

SENSORY PROCESSING AND SOCIAL PARTICIPATION IN CHILDREN WITH
AUTISM SPECTRUM DISORDERS

A THESIS

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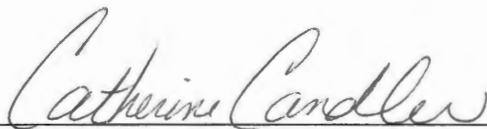
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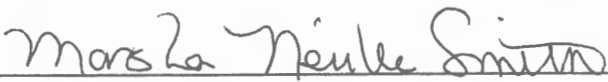
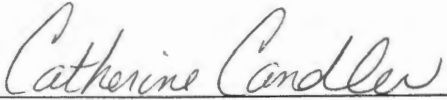
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To the Dean of the Graduate School:


I am submitting herewith a thesis written by Christene Maas entitled "Sensory Processing and Social Participation in Children with Autism Spectrum Disorders". I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment for the degree of Master of Arts with a major in Occupational Therapy.


Catherine Candler, PhD, Major Professor

We have read this thesis and recommend its acceptance:



Interim Director

Accepted:


Dean of the Graduate School

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Thanks to those at Texas Woman's University that have encouraged me to keep going on this master's degree. Two children later, I am finally finishing.

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ABSTRACT

CHRISTENE MAAS

SENSORY PROCESSING AND SOCIAL PARTICIPATION IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

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The purpose of this study was to examine children with ASD in a school setting for evidence of sensory processing patterns and explore for a relationship between sensory processing problems and social participation in school.

For twenty-one student participants with ASD, the *Sensory Profile School Companion* was completed by teachers to determine sensory processing patterns and the *Social Responsiveness Scale* (SRS) was completed by speech therapists to assess social competence for social participation. Data analysis indicated the most frequent atypical sensory processing pattern was sensory avoidance. Moderate significant correlations were present for the relationship between sensory avoiders and overall total social competence and also between sensory avoiders and the social cognition subscale on the SRS. Compared to other research, more typical ranges in sensory processing patterns and social participation were found within this population.

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS.....	iii
ABSTRACT.....	iv
LIST OF TABLES.....	vii
Chapter	
I. INTRODUCTION.....	1
Statement of the Problem.....	2
Purpose of the Study.....	2
Definition of Terms.....	2
II. REVIEW OF THE LITERATURE.....	4
Sensory Integration and Dunn’s Model of Sensory Processing.....	4
Sensory Processing Abnormalities and Children with Autism: How it Affects Functioning at Home and at School.....	5
Sensory Processing Disorder in Children without ASD and Social Participation in School.....	8
Sensory Processing Dysfunction in Children with ASD and Social Participation.....	9
III. METHOD.....	11
Participants.....	11
Instruments.....	13
Procedure.....	15
Limitations and Assumptions.....	16
Data Analysis.....	16
IV. RESULTS.....	18

V. DISCUSSION	22
VI. CONCLUSION.....	29
REFERENCES.....	31

LIST OF TABLES

Table	Page
1. Frequencies of the Sensory Quadrants on the Sensory Profile School Companion	18
2. Frequencies of the Social Responsiveness Scale t scores	20
3. Correlation Between Sensory Profile School Companion Sensory Quadrants and Social Responsiveness Scale Subscales and Total t scores.....	21

CHAPTER I

INTRODUCTION

Autism Spectrum Disorders (ASD) are a group of disorders, neurological in nature, that affect social, behavior and communication skills (American Academy of Pediatrics, n.d.). The central feature to autism is impaired social interaction (National Institutes of Health, 2008). Autism Spectrum Disorders include Autism, Asperger Syndrome and Pervasive Developmental Disorder, Not Otherwise Specified (American Academy of Pediatrics, n.d.). Although not currently a part of the specific diagnostic criteria, children with ASD often have difficulties in sensory processing (Ashburner, Ziviani, & Rodger, 2008; Baker, Lane, Angley & Young, 2008; Kern et al 2007b; Tomchek & Dunn, 2007). Some authors in recent research now go as far to suggest that sensory processing problems should be added as part of the diagnostic criteria for autism (Kern et al, 2007b). Sensory processing abnormalities in children with autism affect daily living skills, academic performance in school, and behavior (Ashburner et al, 2008; Baker et al, 2008). Much of the research in children with ASD related to the school setting, sensory processing and social participation has been done using caregiver information (Ashburner et al, 2008; Baker et al, 2008, Hilton, Graver & LaVesser, 2007). There is limited research exploring solely social participation and sensory processing in children with autism in the school setting (Ashburner et al, 2008; Hilton et al, 2007).

Statement of the Problem

Social impairment is the core deficit for children with ASD. Sensory processing problems impact functional skills of children with ASD. Sensory processing problems may be a contributing factor in the social impairment of children with ASD in the school setting.

Purpose of the Study

The purpose of this study is twofold, 1) To identify sensory processing patterns of children with ASD in the school setting and 2) To determine if there is a relationship between sensory processing patterns and social participation.

Definition of Terms

Autism Spectrum Disorder: A group of disorders, neurological in nature, that are characterized by social impairment, communication and behavior problems. They include autism, pervasive developmental disorder, and Asperger Syndrome (American Academy of Pediatrics, n.d.)

Sensory Processing: Sensory processing is the term for the nervous system's process of "reception, modulation, integration, and organization of sensory stimuli, including the behavioral responses to sensory input..." (Miller & Lane, 2000, p.2).

Social participation: Social participation is the "activities associated with organized patterns of behavior that are characteristic and expected of an individual or an individual acting with others within a social system" (Mosey in American Journal of Occupational Therapy, 2002, p.621).

Sensory seeker: Behavioral pattern using an active strategy for a high neurological

threshold. A child seeks an excessive amount of sensory input to satisfy the high threshold (Dunn, 1997, 1999).

Sensory avoiding: Behavioral pattern using an active strategy for low neurological threshold. The child actively limits interaction with sensory input because of sensitivity (Dunn, 1997, 1999).

Low registration- Behavioral pattern describing a passive strategy for a high neurological threshold. A child may not notice what is happening in their environment, needing a large amount of input to register what is happening in their environment (Dunn 1997, 1999).

Sensory sensitivity: Behavioral pattern using a passive strategy for a low neurological threshold. The child notices and reacts to sensory input that others may not, becoming distracted with the environment (Dunn 1997, 1999).

CHAPTER II

REVIEW OF THE LITERATURE

Sensory Integration and Dunn's Model of Sensory Processing

Jean Ayres, the founder of sensory integration therapy, described sensory integration as “the organization of sensory input for use” (Ayres in Spitzer & Roley, 2001,p.5). Current sensory integration researchers are defining specific descriptions for sensory integration problems (Miller & Lane, 2000; Miller & Fuller, 2007). Sensory processing disorder (SPD) is an overall umbrella term, covering three specific categories, 1) sensory modulation disorder, 2) sensory motor disorder, and 3) sensory discrimination disorder. Sensory modulation disorder has three subcategories of 1) sensory over-reactivity, 2) sensory under-reactivity, and 3) sensory seeking/craving (Miller & Fuller, 2007).

Dunn's Model of Sensory Processing explains sensory processing in terms of neurological thresholds and behavioral responses (Dunn, 1997, 2001). Neurological thresholds refer to the amount of stimuli needed for one to react to the stimuli. Behavioral responses are how the child reacts in relation to the threshold. In Dunn's model, sensory processing is defined by the intersecting patterns of neurological thresholds and behavioral responses. These patterns are low registration, sensory seeking, sensitivity to stimuli, and sensation avoiding. Persons with low neurological thresholds notice sensory input more readily than others, meaning there is too much sensitization to the environment. Low threshold behavioral responses are sensory sensitivity and sensory

avoiding. Sensory sensitivity is a passive responding pattern, where the individual notices sensory stimuli, but does not limit their experience, such as noticing tags on shirts and becoming easily distracted in groups. Sensory avoiders use an active responsive behavior by limiting sensory stimuli, such as being rigid in rituals to ensure predictability of stimuli or leaving a classroom when it is noisy. The high threshold behavioral responses are low registration and sensory seeking. Low registration behavior is a passive behavioral response where the individual may be under responsive and does not perceive sensory information in their environment as readily as others, such as not noticing their name is called or they may have an unusually high pain threshold. Sensory seekers use active behavioral strategies for their high neurological threshold. These include such behaviors like excessive fidgeting, increased chewing of objects, or touch everything around them. These children are actively engaging in the environment, often inappropriately to increase their sensory threshold to an optimal level. Dunn's Model of Sensory Processing is the theoretical model upon which the *Sensory Profile* (Dunn, 1999), *Sensory Profile School Companion* and the *Short Sensory Profile* (SSP) (Dunn, 1999) is based. The SSP is now a widely used standardized questionnaire for sensory processing, and has been included in several studies (Ashburner et al, 2008; Baker et al, 2008; Dunn 1997, 2001; Tomchek & Dunn, 2007).

Sensory Processing Abnormalities in Children with Autism: How it Affects Functioning at Home and at School

Research supports the concurrence of atypical sensory processing patterns and autism (Ashburner et al, 2008; Baker et al, 2008; Kern et al, 2007a; Kern et al 2007b;

Tomchek & Dunn, 2007). The prevalence of sensory processing abnormalities and autism has estimated to range as high as 80-95%(Ashburner et al, 2008; Baker et al, 2008; Tomchek & Dunn, 2007; Watling, Dietz, & White, 2001). Atypical sensory experiences in children with ASD can affect their overall functioning in the school setting and in daily living skills (Ashburner et al, 2008; Baker et al, 2008;) Several studies have found correlations between specific sensory processing patterns and autism spectrum disorders (Ashburner et al, 2008; Baker et al, 2008; Kern et al, 2007a; Kern et al, 2007b; Tomchek & Dunn, 2007; Watling et al, 2001). Associations between autism spectrum disorders and atypical sensory processing have been linked with problems in all main sensory modalities and multisensory processing in children with autism (Kern et al 2007b).

The relationship of atypical processing of auditory stimuli and ASD has been identified in several studies (Ashburner et al 2008; Baker et al 2007; Tomchek & Dunn, 2007). Particularly, auditory filtering and ASD have been consistently correlated through studies, as identified by use of the SSP (Ashburner et al, 2008; Baker et al, 2008; Tomchek & Dunn, 2007). Auditory filtering problems can appear as a hypersensitive response or an under responsive response to auditory input (Ashburner et al 2008; Tomchek & Dunn 2007). Problems with academic performance have been significantly correlated to atypical auditory filtering and underresponsive/sensation seeking factors of the SSP (Ashburner et al, 2008). Attention problems in the school setting can also be related to auditory filtering deficits. Auditory filtering problems can be observed in behavior that appears distracted and inattentive during cognitive tasks in busier settings,

such as schools (Ashburner et al, 2008; Baker et al, 2007). Ashburner et al (2008) found associations with auditory filtering and problems in learning and attention in school, possibly due to difficulty hearing the teacher with background noise.

Sensory seeking behavior and underresponsive behavior are other patterns of atypical sensory processing present with those with ASD as identified by the SSP (Ashburner et al, 2008; Baker et al, 2007; Hilton et al, 2007; Tomchek & Dunn, 2007). Differences exist in sensory seeking or underresponsive behaviors with children with ASD as compared to typically developing peers (Tomchek & Dunn, 2007). As much as 90% of a sample of children with ASD demonstrated significant differences in the Underresponsive/Seeks Sensation section of the SSP, with behaviors of seeking input from several of the sensory systems (Tomchek & Dunn, 2007). Seeking sensation behaviors have been moderately correlated with maladaptive behavior, which may include behaviors that are seen as repetitive and stereotyped behaviors in children with ASD (Baker et al, 2008).

Sensory processing patterns that are hypersensitive to sensory stimuli have been documented in literature in individuals with ASD (Baker et al, 2008; Kern et al, 2007a; Kern et al, 2007b; Tomchek & Dunn, 2007). Tactile sensitivity in particular has been found in children with autism (Kern et al, 2007b; Tomcheck & Dunn, 2007) In a study specifically addressing children with Asperger syndrome, Dunn found atypical responses in hypersensitivity, but also in poor registration, indicating an overall issue modulating sensory input (2002). Tactile hypersensitivity in children with ASD can affect attention and can be perceived as hyperactive behavior (Ashburner et al, 2008). This could be due

to attempts to reduce or avoid tactile input in their environment, especially with the unpredictable movements of children in the school setting or playground.

Anxiety that can contribute to difficulties in social interaction has correlated significantly with sensory processing problems in children with autism in both the school and home setting (Ashburner et al, 2008; Baker et al, 2008; Hilton et al, 2007). Baker et al (2008) found for their sample of children with autism overall poorer sensory processing related to more behavioral and emotional problems. Watling, Dietz, & White (2001) also found emotional difficulties related to sensory processing problems as a significantly different factor when compared to typical peers. Emotional difficulties based in sensory processing issues can also contribute to social participation problems. First hand experiences from adults with ASD describe sensory problems as significantly affecting their communication and social participation (Shoener, Kinnealey, & Koenig 2008). Studies are identifying a concurrence of sensory processing abnormalities and autism, with support to suggest that sensory processing problems be added as part of the diagnostic criteria for autism (Kern et al, 2007b).

Sensory Processing Disorder in Children without ASD and Social Participation in School

Social participation as it relates to occupational therapy is described as “activities associated with organized patterns of behavior that are characteristic and expected of an individual or an individual acting with others within a social system” (Mosey in American Occupational Therapy Association, 2002, p.621). In researching social participation patterns in those with SPD and typically developing peers in school, Cosby

(2007) found that those with SPD were reported by teachers as having significant differences with cooperation and self-control in comparison to typically developing peers. In parent reporting, children with SPD have shown significant differences with self-control. Children with SPD only also identified cooperation and social skills as areas of difficulty for themselves.

Sensory Processing Dysfunction in Children with ASD and Social Participation

In studies examining sensory processing deficits with children with ASD, social interaction often is studied as a subpart of assessments (Ashburner et al, 2008; Baker et al, 2008). In these studies, social interaction problems as a subset of other assessments have been inconsistent in correlating significantly with sensory processing deficits (Ashburner et al, 2008; Baker et al, 2008). In a study by Hilton et al (2007), sensory processing and social competence were solely examined with children with high functioning autism. Relationships between sensory sensitivity, sensory seeking behaviors, sensory avoidant behaviors, low registration behaviors and social competence were all statistically significant. The most strongly correlated relationships were found between sensory avoidant behavior and sensory sensitivity behavior with problems of social competence. Sensory sensitivity behaviors include being distractible, hyperactivity, and complaining, which can affect social interaction skills of attending to others in conversation or playing games (Dunn, 1997, 2001; Hilton et al, 2007). Sensory avoidant behaviors include limiting sensory input, being rule bound or relying on rigid rituals, which can result in a child isolating themselves in social situations or inflexible play

behavior (Dunn, 1997, 2001, Hilton et al, 2007). These sensory processing abnormalities contribute to the social impairment that already exists with children with ASD.

CHAPTER III

METHOD

The study is a correlation research design. It is modeled after a study by Hilton et al (2007) investigating a relationship between social competence and sensory processing dysfunction in high functioning autistic children. A bivariate correlational research design was used to explore the relationship between social participation and sensory processing scores in the school setting. A descriptive table of frequencies of quadrant scores for sensory processing patterns and outcomes for social impairment.

Participants

Participants were taken from the population of children with ASD who were actively attending one of the Autism Spectrum Disorder Nest Program sites (ASD Nest Program) in an urban setting. The ASD Nest Program is an integrated co-teaching (ICT) program for children with higher functioning autism spectrum disorders in the New York City Department of Education (New York City Department of Education [NYC DOE], 2009). The ASD Nest Program was created so children with higher functioning ASD could attend neighborhood schools and learn how to function well academically, behaviorally, and socially within their school and community (Koenig, Bleiweiss, Brennan, Cohen, & Siegel, 2009). To be eligible for the ASD Nest program, children have to meet state eligibility requirements for an educational classification of autism, have average cognition, mild to moderate inferring behavior, and average speech/language except for pragmatics. The evaluation process includes observation in

their current school setting, assessment using the Autism Diagnostic Observation Scale (ADOS), the Stanford Binet V, parent interview using the SRS, and speech evaluation to determine if they have autism and are able to participate in grade level academics in an inclusion class. An occupational therapy evaluation may occur before or after the decision for participation in the ASD Nest Program. “The ASD Nest Program model strives to create, within a grade appropriate academic framework, a therapeutic environment in which the requisite supports are provided by a transdisciplinary team of specially trained educators and therapists”(Koenig et al, 2009, p.7).

Participation was requested from the parents of students in the classes that are part of the ASD Nest Program. Consent was received for twenty-one student participants out of thirty-three requested in the study. Ages of the student range from 5 to 10 years old. Thirteen participants were ages 5-7 and eight participants were ages 8-10. One child was female and twenty were male. The students ranged in grades Kindergarten through 4th grade. Fifth graders in the ASD Program were excluded as they were on the researcher’s current caseload, as per the New York City Department of Education Proposal Review Committee’s request to not have any children in the researcher’s caseload included. Exclusion criteria for the study also included any children with known co-existing diagnoses.

The teachers in the ASD Nest Program all must have specific training before teaching within the ASD Nest Program. This includes classes that have training on ASD, behavioral theory and applications (Koenig et al, 2009). In addition, there are classes specific to the ASD Program and specific ASD Program social development curricula

(Koenig et al, 2009). The teachers for the classes of the ASD Program include two classroom teachers, one special education, one general education teacher, and an additional a cluster special education teacher who supports children during lunch, special subjects, or when an identified need occurs with the children with ASD.

The speech language pathologists (SLP) in the ASD Nest Program have a mandated time for social development group. This group includes speech language-pathologists, classroom teachers and occupational therapists. The SLP is consistently present at all of the times in the social development group as it is a mandated time. Therefore, the SLPs were asked to complete the questionnaire used to assess social participation as they had the most interaction with the child during the social development group.

Twelve teachers participated out of seventeen requested to complete questionnaires, who teach the children with consent in the ASD Nest classes. Four out of four speech language pathologists participated, who treat these children with consent in the ASD Nest classes.

Instruments

The *Sensory Profile School Companion* (2006) was used to assess sensory processing problems in the school context. The *Sensory Profile School Companion* is a questionnaire that consists of 62 items to be completed by a teacher in the school setting. Scores are in the form of quadrant scores, sensory systems, and school factors. Quadrant descriptors are according to Dunn's Model of Sensory Processing, which are registration, seeking, avoiding, and sensitivity. The *Sensory Profile School Companion* has

established reliability in internal consistency and test-retest reliability. Internal consistency was calculated for the *Sensory Profile School Companion* for the Quadrants, School Factors, and Sections. The alpha coefficients for the different categories ranged from .83 to .95, establishing good internal consistency (Dunn, 2006). Test-retest reliability coefficients ranged from .80 to .95 (Pearson product moment correlation) and standard error of measurement had small to moderate variability (Dunn, 2006).

Validity was established through exploratory study with teachers and school based occupational therapists, along with a pilot study to collect data for construct validity (Dunn, 2008). Convergent and discriminative validity were established through correlation of the *School Companion* to the *Sensory Profile* (caregiver questionnaire), factor analysis of the pilot *School Companion*, and multivariate analysis of variance for specific disability group studies. The psychometric properties of reliability and validity for the *School Companion* indicate that it measures sensory processing.

The *Social Responsiveness Scale* (SRS) by Constantino and Gruber (2005) was used to examine social participation. The SRS is a 65- item questionnaire to assess severity of social impairment of those with ASD for children ages 4-18, which can be completed by a parent, caregiver or teacher. The questionnaire is in a Likert scale format, resulting in a scale designed to be sensitive to a range of behaviors related to symptomology of autism spectrum disorders. The SRS produces a total score, which describes the overall severity of social impairment. The five subscale scores are used specifically for treatment planning and evaluating treatment. The subscales are social awareness, social cognition, social communication, social motivation, and autistic

mannerisms. Internal consistency for total score using Cronbach's alpha were reported for ratings with groupings of normative males and females, rated by teacher and parents and also a clinical sample of children with and without autism. Alpha reliability for all groupings was above .90, indicating reliability in assessing severity of ASD. Subscale reliability for the treatment subscales have alpha coefficients ranging from .76 to .91. Retest temporal stability for the test construct, indicated coefficients of .77 (females) to .85 (males). Interrater reliability coefficients were assessed using comparisons between mother, father and teacher with a range from .75 to .91. Validation studies for the SRS Treatment subscales were based on professional expert studies and internal consistency item correlation ranges from .77 to .92, which suggests the SRS is a valid measure for assessing the social participation of the children with ASD in a school setting.

Procedure

The principal investigator obtained institutional approval from Texas Woman's University IRB and Texas Woman's University graduate school. Institutional approval from the New York City Department of Education Proposal Review Committee was obtained prior to the study.

The principal investigator obtained permission from the administration of participating school. The principal investigator presented the study and requested volunteers at a staff meeting. The principal investigator requested participation via a second request by personal contact of teachers and speech therapists. The principal investigator contacted the parents in two ways. The principal investigator briefly explained the study in a parent meeting about sensory processing. The principal

investigator contacted parents via a parent letter explaining the study and parent consent form. A parent consent form for each student in the ASD Nest program in the participating teacher's class was requested. Twenty-one parent consent forms were obtained out of thirty-three requested.

Once identified teachers and participants were established, the OT met with each participating teacher to educate or review with the teachers how to complete the *Sensory Profile School Companion* questionnaire.

The principal investigator had a meeting with the speech language pathologists of the ASD Nest program to request participation in completing the *Social Responsiveness Scale*. Once consent was received, the researcher had a meeting with all four SLPs to educate regarding the use of the SRS. Follow up informal meetings with two of the therapists were also made regarding specific questions about the SRS.

Limitations and Assumptions

The small sample size limits the generalization of results to a larger population. The children are diverse in ethnicity, however all are from one geographical location in an urban setting. The use of questionnaires only is also a limitation, as it depends on the participants' interpretations of the questions. It is assumed in this study that all the children with ASD have been classified on their Individual Education Plan (IEP) as on the autism spectrum as a requirement to be part of the ASD Nest Program.

Data Analysis

Descriptive statistics is used for the participants' sensory processing patterns on the *Sensory Profile School Companion* and for the outcomes of the *Social Responsiveness*

Scale. Results of the frequencies and percentages of each quadrant for the participants on the *Sensory Profile School Companion* are reported in a descriptive table to compare the sensory processing patterns. Results of the frequencies and percentages of the SRS t-scores for the subscales and total score are in a descriptive table to compare outcomes of social impairment affecting social participation. Data analysis also included a bivariate correlational analysis to determine a relationship between social participation and sensory processing. A Pearson product moment correlation for the sample was used to compare the four sensory quadrant scores of the *Sensory Profile School Companion* to the SRS total t-score and the five SRS subscale t-scores. Data was analyzed with the use of SPSS computer software.

CHAPTER IV

RESULTS

Results of the frequencies and percentages of each quadrant on the *Sensory Profile School Companion* are reported in Table 1, indicating the sensory processing patterns in the sample of children with ASD. The results also indicate within the sensory

Table 1
Frequencies of Sensory Quadrants on the Sensory Profile School Companion (N=21)

Quadrant	Frequency	Percent
Registration		
Probable difference less than others	0	0
Typical performance	8	38.1
Probable difference more than others	5	23.8
Definite difference much more than others	8	38.1
Seeking		
Typical performance	12	57.1
Probable difference more than others	5	23.8
Definite difference much more than others	4	19.0
Sensitivity		
Definite difference much less than others	0	0
Probable difference less than others	2	9.5
Typical performance	9	42.9
Probable difference more than others	8	38.1
Definite difference much more than others	2	9.5
Avoiding		
Typical performance	6	28.6
Probable difference more than others	7	33.3
Definite difference much more than others	8	38.1

processing pattern how many fall within the typical range, probable difference range, and definite difference range.

Typical performance range scores were found within all four quadrants, with the highest percentage of typical performance ranges in the Seeking quadrant at 57.1 percent. The highest percentage of atypical behaviors was in the Avoiding quadrant, with approximately 71 percent in the probable difference and definite difference range. Scores in the probable difference and definite difference ranges were present in all four sensory quadrants.

For the SRS subscales, results are reported in Table 2, with the greatest percentage of t-scores in the typical range in the social communication subscale and the autistic mannerisms subscale. The subscales that deviated the most from typical were in the social awareness and social cognition subscales. Overall SRS total t-scores included 57.1 percent in the mild to moderate range and 42.9 percent in the typical range.

The Pearson Product Moment Correlation compared the four sensory quadrants of the *Sensory Profile School Companion* to the SRS total t-score and five SRS subscale t-scores. Table 3 shows the results of the correlation.

Table 2

Frequencies of the Social Responsiveness Scale t scores (N=21)

Subscale t score	Frequency	Percent
Social Awareness		
Typical	8	38.1
Mild to moderate	12	57.1
Severe	1	4.8
Social Cognition		
Typical	9	42.9
Mild to moderate	11	52.4
Severe	1	4.8
Social Communication		
Typical	11	52.4
Mild to moderate	10	47.6
Severe	0	0
Social Motivation		
Typical	9	42.9
Mild to moderate	12	57.1
Severe	0	0
Autistic Mannerisms		
Typical	11	52.4
Mild to moderate	9	42.9
Severe	1	4.8
Total t score		
Typical	9	42.9
Mild to moderate	12	57.1
Severe	0	0

Table 3

Correlation Between Sensory Profile School Companion Sensory Quadrants and Social Responsiveness Scale (SRS) Subscales and Total t Scores (N=21)

Sensory Quadrant	SRS t scores					
	Social Awareness	Social Cognition	Social Communication	Social Motivation	Autistic Mannerisms	Total
Registration	-.169	-.161	-.038	-.043	-.112	-.093
Avoiding	-.344	-.504*	-.419	-.400	-.368	-.460*
Sensitivity	-.088	-.233	-.150	.116	-.300	-.157
Seeking	-.065	.044	.033	.224	-.112	-.093

* correlation is significant at the 0.05 level (2 tailed)

A negative moderate correlation is present between the SRS subscale of social cognition and the Avoiding quadrant. When SRS scores increase, the more severe the deficits in social competence. On the *Sensory Profile School Companion*, for the Avoiding quadrant, as the score decreases, the more atypical the sensory response. This indicates that in the data that there is a relationship when sensory avoidance behaviors are more atypical, then social cognition deficits are more severe. However, causality is not indicated in the correlation. A negative moderate correlation also exists for the SRS total t-score and the Avoiding quadrant. This indicates overall there is a correlational relationship with social competence decreasing when sensory avoidance behaviors are more atypical.

CHAPTER V

DISCUSSION

In this study, there were only two moderate correlations between sensory processing and social participation results. The Avoiding quadrant on the *Sensory Profile School Companion* moderately correlated with the SRS social cognition subscale. The Avoiding quadrant also demonstrated moderate significance in a negative correlation with the overall SRS t-score, indicating that overall social participation has a relationship to sensory avoidance.

Avoidance in sensory processing occurs with children who have a low threshold tolerance for sensory input, and use an active strategy to get away from this input (Dunn, 2006). Social cognition, as defined by the SRS, is the ability to interpret social cues once they are picked up (Constantino and Gruber, 2005, p.17). A moderate correlation between avoidance and social cognition could be attributed to an interaction between the social impairment deficits of ASD and sensory processing problems with becoming overwhelmed by sensory input. For example, as part of the diagnosis of ASD, a child may not interpret social situations well, therefore, avoid a wide variety of activities and appear isolated (Hilton et al, 2007). Conversely, sensory processing problems relating to sensory avoidance involve low neurological thresholds and sensory over-reactivity (Dunn, 1997). The central nervous system has too much sensitization to new stimuli with neurons reacting more readily (Dunn, 1997). This can result in a threatening situation that is uncomfortable or frightening (Dunn, 2006). This can affect social participation in

the school setting by the child withdrawing from social situations they perceive as threatening or causing an emotional outburst, thereby decreasing exposure to situations where there may be discomfort from oversensitivity (Dunn, 2006).

The two correlations support other research where atypical sensory responses have been found with children with ASD. Sensory avoidance behaviors have specifically been shown to correlate with social competence in children with ASD in other research (Hilton et al, 2007; Kern et al, 2007). Sensory avoidance behaviors have even been observed in one study to not change in age over time in those with ASD, where as sensory seeking behaviors were seen to be close to controls as age increased (Kern et al, 2007a).

Overall, however, fewer significant correlations with sensory processing and social participation are present in this study, as compared to the study by Hilton et al (2007). In addition, on both sensory quadrants and social participation, there are more children in the typical ranges than other studies.

The atypical difference levels on the *Sensory Profile School Companion*, range from 42.8 percent to 71.4 percent, including probable and definite difference levels. When only examining the definite difference levels for the sensory quadrants, the range is from 9.5 percent to 38.1 percent. This data supports other research, in which children with ASD often have atypical sensory processing patterns. However, there were more percentages of typical performance ranges as compared to other studies (Ashburner et al, 2008; Baker et al, 2007; Hilton et al, 2007; Tomchek & Dunn, 2007). In the study by Hilton et al, scores in the typical performance or less area on the quadrants for the

Sensory Profile ranged from 8.3 to 22.2 percent (2007). In this study, scores in the typical performance on quadrants for the *Sensory Profile School Companion* area varied from 28.6 to 57.1 percent.

The percentage frequency of atypical difference levels on the SRS total t-score range for social impairment occur mostly in the mild to moderate range at 57 percent, which is the range associated with children with high functioning autism. The remainder of the children in this study scored within the typical range for the SRS total t-score at 42.9 percent, which is a higher percentage as compared to one other study using the SRS (Hilton et al, 2007).

The social communication subscale on the SRS had the most number of typical range scores at 52.4 percent. Social communication, according to the SRS, is the expressive components of social communication and motor components related to reciprocal behavior (Constantino & Gruber, 2005). Examples of the Likert scale questions in the social communication subscale includes “Is able to imitate others’ actions” and “Avoids eye contact or has unusual eye contact” (Constantino & Gruber, 2005, p.18). The motoric components of social competence could be those factors that are addressed most frequently by social skill groups, families, and schools, such as asking the child to look in your direction when talking.

The subscales on the SRS that deviated the most from typical were in social awareness and social cognition. Social awareness is the ability to pick up on social cues and social cognition is how to interpret the cues once they are picked up (Constantino & Gruber, 2005). These areas are more abstract and difficult to learn for children with high

functioning autism, and may require more direct teaching (Winner, 2008). The ASD Nest Program does address these areas in the social development curriculum with more direct teaching related to social cognition occurring in the third grade (Koenig et al, 2009). Assessment from the SRS subscales also provides guidance in specific areas with treatment, with any subscale t-score at 60 or above indicating a significant deficit (Constantino & Gruber, 2005). Students may have had an overall typical range score, but may have a 60 or above in a subscale t-score. Therefore, although showing overall typical social participation, a student may still have a significant deficit in a specific area that can affect social interaction.

One factor resulting in higher percentages of typical ranges in both sensory processing and social participation assessments could be that the children are part of a program that has transdisciplinary involvement to address the atypical behaviors of the children with ASD. The students in the ASD Nest program participate in a social development time that addresses aspects of the subscales of the SRS, which may contribute to several of the children scoring in the typical range of the SRS total t-score. The social development intervention (SDI) focuses on “social communication, social problem solving, social skills, and pragmatic language development...” (Koenig et al, 2009, p.10).

Most of the students also receive school based occupational therapy services, which can impact the sensory modulation throughout the day positively, particularly if a sensory diet or self-regulation strategy is in place for the student. Sensory diets and sensorimotor activities occur frequently as part of the class day in ASD Nest classes. The

majority of the teachers have basic knowledge of sensory processing dysfunction issues and can readily have access to consultation with OTs to address these issues. Behavior problems from atypical sensory processing may not happen at the school if addressed by appropriate sensory strategies. A study of children with high functioning ASD who are not part of this specific programmatic social development program is recommended to compare how sensory processing and social participation differs with other school programs. In addition, a study with close matches of children with ASD in different school programs may also provide insight into effectiveness of various programs on sensory processing and social participation for varying levels of impairment of children with ASD.

Another factor that may contribute to the results are the specific participants of this study as compared to other studies with children with ASD. Scores for the students on the ADOS were unavailable, therefore where the child is on the range for high functioning ASD was not known. The children admitted to the ASD Nest Program may have fewer sensory processing or social participation issues than other children with ASD represented in other studies.

This study occurred only in the school setting in an urban area, which may yield different from other research that used results from caregiver information. Students may be able to appear to function better in a structured school environment, rather than in unstructured time with peers, siblings or parents. This could be due to fluctuation in atypical sensory processing throughout the day. Wilbarger (1991) describes children with sensory defensiveness, such as those with low thresholds, as having difficulty recovering

to an optimal level of arousal when presented with sensory events over time. A child who has sensory avoidance or sensory sensitivity problems throughout the day may experience some anxiety, but may be able to use enough cognitive strategies or sensory diet strategies to control behavioral reactions while at school. This may vary at home at the end of a day when the stress from sensory events has accumulated, resulting in more extreme behavioral reactions.

The use of questionnaires by teacher and SLP participants is a limitation and may affect the outcome of the results. The scores from the questionnaires depended on the interpretation of items by the teacher or the SLP when completing them.

Replication of this study in other schools is recommended to further examine the correlation of sensory processing and social participation of children with ASD in school settings. Due to fewer moderate correlations found in this study as compared to other studies using caregiver information, more studies in schools could determine if there are differences in sensory processing in various contexts of home and school. Brown and Dunn (2010) provide emerging research into the relationship of the context of home and school along with sensory processing in children with autism. Specifically, avoiding and seeking quadrant scores were used for correlational analysis on the *Sensory Profile School Companion* and the *Sensory Profile*. The results indicated a relationship between sensory processing and context in children with autism. Research also shows differences in perception of social participation between caregivers and school with children with sensory processing disorder and typical peers (Cosbey, 2007). Comparing caregiver and school information regarding sensory processing and social participation in children with

ASD can examine if significant differences exist between home and school. Perhaps including data in studies on specific sensory systems and correlating it with social participation can also provide more information regarding abnormalities in specific sensory systems affecting social participation in those with ASD in schools.

CHAPTER VI

CONCLUSION

This study examined social participation and sensory processing for children with high functioning ASD in an urban school setting. Overall, this study provides limited support for a relationship between social participation and sensory processing. Two moderate correlations between sensory processing and social participation were found using these participants, one between the overall social responsiveness scale t-score and sensory avoiding, and the other between social cognition and sensory avoiding. There were fewer correlations as compared to other research that use caregiver information.

Data for sensory processing indicated atypical sensory patterns in the students with ASD, but overall there were fewer atypical ranges found in the sensory processing and social participation assessments for the participants in this study.

Implications for the practicing occupational therapist includes a role in the school to provide information regarding sensory processing patterns, sensory strategies for children with ASD and assess if sensory problems affect the student's interpretation of social situations. Social participation is within the scope of practice, but may not always be the priority in treatment of elementary children with ASD despite the large amount of social interaction needed in school. Another implication of practice is that more interviewing of caregivers of students regarding sensory processing and social participation may provide information if there is a difference at home. The result may be a complementary home program to ensure carryover of sensory diets and sensory

strategies to improve social participation at home. Finally, communication between the OT and across disciplines in the school can ensure all school staff involved can address sensory processing issues and social participation issues as they affect the classroom.

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