperation. After the child finished eating he was provided with a variety of fidget toys and Play-Doh® to play with while he answered the questions. Between the *CAPE* and the *PAC*, the researcher gave the subject a short break to get up, walk around, use the restroom and get a drink.

Both assessments were completed in full according to proper administration guidelines.

## Demographics

The subject is a 7.6-year-old male who attended the ECU Psychology Clinic group for children with ASD. He participated in 6 out of the 7 sessions. The subject lives with his parents and 3 older brothers. He is in the 2nd grade at a public elementary school. He is currently receiving occupational therapy, speech therapy and a combination of special education and regular education courses. The subject is not involved in any organized sports or activities in the community or at school with the exception of the ASD group.

## Data Analysis

After the data was collected it was analyzed using the supplemental score sheets provided with the assessment tools. The summary score sheet as well as the supplemental summary score sheets were utilized to gather information for *The Sensory Profile* assessment. For the *CAPE/PAC*, the summary score sheet was utilized. The domain and activity type score sheets were used for both the *CAPE* and the *PAC*. Both domain score sheets and the activity-type score sheets were provided as an appendix in the *CAPE/PAC* administration manual (King et. al., 2004). To help with analysis, the investigator created and compiled the information for both assessments into a synthesis table. The assessments and newly created tables with scores were analyzed to come up with conclusions provided in the discussion. An example of the synthesis chart is provided in Appendix A. TABLE 1 below

demonstrates the sources and types of data collected. The STEP-SI model of clinical reasoning (Miller, et al, 2003) was used as an a priori coding mechanism. TABLE 2 demonstrates the a priori coding used.

TABLE 1: Data Analysis Source Chart

<u>Data Collection</u>	<u>Type</u>	<u>Source</u>	<u>Analysis</u>
Standardized	Sensory Profile	Parent	Quantitative
Standardized	CAPE/PAC	Child	Quantitative
Non-standardized	Informal Interview	Mother	Qualitative
Non-standardized	Informal observations	Researcher	Qualitative

TABLE 2: A priori Coding Using the STEP-SI Model

	Sensory Profile	CAPE	PAC	Informal Interview	Researcher Obs.
Sensation	x			X	X
Modalities/Qualities (system and frequency, duration, intensity, rhythmicity, and complexity)		Inferred by analysis	Inferred by analysis		X
Task (activity)	x	X	X	X	X
Environment (where)	x	X		X	X
Predictability					X
Self-Monitoring					X
Interaction		X		X	X

## Trustworthiness

Trustworthiness was established through the use of objective data received from the assessments administered. Data was visually inspected, organized and reviewed for patterns noted in sensory processing types. Observations/field notes were reviewed and coded for content analysis. Triangulation of observations and assessments allowed for strengthened interpretations of the collected data.

## CHAPTER 4

### **Results**

#### Introduction

The results of this study will be presented in this chapter. The first results to be presented will be the quantitative results from *The Sensory Profile* that was administered and completed by the caregiver. The results will be given in reference to the norms provided by the summary score sheets. Next, the results from the *CAPE/PAC* will be presented. Then the qualitative findings including observations of the client while he participated in a children's group and the informal interview of his mother will also be presented to support the assessment findings. The final chapter will discuss how an occupational therapist may then utilize these results to promote outcomes for a child who has ASD and sensory processing problems.

Quantitative Findings:

*The Sensory Profile*

The results of *The Sensory Profile* performed on the subject are found in TABLE 3:

TABLE 3: Sensory Profile Overall Results

	Similar to Others	Probable Difference Compared to Others	Definite Difference Compared to Others
Registration of Sensory Information		X	
Seeking of Sensory information			X
Sensitivity to Sensory Information			X
Avoiding Sensory Behaviors	X		

The four categories above make up Dunn's sensory processing model (See Appendix B). A supplemental score sheet allows the researcher to gather more data regarding specific areas of *The Sensory Profile*. The results for the factor summary are found in TABLE 4:

TABLE 4: Sensory Profile Factor Summary Results

	Typical Range	Probable Difference Compared to Others	Definite Difference Compared to Others
Low Endurance/Tone	X		
Sensory Sensitivity	X		
Sedentary	X		
Fine motor/Perceptual	X		
Emotionally Reactive		X	
Poor registration		X	
Sensory Seeking			X
Oral Sensory Sensitivity			X
Inattention or Distractibility			X

All of the findings reported above are analogous to what was observed during the testing session. The subject was easily distracted and his name had to be repeated several times to get his attention. Even the choice of food he ate while during the session (chicken nuggets and french-fries) was something his mother commented on saying that that was all he ever wanted to eat. Likewise, the subject did not seem to have any endurance or tone issues, was not sedentary throughout the testing procedures and did not have any perceived fine motor coordination problems. The section summary for *The Sensory Profile* is reported in TABLE 5:

TABLE 5: Sensory Profile Section Summary Results

	Typical Range	Probable Difference Compared to Others	Definite Difference Compared to Others
Visual Processing	X		
Vestibular Processing	X		
Touch Processing	X		
Sensory Processing Related to Endurance/Tone	X		
Modulation Related to body Position and Movement	X		
Modulation of Movement Affecting Activity Level	X		
Emotional and Social Responses	X		
Modulation of Sensory input affecting Emotional Responses		X	
Modulation of Visual Input Affecting Emotional Responses and Activity Level		X	
Auditory Processing			X
Multisensory Processing			X
Oral Sensory Processing			X
Behavioral outcomes of Sensory Processing			X



All of the above results are also comparable to what was observed of the subject either during the testing session or during the client's participation in a children's group for kids with ASD that took place on Eastern Kentucky University's campus.

*Children's Assessment of Participation and Enjoyment/Preferences of Activity Choice*

The results of the *CAPE/PAC* that was performed are found in TABLE 6:

TABLE 6: CAPE/PAC Results by Activity Type

<b>CAPE Activity Type Scores</b>	Recreation Activities	Physical Activities	Social Activities	Skill-based Activities	Self-Improv. Activities	<b>Overall Scores For CAPE</b>
<b>Diversity</b> 0- No 1- Yes	11/12 92%	3/13 23%	10/10 100%	4/10 40%	9/10 90%	Low-----X-----Hi 0                    37    55
<b>Intensity</b> 1- 1x in past 4 mos 2- 2x in past 4 mos 3- 1x/mo. 4- 2-3x/mo. 5- 1x/week 6- 2-3x/week 7- 1x/day+	5.34	1.46	3.2	2	4.9	Low-----X-----Hi 1                    3.3                7
<b>With Whom</b> 1- Alone 2- With family 3- With other relatives 4- With friends 5- With others	2.18	2.34	2.1	2.25	2.45	Low-----X-----Hi 1                    2.3                5
<b>Where</b> 1- Home 2- Relative's Home 3- In our neighborhood 4- At school 5- In your community 6- Beyond your community	2.73	2	2.7	2.25	3.34	Low-----X-----Hi 1                    2.8                6
<b>Enjoyment</b> 1- Not at all 2- Somewhat; Sort of 3- Pretty much 4- Very much 5- Love it	3.81	3.34	3.3	4.25	3.23	Low-----X-----Hi 1                    3.6                5
<b>PAC-Preference Scores</b> 1- I would not like to do at all 2- Would sort of like to do 3- Would really like to do	2.3	2	2.6	2.2	1.7	N/A

The *CAPE* identified that the subject participates in a widely diverse selection of activities. The mother reported that the subject in this case has three older brothers and that he engages in play behaviors with them in the home environment. This may account for the diversity of activities that the subject has participated in. The *CAPE* also revealed that the subject participated in a low-to-medium amount of activities throughout the week (the intensity of his participation in activities). The *CAPE* demonstrated that the subject preferred more solitary activities, which is typically common for many children who have ASD. The *CAPE* also revealed that the child did not participate in many physical activities at all. The *CAPE* did reveal that the subject had a medium-to-high overall enjoyment in his activities. This finding is interesting to note because some have concluded in the past that the reason children with ASD do not participate in activities is due to a lack of enjoyment, instead of taking sensory processing problems into account. This will be discussed further in Chapter 5.

The *PAC* revealed that there are many activities that the subject would “sort of like to do” or “really like to do,” demonstrating a desire to participate in a variety of activities (See TABLE 4). However, it is important to note that there are several activities, which the subject selected as “would really like to do” but according to the *CAPE* has not participated in within the four months prior to being tested. A large discrepancy was observed in the category of physical activities: this is the lowest category that the subject participated in but still showed an interest for those types of activities. Implications will be further discussed in the next chapter.

The sensory characteristics of the activities that the subject liked to do were compared with the results of his sensory needs to see if they were congruent. A table was created to assist with the analysis and synthesis of the data (See a sample in Appendix A). Some of the activities that the subject marked as “love it” were doing crafts, drawing or coloring, collecting things, playing computer or video games, visiting, swimming and horseback riding. The subject also stated that playing on playground equipment, going to the public library, watching TV or renting a movie, making food, going on a full day outing (such as to the zoo or an amusement park) were all “love it” activities.

When the individual domain scores were examined on the *CAPE/PAC* it showed that the subject preferred “formal” activities to “informal” activities. It is well known in the occupational therapy community that children with ASD prefer structure, and do better in environments that provide that structure (American Occupational Therapy Association, 2011). This is likely why the subject enjoys the formal activities compared to informal ones.

#### Qualitative Findings:

##### *Specific Observations in Context*

Structured observations were gathered through field notes as the child participated in the ECU Children’s ASD Group at the Psychology Clinic.

One observation made during the group was that whenever the subject spoke, he usually whispered. This demonstrated a clear aversion to loud noise. Every week the ASD group had a different theme with activities to correspond to that theme and one evening the theme was music. The subject was observed as becoming visually upset and overwhelmed in a station where every child was given a musical instrument to play with. The subject was removed from the station by the researcher and taken on a walk around the building to help him calm down. These two examples reflect the difference found in the subject's auditory processing abilities compared to neuro-typically developing children.

Another observation was that one evening the subject was observed as being restless. When it was time to go to the stations, the subject ran to the couch and asked to be "squished" as this was something he had gotten used to, being provided deep pressure with the couch cushions. After being under the couch cushions for several minutes, the subject appeared to be calmer and was encouraged to join the rest of his group at the stations. Several minutes later, the researcher observed the subject walking around the hall with another worker. When asked, the worker stated that the subject was getting frustrated and angry at the station and was getting ready to kick a different worker so he decided to take the subject for a walk. When the subject saw the couch he ran to it and got under the cushions and did not want to come out.

Knowing that this behavior was atypical, the researcher and other worker tried to determine alternative reasons for the behaviors that were observed. After

many different suggestions, the subject finally decided to come out from the couch cushions when going to a conference room and writing on the white board with markers was presented as an option. When he was writing on the marker board he started repeating the words “stupid kid.” When asked why he was saying that, the subject revealed to the researcher that someone had said that to him earlier in the day at school. This demonstrates that the subject may have difficulty with emotional reactivity and coping strategies, which can limit his participation in activities. Because of the subject’s behavior, he missed participating in the majority of the night’s activities. His scores on the Sensory Profile support these observations.

After sitting in the conference room writing on the whiteboard, the subject’s mother came in and was asking questions about his behavior during the evening. The subject then got under the table (which may demonstrate a desire for proprioceptive input), his mother told him to come out, that they do not hide under tables. The mother’s response suggested that this is a behavior that the subject sometimes does at home. Further it suggests that his mother does not allow this behavior, which could provide some comfort to the subject based upon his sensory needs. When the subject came out from under the table he started smacking the wall with strong force (also showing a desire for intense proprioceptive input). His mother also stated that he was not allowed to hit the wall. This demonstrated that the subject did not know how to modulate his behavior in a way that his mother found to be socially acceptable.

If there were activities that the subject knew he could do when he becomes upset that would provide the same intensity of sensation of smacking a wall, he would have more socially acceptable responses and still fulfill his sensory needs. Further, by participating in an activity that provides him with the sensory input he is seeking, he may be better able to return to participating in valued occupations instead of being pulled from them, like on the particular night that was described. This will be further discussed in the next chapter.

### Summary

The subject shows many differences on *The Sensory Profile* when compared with typically developing children. His sensory differences also presented themselves during observations while he participated in a children's group for ASD. It was important to note that at times, his sensory processing abilities interfered with his ability to participate in the group. It was observed that his mother set firm limits of what she deemed to be acceptable behaviors in social situations, not understanding potential sensory registration needs of the child.

When looking at the *CAPE/PAC* to see the types of activities that the subject currently participates in and would like to participate in, it is clear that he preferred more solitary and structured activities. This is expected as typical behavior of someone who has autism spectrum disorder. The subject enjoys activities that provide intensity in vestibular, proprioceptive and tactile feedback, and he avoids

activities that provide high auditory and gustatory feedback. This is supportive of *The Sensory Profile* scores received that showed defensiveness in those sensory systems.

The *CAPE* showed that the subject rarely engaged in activities in the community (such as joining a local boy scout group or sports team). The *CAPE* also demonstrated that the participant rarely participated in physical activities. The *PAC* showed that the subject has a desire to participate in some of those activities; this mismatch will be discussed further in Chapter 5.

*The Sensory Profile* also showed that the subject is emotionally reactive to sensory input and this was demonstrated in the observations. The results of *The Sensory Profile* were supported when triangulated with the observational data gathered during the children's ASD group.



## CHAPTER 5

### **Discussion and Implications**

#### Introduction

The following is a discussion of the results and the implications for practice. The research questions that were posed in Chapter 1 will be discussed in this section. In addition, limitations and implications for future research suggested by the results will be included.

Research Question 1- Does a child with autism spectrum disorder participate in activities that support his/her sensory processing needs for engagement in occupation?

To answer this question, the researcher compared the results of this study with peer-reviewed literature, to examine the relationship between activities that children participate in and sensory preferences. The STEP-SI model will also be used to analyze the quality of sensation received from various activities.

The results of *The Sensory Profile* demonstrated that the subject was sensation seeking in vestibular, tactile and proprioceptive processing but also had sensory sensitivity in the categories of oral sensory, auditory processing, and multisensory processing. *The Sensory Profile* also demonstrated that the subject had

difficulty with inattention/distractibility and struggled with the behavioral outcomes of his sensory processing abilities.

The *CAPE/PAC* demonstrated that the subject preferred solitary activities and formal activities. It is hypothesized that the subject enjoys these activities more because he struggles with auditory and multisensory processing, meaning he would have a difficulty in a very noisy environment or an environment where many different things were going on (e.g. lights flashing, noises, things touching him). Activities that are more solitary and that the subject indicated a strong preference for doing included: crafts, drawing or coloring, collecting things, playing with things or toys, and going to the movies. In looking at the data of the *CAPE* on those objects, all of those activities were ones that the subject had participated in with a high frequency within the past month, with the exceptions of collecting things (two times in the past four months) and going to the movies (one time in the past four months).

The subject enjoys activities that provide strong vestibular, proprioceptive and tactile feedback, which supports his processing patterns of sensation seeking. The subject avoids activities that provide a lot of auditory and gustatory feedback, which supports his processing patterns of sensory sensitivity. The subject enjoys swimming, horseback riding, dancing, snow sports and bicycling/skating due to the high intensity of sensory input that those activities can provide to a person. According to Kirkpatrick (2012), all of these activities provide tactile, vestibular and proprioceptive input to a person. Additionally, the swimming, horseback riding and bicycling activities are quieter in nature, thus his avoidance of auditory stimuli is

met. All of the activities can be solitary or parallel play without the threat of cooperative or interactive play. This corresponds to behavior that was observed during the children's autism spectrum disorder group.

The subject was observed many times enjoying the proprioceptive and tactile input that the couch cushions gave him when he was being "squished" by the researcher. Similarly, the subject was also observed on two occasions as retreating under a table when he became emotionally upset. The area under the table provided a smaller, quieter space that may be perceived as a haven for the subject when met with unwelcome sensory input. Both of these sensations appeared to help the child to self-regulate.

The subject is what Dunn called a "sensation seeker" and since the subject does not have problems with hyper-sensitivity or over-responsivity to touch or vestibular processing or proprioception, he is able to get his desired sensory input through participation in the activities listed above (swimming, horseback riding, dancing, snow sports and bicycling/skating). However, his mother stated that the subject is highly allergic to horses, which limits his ability to ride them. This is unfortunate because several studies have demonstrated improvements in sensory processing from horseback riding for children who have ASD (Bass, Duchowny, & Llabre, 2009; Gabriels, et. al. 2012; Memishevikj, & Hodzhikij, 2010). The subject participated in all of the activities listed above frequently, with the exception of horseback riding (because he is allergic) and snow sports (likely due to the fact that there was a lack of snow within the previous 4 months). These activities avoid one's

sense of taste and to a degree, one's sense of hearing, therefore these may be less threatening activities to the subject.

Dunn's model of sensory processing suggests that there is a sensory homeostasis, or set pattern each person has which makes the body content. Therefore, individuals are drawn to activities that help to reach that inner homeostasis. This idea supports why the subject engaged in these activities, in order to innately support his sensory needs. An understanding of the STEP-SI model further supports this position. Ayres hypothesized that individuals seek sensory information to support their learning needs (1979). By this engagement, individuals continue to develop more complex responses and further refine their outcome behaviors such as social participation, activity performance and learning. This process is challenged in individuals that have sensory modulation problems such as children who have ASD.

The subject was also determined to be avoidant of auditory stimuli. This was apparent during the ASD group. The subject had to be pulled out of the musical group because he was becoming visibly upset from the noise. The subject's avoidance of auditory stimuli was also observed in how the subject spoke, he almost always whispered even when in front of a larger group. By whispering, the subject was reducing the amount of sound he heard from his own voice. This may be due to his strong aversion to auditory stimuli and activities that have an auditory component.

Another observation was that the subject did not list many gross motor activities (sports, racing, etc.) as activities he either wanted to do or as activities that he had participated in within the last 4 months. Although no gross motor deficits were observed during the children's ASD group, gross motor and praxis problems may occur with children who have sensory processing disorder. Kirkpatrick stated in her article how important it is to know what the child's abilities are in motor coordination and praxis when looking at activity choice (2012). The subject may not participate in some of the gross motor activities due to praxis or coordination difficulties. The basis of praxis is proper functioning of the tactile, proprioceptive and vestibular systems (O'Brien & Williams, 2010). Thus, participating in gross motor activities may provide the sensory input the subject needs. The subject's lack of interest in participating in gross motor activities may limit his need for frequency and intensity of input to the tactile, proprioceptive and vestibular systems that would also help to develop his praxis skills.

When considering the results of the assessments and triangulating those results with the observations of the subject, it does appear that, for the most part, the subject participates in activities conducive to his sensory needs. This child rarely had emotional outbursts when observed within the group. This may be due to him receiving the sensory stimulation that he needs through various activities. It is important to note, however, that when the subject was faced with auditory stimuli he could not tolerate, he did experience problems with modulation. This likely would have led to behavioral problems if the subject had not been removed from

the situation by the investigator. This incident demonstrates a need for the subject to learn more about how to modulate his behavior or use other strategies such as removing himself from situations in which stimuli will occur that he will be unable to tolerate.

There were items on the *PAC* that demonstrated activities that the subject does not participate in but wishes he could, and this leads into the next research question.

Research Question 2- How may parents' preconceived notions about their child's sensory needs impact the child's ability to participate in activities?

It was revealed during this study that the subject had never participated in a team sport, had never participated in extracurricular enrichment (such as taking art classes or music lessons), and does not participate in any community activity besides religious ones. The child's engagement with peers is limited to school, the ASD that met briefly, and his three brothers. The subject revealed that he would like to do activities such as taking music lessons and dance lessons but has never done so before. The subject typically participates in activities that occur at home rather than in the community. This could be related to his sensory processing problems. His parents may prefer he do activities at home rather than in a community setting where something could cause him to have a tantrum or behave

in a socially unacceptable way. His auditory sensitivity could also contribute to his lack of participation in these areas.

The reason for his lack of participation in these types of activities was not given, however from the interactions the researcher had with the mother, they are implied. For a parent, it might be unnerving to try something new in public without knowing how the child is going to react. This is likely true of many parents who have children with ASD (DeGrace, 2004; Reynolds, Bendixen, Lawrence & Lane, 2011). A parent may be afraid, for example, that their child with ASD may throw a tantrum in the middle of a soccer game because he had to wait to go on to the field. Or, a parent may be afraid of rejection by the child's peers. Reynolds et. al. discusses how children with ASD "are not considered attractive playmates by other children" (p. 1503) because of their difficulties with social interaction (2011). As DeGrace states in her article, that for families of children who have ASD, their lives become centered around ASD. Families become more focused on trying to keep the child with ASD in a "manageable state," often neglecting trying new activities (2004). Parents are afraid of interrupting the status quo for their children with ASD, and likewise they are afraid of how other children will act or treat their child in a new situation.

Similarly, King et. al. stated that the amount of participation a child has in physical activities can be determined by the parents' perceptions of the physical abilities of their child (2005). This may be another reason a child with ASD may not be able to participate in physical activities. The child may experience praxis issues

and the parents may be afraid that the child would be unable to participate or may get made fun of by peers due to coordination issues.

As *The Sensory Profile* demonstrated, there are certain sensations that the subject seeks (proprioception, vestibular and tactile) and there are certain sensations he avoids (gustatory and auditory). Without the help of an assessment, his parents may not fully understand the sensory needs their child has related to frequency, duration, intensity and rhythm. While one situation can cause the subject to have a tantrum, another situation could be calming and alerting to the child. Even though the parents of a child with ASD may have a very negative experience with one type of community group, it doesn't mean that they will have the same negative experience in a different group.

If the parent were to find activities that support the sensory processing patterns of their child, their child may be able to participate more in the community or at school. For example, while an afternoon music group may not be very good for the subject because of his auditory defensiveness, joining a local swim team might. In addition to getting the sensory input that the subject craves, by joining a local swim team he will get the added benefit of increasing his gross motor skills and socializing with his teammates (Kirkpatrick, 2012). Participating on a team like this could also improve his overall self-confidence. This leads into the final research question.



Research Question 3- How can data from *The Sensory Profile* of a child with ASD help one to understand the child's preferences and participation in childhood activities?

As noted in the literature, data from *The Sensory Profile* on a child with ASD can serve several functions (Case-Smith & Arbesman, 2008; Champagne & Stromberg, 2004; Schaaf & Miller, 2005). First, it can aid a parent and therapist to understand why a child participates in certain behaviors or activities. If a child is sedentary (i.e. always wants to read books or participate in solitary activities) or becomes overwhelmed in busy environments, *The Sensory Profile* may reveal that the child is a sensation avoider. The occupational therapist can interpret the assessment and give parents an understanding of the child's choice in activities. Further *The Sensory Profile* data can help parents to support sensory needs through encouraging participation in various activities.

Second, it can help one to understand the basis of problematic behaviors. As stated above, ASD is a communication disorder. Rarely is a child with ASD able to clearly communicate their needs, so they do so with their behavior. For example, if a child likes to rock or bang his or her head, they could be trying to increase the frequency, intensity or duration of sensory input. *The Sensory Profile* may reveal that the child is a sensation seeker. Using the STEP-SI model allows an occupational therapist and parents to track frequency, intensity and duration of sensory input that the child gets through behaviors. They can then provide similar sensation to promote successful participation and engagement in activities (Miller et. al. 2002). To avoid problematic behavior, more sensory input may be provided to the person

throughout the day through foundational input to the proprioceptive system (i.e. through a weighted vest). Rhythm of activities within routines and the complexity of the activity are further considerations. Thus, understanding the sensory qualities of all activity and/or use of preparatory methods can reinforce desired behaviors in multiple settings.

Environments are an important consideration in fostering and challenging a child's sensory system as well. Environmental contexts include home, school, and other community settings. The milieu of each setting considers both physical and social expectations for behaviors. If a child demonstrates tantruming behavior in more chaotic environments, such as a grocery store or theme park, *The Sensory Profile* may reveal that the child is a sensation avoider and wants to leave the situation but cannot communicate that clearly. The child may tantrum whenever placed in that environment. To avoid future problematic behavior, a parent may structure the experience using sensory techniques to support the child's needs (i.e. putting headphones on the child that play calming music) or they may choose to leave the child with ASD in the care of someone else while they do the shopping.

Third, Cohn states that knowing the sensory processing patterns of a child who has ASD can give a parent and therapist ideas of activities that might be very appropriate for that individual's sensory needs (2001). The therapist and parent can collaborate with the activities and find ways in which to increase the child's participation. For example, if the child is a sensory seeker such as the subject in this case study, enrolling the child on a swim team may be an excellent way to help the

child to modulate his behavior while getting the added benefits of socializing with peers and being on a team sport.

The therapist can look at the *CAPE/PAC* and find activities that the child already enjoys or would like to participate in that support the child's sensory needs. The therapist can identify ways that the child's interests can be combined with his or her sensory processing patterns. The therapist may need to help structure the activities so that they match the skill level of the child. By collaborating with the parents and the child and using information from the *CAPE/PAC* and *The Sensory Profile*, the child may be able to increase his or her participation in occupations. The increased participation in occupations will help the child to experience a higher quality of life and develop social participation with peers.

### Implications for Occupational Therapy

It has been demonstrated that children are more likely to participate when they have a choice of activities (Reinhartsen et. al., 2002). However, for many children who have ASD, their options may be limited for several reasons. Various activities may be unavailable to the child due to geographical constraints, financial constraints, or because the child lacks the physical ability to participate. Another reason a child's choice of activities may be limited may be due to parents not wanting their child to, or being hesitant to let their child participate in certain activities like community groups or teams as discussed above. The child may also

be limited in activity choice due to the parent choosing the activities, and these activities may not benefit or support the child's sensory needs (Welters-Davis & Mische-Lawson, 2011).

It has also been suggested that by participating activities that are supportive of a child's sensory needs, the child experiences less behavioral problems and more participation in various occupations. Therefore if therapists can help parents to identify a child's sensory needs and encourage activities that can support their sensory needs, they may be able to increase the child's participation in activities and decrease problematic behaviors. Further, as children increase their participation in activities that provide needed sensory input, Ayres posited that they will develop more complex repertoires of self-regulating behavior (1972). Participation and engagement in these activities is key to enhancing the child's development (Ayres, 1972).

Occupational therapists can utilize the STEP-SI model to help educate parents of children who have ASD about sensory processing patterns and sensory experiences and behaviors. Therapists can help parents to discover and understand their child's unique sensory processing patterns and the various activities that are supportive of that child's sensory processing preferences. By educating the parents about activities that will support their child's sensory needs, the child is more likely to have access to and engage in activities that will help him or her to receive the sensory stimulation that their body needs. This in turn, it is hypothesized, would result in better behavioral outcomes for the child, a higher quality of life for the

child and improved abilities to engage in play, education and other functional performance areas.

The therapist can also educate the parent on the task, environment and predictability and how those can affect the child's behavior. For example, a child who is typically unable to tolerate loud noises may be able to tolerate loud noise if it is the child causing it by playing video games. Or, if a child is in a familiar environment, he or she may be able to handle noxious stimuli better than if they are in an unfamiliar place. Lastly, if a child is able to predict a sensation is going to occur, he or she may be better able to tolerate it than if they are not expecting to experience that sensation. For example, if a child knows that the carpet makes them itchy but in order to play with their cars at home they have to get on the floor, he or she may be able to better tolerate the feeling of the carpet because they are expecting it, it is during a task they like, and they are in a familiar place. Whereas if the parent has the child sit on a carpeted floor to wait while talking to an employee at the bank, the child may have a tantrum. By educating the parents on how the interplay of the Sensation, Task, Environment, and Predictability may affect the child, the parent may be able to structure activities so that the child is better able to participate.

## Limitations

This study contained several limitations. First, this was a mixed-methods case study completed on only one child, which limits generalizability of the findings. Second, only two assessments and observations were utilized to collect data. Developing and utilizing a structured interview may have added more understanding to the subject's responses. Using other methods to collect similar data (such as *The Sensory Processing Measure* instead of *The Sensory Profile*) may have yielded different data sets, which may have changed the interpretations or implications. For many of the *CAPE* responses it was unclear if the child participated in activities because that is his personal choice, or if his brothers, parents or other situations dictated his participation in those activities. This is an area that a structured interview could have helped to address.

## Recommendations for Future Research

This study addressed one child with ASD's activity preferences and his sensory processing patterns. To expand the research it would be beneficial to include more children with ASD and see if those children participate in activities that support their sensory needs. It would have been helpful to have the parent complete an *Adult Sensory Profile* to identify her preferred sensory processing styles. This, along with a semi-structured interview, could allow the researcher to

determine if participation in activities may be affected by a mismatch between the child's sensory processing styles and the parent's sensory processing style.

Additionally, it would be important to further tease out whether a child participates in activities because he or she wants to, or if the activity choice is dictated by a person or context that the child is in. This is one challenge in working with a child population. Children often have limited choice in the activities they participate in. Children are not completely autonomous and are limited by what their parents and their community can offer to them. Since the subject in this study has three older brothers, it was difficult to determine if he participated in activities because he wanted to, or if he did it because his older brothers were engaging in those activities. This study adds to the research regarding sensory processing patterns in children who have ASD and activity choice. It also addresses how activities can aid children with ASD to learn to self-modulate their behavior so that they can experience more participation with their peers and a higher quality of life.

### Summary

In conclusion, it has been demonstrated that a child who has ASD does participate in activities that support his sensory processing patterns. The subject in this mixed-methods case study did not experience many behavioral problems, perhaps due to the fact that his sensory processing needs were being met through his engagement in activities. For children who display more behavioral problems, it

is hypothesized that it is due to their sensory processing needs not being met. Children may not have their sensory processing needs met if their parents' sensory processing patterns are different from their own. Children may also be limited in their activity choice due to parents not wanting or being afraid of allowing their child with ASD to participate in various activities.

Occupational therapists possess the skills and knowledge of applying clinical reasoning models such as the STEP-SI to analyze sensory experiences. Occupational therapists should utilize their knowledge and information gathered from assessments such as *The Sensory Profile* and the *CAPE/PAC* to find activities that children have a desire to participate in that will also support the child's sensory processing patterns. Daily routines have a sensory base, regardless if practiced in school, home or community settings. Understanding how sensory qualities of activities impact a child with ASD is critical. The frequency, duration, intensity, rhythmicity and/or complexity of an activity can impact a child's behavior. By allowing children with ASD to engage in activities that are supportive of their sensory processing patterns, they will experience less behavioral problems, more engagement in meaningful occupation, and thus, a higher quality of life.



## References

- American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process. (2<sup>nd</sup> ed.). *American Journal of Occupational Therapy*, 62(6), 625-683.
- American Occupational Therapy Association. (2011). *Occupational therapy's role with autism*. Retrieved from: <http://www.aota.org/DocumentVault/Autism-Resources/Consumer.aspx>
- Arbesman, M. & Liberman, D. (2010). Methodology for the systematic reviews of occupational therapy for children and adolescents with difficulty processing and integrating sensory information. *American Journal of Occupational Therapy*, 64, 368-374. doi: 10.5014/ajot.2010.09068
- Attwood, T. (2004). *Exploring feelings: Cognitive behavior therapy to manage anger*. Arlington, TX: Future Horizons.
- Ayres, A. J. (1965). Patterns of perceptual motor dysfunction in children: A factor analytic study. *Perceptual and Motor Skills*, 20, 335-368.
- Ayres, A. J. (1972). *Sensory integration and learning disorders*. Los Angeles: Western Psychological Services.
- Ayres, A. J. (1979). *Sensory integration and the child*. Los Angeles: Western Psychological Services.

- Ayres, A. J. & Tickle, L. S. (1980). Hyper-responsivity to touch and vestibular stimuli as a predictor of positive response to sensory integration procedures by autistic children. *American Journal of Occupational Therapy, 34*, 375-381.
- Baker, A. E. Z., Lane, A., Angley, M. T., & Young, R. L. (2008). The relationship between sensory processing patterns and behavioral responsiveness in autistic disorder: A pilot study. *Journal of Autism and Developmental Disorders, 38*. 867-875.
- Bass, M.M., Duchowny, C.A., & Llabre, M.M. (2009). The effect of therapeutic horseback riding on social functioning in children with autism. *Journal of Autism and Developmental Disorders, 39*, 1261-1267.
- Bundy, A. C., Shia, S., Qi, L., Miller, L. J. (2007). How does sensory processing dysfunction affect play? *American Journal of Occupational Therapy, 61*, 201-208.
- 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.
- Centers for Disease Control and Prevalence (2012). Facts about asd's. Autism Spectrum Disorders (ASD's). Retrieved from:  
<http://www.cdc.gov/NCBDDD/autism/facts.html>, August 13, 2012.

- Champagne, T., & Stromberg, N. (2004). Sensory approaches in inpatient psychiatric settings: Innovative alternatives to seclusion and restraint. *Journal of Psychosocial Nursing*, 42(9), 35-45.
- Cohn, E. S. (2001). Parent perspectives of occupational therapy using a sensory integration approach. *American Journal of Occupational Therapy*, 55, 285-294.
- DeGrace, B.W. (2004). The everyday occupation of families with children with autism. *American Journal of Occupational Therapy*, 58(5), 543-550.
- Donohue, M. V. (2011). Interventions for children to develop social participation roles, skills and networks. In Cole, M. B. & Donohue, M. V. (Eds.). *Social participation in occupational contexts: In schools, clinics, and communities*. (pp. 201-227). Thorofare, NJ: Slack Inc.
- Dunn, W. (2006). *Sensational kids: Hope and help for children with sensory processing disorder*. New York, NY: G. P. Putnam's Sons.
- Dunn, W. (1999). *Sensory profile: User's manual*. San Antonio, TX: PsychCorp.
- Dunn, W. (2008). *Technical report: The sensory profile*. San Antonio, TX: Pearson.
- Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. *Infants and Young Children*, 9(4), 23-35.

- Dunn, W., Myles, B. S., & Orr, S. (2002). Sensory processing issues associated with asperger syndrome: A preliminary investigation. *American Journal of Occupational Therapy*, 56(1), 97-102.
- Ermer, J., & Dunn, W. (1998). The sensory profile: A discriminant analysis of children with and without disabilities. *American Journal of Occupational Therapy*, 52(4), 283-290.
- Falvo, D. R. (2009). Intellectual and developmental disabilities. In *Medical and psychosocial aspects of chronic illness and disability* (4<sup>th</sup> ed.) (pp. 195-220). Sudbury, MA: Jones & Bartlett
- Gabriels, R. L., Agnew, J. A., Holt, K. D., Shoffner, A. Zhaoxing, P., Ruzzano, S., Clayton, G. H., & Mesibov, G. (2012). Pilot study measuring the effects of therapeutic horseback riding on school-aged children and adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders*, 6(2), 578-588.
- Jacobs, K. and Jacobs, L. (Eds.). (2004). Quick reference dictionary for occupational therapy (5<sup>th</sup> ed.). Thorofare, NJ: SLACK, Inc.
- King, G., Law, M., King, S., Hurley, P., Rosenbaum, P., Hanna, S., et al. (2004). *CAPE/PAC: Children's assessment of participation and enjoyment & preferences for activities of children*. San Antonio: Pearson, INC.
- Kirkpatrick, J. (2012). Sports for children with sensory processing disorders: A guide for occupational therapy practitioners. *OT Practice*, 17(10), 8-13.

- Lane, S. J. & Schaaf, R. C. (2010). Examining the neuroscience evidence for sensory-driven neuroplasticity: Implications for sensory-based occupational therapy for children and adolescents. *American Journal of Occupational Therapy, 64*, 375-390. doi:10.5014/ajot.2010.09069
- 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. *American Journal of Occupational Therapy, 53*, 207-213.
- May-Benson, T. A., Koomar, J. A. (2010). Systematic review of the research evidence examining the effectiveness of interventions using a sensory integrative approach for children. *American Journal of Occupational Therapy, 64*, 403-414. doi: 10.5014/ajot2010.09071
- Memishevikj, H. & Hodzhikij, S. (2010). The effects of equine-assisted therapy in improving the psychosocial functioning of children with autism. *Journal of Special Education & Rehabilitation, 3*(4), 57-67.
- Miller, L. J., Wilbarger, J., Stackhouse, T. & Trunnel, S. (2002). Appendix A: Use of clinical reasoning in occupational therapy: The STEP-SI model of intervention of sensory modulation dysfunction. In Bundy, A. C. Lane, S. J., Murray, E. A., & Fisher, A. G. (Eds.) *Sensory Integration: Theory and Practice*. (p. 435-51). F.A. Davis.

- Miller, L. J., Anzalone, M. E., Lane, S. J., Cermak, S. A., & Osten, E. T. (2007). Concept evolution in sensory integration: A proposed nosology for diagnosis. *American Journal of Occupational Therapy, 61*(2), 135-140.
- Miller, L. J., Nielsen, D. M., Schoen, S. A., & Brett-Green, B. A. (2009). Perspectives on sensory processing disorder: A call for translational research. *Frontiers in integrative neuroscience, 3*(22), 1-12.
- Mische-Lawson, L. (2006). *The relationship between sensory processing patterns and play preferences of young children*. (Dissertation). University of Kansas, Kansas.
- O'Brien, J. & Williams, H. (2010). Occupational therapy intervention: Performance Areas: Application of motor control/motor learning to practice. In Case-Smith, J. & O'Brien, J. (Eds.). *Occupational therapy for children* (6th ed.) pp.245- 274. Maryland Heights, MO: Mosby Elsevier.
- Parham, L. D., & Mailloux, Z. (2010). Sensory integration. In J. Case-Smith & J.C. O'Brien (Eds.), *Occupational Therapy for Children* (6<sup>th</sup> ed), (pp.325-372). Maryland Heights, MO: Mosby Elsevier.
- Pierce, D. (2001). Untangling occupation and activity. *American Journal of Occupational Therapy, 55*, 138-146.

- Polatajko, H. J. & Cantin, N. (2010). Exploring the effectiveness of occupational therapy interventions, other than the sensory integration approach, with children and adolescents experiencing difficulty processing and integrating sensory information. *American Journal of Occupational Therapy, 64*, 415-429. doi: 10.5014/ajot.2010.09072
- Post, Y., Boyer, W. & Brett, L. (2006). A historical examination of self-regulation. Helping children now and in the future. *Early Childhood Education, 34*, 5-14. doi: 10.1007/s10643-006-0107-x
- Reinhartsen, D. B., Garfinkle, A. N., & Wolery, M. (2002). Engagement with toys in two-year-old children with autism: Teacher selection versus choice. *Research and Practice for Persons with Severe Disabilities, 27*(3), 175-187.
- Reynolds, S. Bendixen, R. M., Lawrence, T. & Lane, S. J. (2011). A pilot study examining activity participation, sensory responsiveness, and competence in children with high functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders, 41*, 1495-1506. doi: 10.1007/s10803-010-1173-x
- Roberts, J. E., King-Thomas, L. & Boccia, M. L. (2007). Behavioral indices of the efficacy of sensory integration. *American Journal of Occupational Therapy, 61*, 555-562.

- Rogers, S. L., (2010). Common conditions that influence children's participation. In J. Case-Smith & J. C. O'Brien (Eds.), *Occupational Therapy for Children* (6<sup>th</sup> ed) (pp. 146-192). Maryland Heights, MO: Mosby Elsevier.
- Schaaf, R. C. & Nightlinger, K. M. (2007). Occupational therapy using a sensory integrative approach: A case study of effectiveness. *American Journal of Occupational Therapy*, 61, 239-246.
- Schaaf, R. C., Benevides, T., Blanche, E. I., Brett-Green, B. A., Burke, J. P., Cohn, E. S... Schoen, S. A. (2010). Parasympathetic functions in children with sensory processing disorder. *Frontiers in Integrative Neuroscience*, 4, 1-11. doi: 10.3389/fnint.2010.00004
- Schaaf, R. C., & Miller, L. J. (2005). Occupational therapy using a sensory integrative approach for children with developmental disabilities. *Mental Retardation and Developmental Disabilities Research Reviews*, 11. 143-148.  
Doi:10.1002//mrdd.20067
- Sensory Processing Disorder Foundation. (2002). About SPD. Retrieved from <http://www.spdfoundation.net/about-sensory-processing-disorder.html>
- Tomchek, S. D., & Dunn, W. (2007). Sensory processing in children with and without autism: A comparative study using the short sensory profile. *American Journal of Occupational Therapy*, 61(2). 190-199.



Welters-Davis, M., & Mische-Lawson, L. (2011). The relationship between sensory processing and parent—child play preferences. *Journal of Occupational Therapy, Schools, & Early Intervention, 4*(2), 108-120.

doi:10.1080/19411243.2011.595300

Williams, M. & Shellenberger, S. (1994). The Alert Program for self-regulation.

*Sensory Integration Special Interest Section Newsletter, 17*, 1-3.

Yack, E., Aquilla, P., & Sutton, S. (2002). *Building bridges through sensory integration: Therapy for children with autism and other pervasive developmental disorders.*

Arlington, TX: Future Horizons Inc.

APPENDIX A:  
CAPE/PAC Summary of Results Table

Table 7: CAPE/PAC Summary of Results Table

<b>CAPE</b>	<b>CAPE</b>	<b>CAPE</b>	<b>CAPE</b>	<b>CAPE</b>	<b>CAPE</b>	<b>PAC</b>
Activity	Have you done this activity in the past 4 mos?	How Often? 1=1x in past 4 mos 2= 2x in past 4 mos 3=1x in a month 4=2-3x/month 5=1x/week 6=2-3x/week 7=1x/day+	With whom do you do this more often? 1=Alone 2=With family (Parents, siblings) 3= With other relatives 4= With friends 5= With others	Where do you do this more often? 1=At home 2=At a relatives home 3=In your neighborhood 4=At school (not during classes) 5=In your community 6=Beyond your community	How much do you like or enjoy doing this activity? 1=Not at all 2= Somewhat; sort of 3=Pretty much 4=Very much 5=Love it!	If you could do anything in the whole world, would you like to be: 1=I would not like to do at all 2=I would sort of like to do 3=I would really like to do
Doing Puzzles	Yes	5	4	4	2	2
Playing board or card games	Yes	4	4	4	2	2
Doing crafts, drawing or coloring	Yes	7	1	4	5	3
Collecting things	Yes	2	1	1	5	3
Playing computer/video games	Yes	7	5	4	5	2
Talking on the phone	Yes	3	2	2	2	1

APPENDIX B:  
Dunn's Model of Sensory Processing

## Winnie Dunn's Sensory Processing Model

<b>Neurological Threshold Continuum</b>	<b>Behavioral Response Continuum</b>	
	Responds in ACCORDANCE with threshold	Responds to COUNTERACT the threshold
High (Habituation)	<i>Poor Registration</i>	<i>Sensation Seeking</i>
Low (Sensitization)	<i>Sensitivity to Stimuli</i>	<i>Sensation Avoiding</i>

**Figure 1: Dunn's Sensory Processing Model. Reproduced with permissions--License #2926020309450. Source: Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and families: A conceptual model. *Infants and Young Children*, 9(4), 23-35.**