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# Sensory Processing Disorder: An Introduction For Classroom Teachers

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# SENSORY PROCESSING DISORDER: AN INTRODUCTION FOR CLASSROOM TEACHERS

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## Abstract

Elementary students may be impacted by Sensory Processing Disorder (SPD) resulting in poor performance, anxiety, or behavioral challenges. This literature review defines sensory processing disorder and provides information about ways teachers can recognize and support students with SPD in the classroom. The research explores all aspects of sensory processing disorder; history, comorbid conditions, causes, diagnosis, interesting connections and interventions. Teachers need to understand SPD to modify classroom environments and teaching methods. Information from this literature review provides a theoretical foundation for the SPD handout that will support teachers when working with students with sensory processing disorder.

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## Chapter One:Introduction

Sensory processing is a neurological process that organizes information received from the body and information from the environment for use in our daily lives. Sensory processing is in a state of consistent change, activity, and progress. Sensory processing is recurring and never ending. Sensory processing occurs in the nervous system, which consists of one hundred billion neurons, a spinal cord, and a brain. Sensory processing involves the following; reception, detection, integration, modulation, discrimination, praxis and postural responses. Sensory Processing Disorder (SPD) is difficulty in the way the brain takes in, organizes and uses sensory information (Carol Stock Kranowitz,1998).

Sensory Processing Disorder (SPD) is a struggle within the brain to organize and use sensory information. SPD impacts a person's ability to interact effectively within their environment. Having SPD does not imply that a child has a brain injury or disease but rather a traffic jam of information in the brain. When the brain is experiences a traffic jam the following scenarios could be happening:The brain may not be able to integrate, organize, modulate, or discriminate sensory messages accurately; The brain may send out inaccurate information to direct a child’s actions; When the brain provides inaccurate information needed by a child to function within the environment, it may trigger problems; Problems experienced due to an SPD traffic jam include being able to listen, pay attention, interact with others, process new information, remember, and learn.

Also, another important factor is to determine which specific type of SPD a child is experiencing so that appropriate treatment can be provided both in and outside of school.

SPD has many symptoms that resemble other common disabilities. Symptoms can overlap so much that differentiating between one disability and another is challenging for professionals. It is also possible for a child to have only SPD symptoms, or the child may have SPD symptoms associated with another disability. SPD can stand alone but often coexists with comorbid conditions. For example a child may have SPD but also Autism Spectrum Disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), Fetal Alcohol Spectrum Disorder (FASD), or Obsessive Compulsive Disorder (OCD). Research continues to develop and evolve searching for the possible causes of SPD such as genetic or hereditary predisposition, prenatal circumstances, premature birth, low birth weight, birth trauma, or reasons unknown.

When SPD is suspected an evaluation is important. The SPD evaluation process is thorough, measuring a child's skills and attributes related to sensory and motor skills while considering the child's broad scope of development including academics, language, and social skills. An evaluation may be completed by any of the following professionals: occupational therapist, speech language pathologist, psychologist, special education teacher, pediatrician, or developmental optometrist. Following the evaluation and the child has been diagnosed with SPD, therapy services can begin. If they qualify for special education services at school they will receive the therapy services as part of the Individuals Disabilities Education Act (IDEA). If students are diagnosed with SPD in a private setting they can receive therapy, but at a cost to the family. Therapy/services can consist of any of the following; occupational therapy, physical therapy, speech and language therapy and vision therapy.

It is also important that teachers and families/guardians advocate for the students at school by communicating with the general education and special education teachers and

paraprofessionals. As a parent of a child with sensory processing disorder I have learned the art of advocating and communicating effectively with our local school district. I am in constant communication with my child's general education teacher, special education teacher, and one-on-one paraprofessional. This thesis will explore current SPD research to create a presentation and document to share with classroom teachers at my school so they can better understand how to work with children in a school setting.

Children with SPD have a very difficult time at school. School can be very stressful, tiring, and overwhelming. School naturally puts pressure on children to perform and conform and children with SPD are unable to handle the pressure. School is all about changes and transitions which can be overwhelming for children with SPD. Schools are full of sounds, smells, and lights which can put a child with SPD into sensory overload. A school day is long and children with SPD tend to need breaks throughout the day to keep them organized which is challenging in a school environment. SPD is misunderstood by many administrators and teachers which makes it harder to meet the needs of a child with sensory processing disorder.

To better support children at school with SPD it is important that teachers educate themselves and receive proper training on how to recognize sensory needs and provide proper support. SPD children are successful at school when they are provided with the correct sensory tools and strategies for support. Teachers can use a variety of research based strategies in the classroom to address sensory needs based on the SPD child's documented areas of need. Children with SPD can have sensory difficulty in any of the following senses; vision, auditory (hearing), olfactory (smell), gustatory (taste), tactile (touch), vestibular (movement). An SPD child with vision sensory sensitivity may react to the fluorescent lights in the classroom. Child's

light sensitivity could be recognized by the teacher in the following ways; the child will constantly rub their eyes, cover their eyes or verbally express that the lights are too bright. A sensory strategy would be to use classroom light filter covers or allow students to wear sunglasses to wear or a visor while in the classroom.

A child with an auditory sensitivity will struggle with the myriad sounds in all environments. A teacher will recognize a child with auditory sensitivity if the child is covering their ears and prefers to be in a quiet space. A sensory strategy would be to provide the student with noise cancelling headphones. A child with olfactory sensitivity struggles with smells. Teachers will notice an olfactory sensitive student when the student plugs their nose or makes comments about smells bothering them. Teachers can limit use of perfume, room air fresheners, foods, or products in the classroom that could impact the child's ability to learn based on smell sensitivity.

Some children with SPD will struggle with tactile which is identified when the child becomes uncomfortable or stressed by touch. Sensory strategies include adequate spacing between students and allowing the child to walk at the end of the line to avoid unnecessary touch from peers. Lastly, some students with SPD struggle with vestibular sensitivity. Teachers will realize a vestibular sensitivity in a child if they need constant movement. Children with vestibular will have a hard time sitting for long periods of time in a classroom. Teachers can incorporate movement breaks throughout the day to support the child.

Bringing awareness to sensory processing disorder is key to the success of any child with SPD and their success in education. Learning about SPD enlightens one about the huge role senses play in the learning process and challenges for students with SPD. It is important for

teachers will benefit from learning a lot about sensory processing disorder to better support SPD children in the classroom. As I begin my research journey to learn more about sensory processing disorder, I seek to answer these questions: What are the characteristics of sensory processing disorder? What is the best way for teachers to recognize and support students with SPD in the classroom?

# Chapter II: Literature Review

## Overview of Literature Reviewed

To find literature for this thesis, searches were conducted using Academic Search Premier, ERIC, EBSCO, and Google Scholar. The key words that were used in these searches included “sensory processing,” “sensory processing disorder,” “sensory integration,” “sensory modulation,” “sensory processing comorbidities,” “sensory processing disorder causes,” “sensory processing disorder diagnosis,” “sensory processing interventions,” “sensory processing prenatal,” “sensory processing perinatal,” “sensory processing risk variable.” This chapter will review literature on sensory processing disorder in the following areas; history, comorbid conditions, causes, diagnosis, interesting facts, and interventions.

## History of Sensory Processing Disorder

Sensory processing disorder is defined as a condition where the brain has a hard time receiving and responding to information through the senses including oral, visual, tactile, olfactory, gustatory, vestibular, auditory, proprioception and interoception. Sensory processing deficits that manifest as behavioral responses have been linked to children with autism spectrum disorders (ASD). Abnormal responses in auditory, visual, tactile and sensory processing in people with ASD have been documented in research. As an individual ages fewer differences are Noted, possibly due to the lack of research sensory processing in adults (Germani et al., 2014).

Sensory dysregulation is more prevalent in children with ASD compared to neuro-typical children (Germani et al., 2014). Sensory symptoms also appear in children with other neurological disorders such as Fragile X Syndrome, severe hearing loss and visual impairments (Germani et al., 2014). Researchers Germani et al. (2014) noted that sensory symptoms alone

cannot differentiate ASD from other disabilities. However, some people believe that sensory processing data may be helpful in early detection of ASD. Notable differences were observed in sensory modulation and regulation behaviors for children with and without ASD. Toddlers with ASD were more likely to be under-responsive to sensory input demonstrated by slow responses, avoiding (limiting amount and type of sensation) and low numbers of sensory- seeking behaviors (Germani et al., 2014).

Researchers Germani et al. (2014) compared the sensory processing differences between infants with a high risk of ASD at 24 months and their older siblings with autism and low risk infants with no family history of ASD. The sensory processing differences were assessed using the Infant/Toddler Sensory Profile (ITSP), a parent-reported measure. The ITSP was administered when the infants reached 24 months. The Autism Diagnostic Observation Scale (ADOS) was administered when the infants reached the age of three. The groups included high-risk infants subsequently diagnosed with ASD, high-risk infants without an ASD diagnosis and low-risk infants without an ASD diagnosis and were compared based on three year outcomes.

Data included 31 low-risk and 60 high-risk infants who completed the ITSP at 24 months and their three year diagnostic assessments. The results revealed no difference between gender or age in regards to high-risk ASD diagnoses, high-risk non-ASD diagnoses and low-risk non-ASD diagnoses. The researchers noticed differences on Mullen Scales of Early Learning (MSLE) scores for expressive and receptive language. Groups also showed significant differences in auditory processing. An auditory processing behavior may be a child attempting to escape from a noisy environment. High-risk ASD diagnosed children scored higher than the two peer groups in

auditory processing. The researchers also reported no differences detected in visual, vestibular, tactile, or oral sensory processing domains. The children at high-risk for ASD diagnoses had significant low registration that indicated limited awareness for sensory stimuli (Germani et al., 2014).

According to researchers James et al. (2011) sensory modulation disorder is the inability to control and organize reactions to sensory input including separate irrelevant and relevant stimuli while sustaining optimal levels of arousal. A sensory modulation disorder impacts the ability to manage emotions, attention, and motoric responses to sensory stimuli which impacts coping and managing challenges in everyday life. A sensory modulation disorder includes one or more of seven sensory systems; gustatory, olfactory, auditory, visual, proprioceptive, vestibular and tactile. Symptoms may include sensory over-responsivity, sensory under-responsivity, craving/seeking, or a combination of the three subtypes (James et al., 2011)

James, Miller, Schaaf, Nielsen, Schoen, (2011) noted that sensory modulation disorders are estimated to affect 5% to 16% of the general population of children. Limited empirical data related to classifying sensory modulation disorder, though proposed patterns of sensory modulation disorder have been identified. Previously the sensory modulation disorder was classified into three areas; sensory over responsivity, sensory under responsivity and sensory seeking/craving. James, et al. (2011) sought to understand the complexities of grouping children with sensory modulation disorder.

The study included 98 children with sensory modulation disorder identified by an occupational therapist (OT) at the Department of Pediatric Rehabilitation at the Children's Hospital of Denver, Colorado. Referrals for OT were made by the children's physicians, teachers

and parents. Behaviors noted on the referral included: aggression, withdrawn, sensory and motor issues, lack of focus, impulsivity and behaviors that disrupted the child's functioning. The sensory modulation disorder diagnosis was indicated following a comprehensive occupational therapy evaluation with an advanced clinician. No standard assessment for sensory modulation disorder exists so diagnoses were determined by the occupational therapist using data collected during the evaluation process. The measures included: standardized norm-referenced scale of sensory-motor abilities, sensory modulation disorder checklist, standard clinician observations made while in the occupational therapy gym, sensory, and developmental review and medical history interview with the child's parents. Following the data review the clinician determined the presence of a sensory modulation disorder.

The results indicated two distinct clusters or subtypes of sensory modulation disorder. Researchers James, Miller, Schaaf, Nielsen, Schoen, (2011) agreed that two subtypes of sensory modulation disorder clearly emerged: sensory seeking/craving and sensory under-responsivity. The third subtype, sensory overresponsivity was found in both sensory seeking/craving and sensory under-responsivity subtypes.

Sensory over-responsivity, the most common form of sensory modulation disorder, characteristically affects auditory and tactile sensations. Sensory over-responsivity, a subtype of sensory modulation disorder, is described as extreme negative reactions to normal sensory experiences. Having these extreme over reactions can impact daily life activities and cause stress for the child and family. For example, some children may find the sound of a vacuum cleaner or fire truck siren highly aversive. They may also dislike the stiffness of new clothes or labels found inside shirts and jeans. The over responsive reactions are consistently found under

the sensory processing disorder umbrella. Most sensory processing disorder research focused on children with developmental disabilities or other childhood disorders. Children with developmental disabilities have higher rates of sensory processing disorders, compared to peers without developmental disabilities or other childhood disorders (Hulle et al., 2015).

Hulle & Lemery-Chalfant & Goldsmith (2015) examined the developmental course of the sensory over-responsivity subtype of sensory modulation disorder from toddlerhood to middle childhood. Researchers wanted to find what contributed to the stability of sensory symptoms across development. They recruited families with twins for the study.

The researchers Hulle et al., (2015) assessed the twins at the ages of two and seven. The results of the Toddler Behavior Assessment Questionnaire (TBAQ) given to mothers and fathers when their twins turned two were used for this study. The 120 item assessment considered temperamental dimensions in children from 18 to 36 months. The subscale items evaluated: activity level, attention, anger, inhibitory control, interests, object fear, smiling/laughter, sadness, social fear, soothability and sensory over-responsivity. Parents rated each specific behavior occurrence for one month using a Likert Scale from 1 (never) to 7 (always).

Once the children turned seven the parents completed the Sensory Over-Responsivity Inventory (SensOR) for each twin separately. The caregivers indicated either yes or no when asked if their twins were bothered by a specific sensation. The assessment included 31 tactile and 23 auditory sensitivity items. The children were considered at risk for sensory over-responsivity if they had eight or more tactile defensive symptoms and four or more auditory defensive symptoms. Because two different measures were used to assess symptoms at age four

and age seven the researchers included a subsample at age four that examined assessment validity. Researchers reviewed the consistency of screening children positively or at risk for sensory over-responsivity.

Results of the study indicated that 294 children screened positive for sensory over-responsivity out of 3058 children at age two. At age seven, 142 children screened positive for sensory over-responsivity out of 978 children. An equal number of males and females screened positive for sensory over-responsivity at two years old compared to the children who screened positive for sensory over-responsivity at age seven. At age seven  a higher number of males who screened positive for sensory over-responsivity.

## Co-morbid Conditions

Autism spectrum disorder is characterized by differences in the areas of social interaction, communication, and  the existence of atypical behaviors and restricted interests Matsuhima & Kato, (2013). Children with ASD commonly have symptoms of sensory processing disorder that can negatively impact their ability to participate socially.

Researchers Matsuhima & Kato, (2013). considered the relationship between social interaction and sensory processing disorder in children with autism spectrum disorder documenting negative social, emotional, and behavioral responses. Strong connections were noted between atypical sensory processing and the severity of social impairments in children with higher functioning autism spectrum disorder (Matsuhima & Kato, 2013).  The current study sought to determine the connection between sensory processing disorder and social interaction deficits in Japanese children with autism spectrum disorder. The second purpose was to determine the specific sensory processing disorder symptoms.

Eighty-four children enrolled in the study which included 42 children with ASD. The children with ASD included 36 males and six females. The 42 typically developing control group included 32 males and 10 females matched for age and sex. The children with ASD were evaluated by licensed psychiatrists and attended special education schools for early intervention. The children in the control group were recruited from preschools and not part of any special education program nor did they demonstrate developmental delays during the infant medical examination. (cite)

Researchers used the Social Responsive Scale (SRS) and the Japanese Sensory (JSInstrument-R) to examine the relationship between social interaction deficits and sensory processing disorders in children with ASD without intellectual disability. The SRS, a 65 item Likert scale questionnaire was completed by parents, teachers, or a caregiver who had observed the child in a natural setting for at least two months. The subscales of the SRS included social awareness, social cognition, social motivation and autistic mannerism. The SRS assessed children between four and 18 years. The JSI-R, a standardized assessment tool, included 147 items grouped into eight subcategories. The subcategories described behavioral responses to sensory stimuli in children four to six years old. The subcategories included behaviors related to sensory processing disorders. The higher the subcategory score or total score on the JSI-R indicated a greater likelihood that the child had sensory processing patterns related to a sensory processing disorder (Matsuhima & Kato, 2013).

The researchers noted significant differences in test scores between the two study groups. More atypical sensory processing patterns and social interaction deficiencies were noted in children with ASD on the SRS. The JSI-R assessment results showed that SPD symptoms were

linked to the social interaction deficits in children with SPD. The results of this study indicated an obvious relationship between social interaction deficits and SPD symptoms in children with ASD. Children with ASD had more severe sensory processing disorder symptoms and social deficits compared to their neurotypical peers (Matsuhima & Kato, 2013).

Attention Deficit Hyperactivity Disorder (ADHD) is a common developmental disorder in children (Shimizu et al., 2014). ADHD is diagnosed according to three subtypes; predominantly inattentive, predominantly hyperactive-impulsive and combined. Researchers have suggested that ADHD may impact a child's sensory processing particularly in the area of sensory modulation. Sensory modulation is the capability to regulate the intensity and environment of sensory input. Prior research Shimizu et al, (2014) indicated that children who had ADHD did not receive and process sensory information properly. They also struggled with producing suitable adaptive responses at home, school, and other social settings and situations. Shimizu et al., (2014) found that children with ADHD showed greater sensory responsivity and significantly more sensory processing impairments than children without ADHD (Shimizu et al., 2014).

Shimizu et al. (2014) assessed and compared the sensory responses of children with and without ADHD and analyzed the possible relationship between sensory processing impairments and behavioral symptoms. The study group consisted of 74 children, from six to 11 years. Thirty-seven children with ADHD included 30 boys and seven girls. Twenty-four of the students attended public schools and 13 attended private schools. The control group consisted of thirty-seven children without ADHD and were matched by age, gender, and type of school. A translated and adaptive version of the Sensory Profile was completed by parents and caregivers

of both groups of children. The Sensory Profile scores were linked with the behavioral symptoms identified by the Child Behavior Check List (CBCL) and the Behavioral Teacher Rating Scale (EACI-P). The research team used the Mann Whitney and Pearson statistical analysis.

The research results concluded the following; children with ADHD had more sensory processing impairments compared to the control group. There was a significant difference between children with ADHD compared to children without ADHD in regards to their oral processing system. It was also discovered that children with ADHD experienced considerable difficulties in sensory processing related sensation avoiding, sensory seeking, sensory sensitivity, and poor registration. Children with ADHD had major sensory processing impairments in the areas of emotional/social responses, emotional reactivity items such as self-esteem, frustration levels, irritability, and anxiety. The study also noted sensory processing impairments in vestibular processing, modulation of the body position and movement, and sensory seeking. Researchers also recognized impairments of auditory processing in children with ADHD which indicated overly responsive behaviors and under-responsivity. The research results suggested that children with ADHD could have sensory modulation impairments which may cause behavior and inappropriate responses. They concluded the possibility that sensory processing contributes to ADHD symptomatology (Shimizu et al., 2014).

Fetal alcohol syndrome is a permanent birth defect caused by maternal drinking of alcohol while pregnant. Fetal alcohol syndrome is described as a growth deficiency cluster of minor face anomalies and damage and dysfunction to the central nervous system. Prenatal alcohol exposure presents along a continuum called Fetal Alcohol Spectrum Disorder (FASD). Alcohol in the developing brain can impact cognitive functioning, memory, attention, learning,

language, motor skills, auditory processing, and problem solving. Previous research Franklin et al. (2008) acknowledged the ways alcohol affected cognitive and behavioral brain functions. The connection between sensory processing and fetal alcohol spectrum disorder has not been well-researched. Sensory processing deficits have been connected to a wide variety of neurobehavioral difficulties. Some manifestations of sensory processing deficits such as hyperactivity, distractibility, social struggles, poor organizational skills, learning difficulties, and behavioral problems have been reported in children with FASD (Franklin et al., 2008)

Due to the limited amount of available research. Franklin et al. (2008) considered the connection between problem behaviors and FASD. The study consisted of 44 children ranging in ages from five to ten. They were evaluated with the Short Sensory Profile (SSP) and Child Behavior Checklist (CBCL). The short sensory profile (SSP) is a 38 item questionnaire completed by a caregiver to help identify a child's sensory processing behaviors. The (CBCL) assessed behavior and emotional problems present in the last six months.

Forty-four children met the study's inclusion criteria following the assessment, and met criteria for FASD. Eighteen of the 44 children reported having a mental health or psychiatric diagnosis. Twenty-three children were diagnosed with attention deficit disorder (ADD) or attention deficit hyperactivity disorder (ADHD). The study results indicated a negative connection between the SSP and the CBCL total scores. Low SSP scores indicated more processing difficulties while high CBCL scores meant there were more problem behaviors. Secondly, children with FASD in the sensory processing probable group demonstrated significant deficits in externalizing problems and problems in the domains of attention, thought problems, socialization and rule breaking on the (SSP) compared to children with FASD in the sensory

processing non-probable group in the (SSP) typical group on the (CBCL) (Franklin et al., 2008) The children scored differently in regards to attention, problem solving and social issues. Thirdly, children with normal CBCL test scored lower in under-responsive/seeking, sensation, and auditory filtering than the children with clinical or borderline CBCL test scores.

The study supported prior research Franklin et al. (2008) indicated that SPD and problem behaviors co-existed in children with FASD. A high number of children displayed both sensory processing and behavioral problems as indicated by the caregiver report. Children with FASD who demonstrated concerns on measures of sensory processing and behavioral issues also demonstrated significant differences in specific sensory and behavioral test domains. Children with FASD who demonstrated sensory processing deficits were also more likely to have functional behavioral issues that fell in the area of socialization, attention, rule breaking, and thought problems.

The results of this study indicated that the children with FASD who struggled with behavioral issues also had a hard time processing auditory stimuli and modulating sensory input from the environment. The majority of the children with FASD showed deficits in behavior and in sensory processing. The study acknowledged that if a child had a difficult time with sensory processing they were more likely to have behavioral issues that make it harder for them to behave appropriately. A child who could not behave appropriately tended to struggle with behavioral regulation. Based on this research occupational therapists should consider sensory processing skills when evaluating and treating all children with FASD. The potential decrease in behavior problems by applying sensory processing interventions is promising for children affected by FASD (Franklin et al., 2008).

Dar et al. (2011) sought to determine the relationship between SPD, childhood rituals, and obsessive compulsive disorder (OCD). OCD is diagnosed by the presence of obsessive thoughts that lead to repetitive behaviors (rituals). Children with sensory processing deficits seek ways to self-calm by creating comfortable and predictable environments. Researchers suggested that when children seek calming in this way they may develop ritualistic behaviors. A child who has sensory defensiveness exhibits stereotypical behavior by being rigid and inflexible. Behaviors that are repetitive in nature, rule-governed, and inflexible in children are referred to as rituals. A typically-developing child includes some form of rituals, children who engage in an exaggerated number of rituals can upset the daily schedule and cause problems in daily functioning (Dar et al., 2011)

Dar et al. (2011) confirmed that children who displayed high levels of ritualism when young tended to be at greater risk for developing obsessive compulsive disorder (OCD). Researchers Dar et al. (2011) documented the connection between sensory sensitivity and OCD. OCD is related to excessive disgust which has been seen as one of the following sensory processing types; olfactory, gustatory and tactile hypersensitivity. Excessive disgust leads towards rituals. It is also suggested that children with OCD exhibited an intolerance to sensory stimuli which leads to stress which then leads to rituals. Few studies have addressed the connection between sensory processing, childhood rituals, and OCD. The current study hoped to find the relationship between sensory processing, childhood rituals, and OCD. Researchers Dar et al. (2011)sought to examine the link between strong reactions to typical daily sensory events and the use of rituals as described by caregivers of preschool children. The researchers created a

scale that measured oral and tactile hypersensitivity that assisted adults who determined the link between sensory processing and OCD (Dar et al., 2011).

The first part of the study focused on the relationships between strong reactions to everyday sensory events and ritualism in children. The researchers ruled out anxiety as the cause by including measures of trait anxiety. To determine this, researchers singled out items in the sensory profile that related specifically to sensory processing and sensory integration which included; auditory, visual, tactile,oral, vestibular, and multi-sensory events that did not include or involve anxiety or ritualism. Sixty-one children completed part one of this study. Thirty-nine of the children were boys and 22 girls between four and 6.4 years. All children attended kindergarten and none of the children were enrolled in special education. The parents' ages ranged from 27 to 42 years, 51 women and 10 men (Dar et al., 2011).

The Evan's Childhood Routine Inventory (CRI) a 20- item questionnaire that measured compulsive-like behavior in children, was completed by the children's parents. Anxiety was measured using the Screen for Child Anxiety Related Emotional Disorders (SCARED). The research team created a shorter version which included eight items that included at least one from each area. Lastly, strong sensory reactions to everyday events were measured using the Sensory Profile that contains 125 items. The Sensory Profile questionnaire was completed by the children's caregivers. Using data from this analysis the researchers confirmed a relationship between strong reactions to everyday sensory events and childhood ritualisms. They also confirmed a correlation between sensory processing and ritualism using the CRI scale. Twenty-three items linked ritualism with 17 of the items from oral and tactile sensory processing (Dar et al., 2011).

The second part of the study considered whether past or current oral or tactile hypersensitivity was linked with OCD symptoms in adults. The study included 314 participants, 248 women and 66 men. The participants participated by completing questionnaires via email. Obsessive compulsive tendencies were measured using the Obsessive Compulsive Inventory-Revised. Anxiety was measured using the International Personality Pool - NEO. Lastly, oral and tactile hypersensitivity was measured using the condensed version of the OTHS created for part one of this study. The data analysis following part two found that adult oral and tactile hypersensitivity was strongly connected to OCD symptoms (Dar et al., 2011).

## Sensory Processing Disorder Etiology

Sensory processing disorder can significantly impact a child's ability to function properly in all settings. SPD impacts a child's ability to receive, organize and use sensory information. Children with SPD are easy to spot when grouped with same-aged peers. SPD children tend to perform tasks awkwardly and with delay, or they may be unable to perform the task at all. Problems associated with prenatal and perinatal developmental periods have long been considered and described as causes of SPD (Szczepara-Fabian et al., 2018).

Szczepara-Fabian et al. (2018) wanted to determine the most common and currently occuring prenatal and perinatal problems that could serve as a possible indicators for SPD. Currently insufficient data regarding the causes of SPD exists so identifying risk variables can assist and support the development of specialized monitoring for specific children. Eight-nine children identified with SPD and no other neurological disorders were participants in this study. The study included children aged seven months to eighteen years. Eighty-eight healthy children without SPD were also included.

Each parent provided medical documentation regarding the mother's pregnancy and birth, and the child's sensorimotor development. The questionnaire was completed with the help and support of a therapist. Information that was collected included the mothers pregnancy, childbirth and the child's sensorimotor development. Prenatal information included the following; mother's chronic illnesses, number of pregnancies, infections, bleeding, drugs, cervical insufficiency, bed rest, placenta abruption, c-section, preterm birth at thirty-seven weeks or earlier, instrumental delivery, abnormal birth weight, apgar score, fetal abnormalities, and prolonged jaundice (Szczepara-Fabian et al., 2018).

In addition to the in-depth child assessment, interviewed children were given a pediatric neurology and physiotherapy/SI diagnosis, and an age-appropriate checklist created by the American Occupational Therapy Association. Children who ranged in age from seven months to three years were given the Infant-Toddler Symptom Checklist. Children older than four were administered the South Carolina Sensory Integration Test.

The results of the study indicated that some of the analyzed risk variables occurred significantly and statistically occurred more frequent in children with SPD. The risk variables included abnormal birth weight, low apgar score at one minute, cervical infections and insufficiency, and placental abruption. The apgar score at one minute was highly significant in nineteen of the children with SPD who had low apgar scores during that time frame. Overall, the children with SPD had Apgar scores below seven but above three (Szczepara-Fabian et al., 2018). It was also noted that spotting during pregnancy, bed rest, and premature birth occurred more frequently in children with SPD than in children without the disorder. This was not statistically significant. C-sections and the mother's chronic illnesses occurred similar in

frequency between the two groups. The study also found that bed rest treatment was used more frequently in the mothers of children with SPD but this was also not considered statistically significant. Researchers noted that children with a higher than normal birth weight were also children diagnosed with SPD. Researchers acknowledged that children with three or more prenatal and perinatal risk variables were at a higher risk of having SPD. Suggested that children with three or more risk variables should be monitored closely for SPD (Szczepara-Fabian et al., 2018).

## Sensory Processing Causes

According to Ryckman, Hilton, Cynthia, (2017) in the United States one in 10 infants are born prematurely. Preterm infants are at a high risk of having medical complications and social-emotional, language, cognitive, and sensory processing problems. Preterm infants are exposed to a wide range of sensory stimuli that they are not developmentally prepared for which increases the risk for developing SPD. Sensory processing disorder affects between 39 and 52 percent of infants born prematurely (Ryckman et al., 2017). It is suggested that infants born prior to 32 weeks are at an even greater risk for developing SPD. The most common form of SPD seen in preterm infants is low registration along with tactile defensiveness, hyperactive temperament and the ability to engage and respond to the environment in an appropriate manner. Research has shown that preterm infants with SPD will continue with the disorder until at least age eight (Ryckman et al., 2017).

Sensory development begins early in utero. Sensory development for an infant born preterm occurs in an external environment that exposes the infant to stimuli they are unprepared to integrate. Premature infants spend time in the Neonatal Intensive Care unit known as the

(NICU). Research suggests that the NICU environment could play a crucial role in the development of SPD (Ryckman et al., 2017). Preterm infants no longer have the protection of their mother's womb so they are exposed to more intense tactile, auditory, visual, and nociceptive stimuli within the NICU. Concurrent with sensory exposure, the preterm infant continues significant brain development which can affect motor, neurological, and sensory development.

Ryckman, Hilton, Cynthia, (2017) described the probability of SPD in preterm infants from ages four to six. They sought to define predictors of SPD. Lastly, they wanted to determine a connection between early neurobehavior at term equivalent age to SPD from ages four to six. The study took place at the St. Louis Children's hospital in the children's hospital level four neonatal intensive care unit NICU that included 75 beds. Half of the bed spaces were an open ward style with eight to 12 beds while the other half were private NICU rooms.

The study included 136 infants from a separate study that focused on understanding brain development of preterm infants. Eight preterm infants withdrew from the study, one was excluded due to a congenital abnormality, one moved to another hospital and 22 passed away which left the study with a total of 104 preterm infants. Ongoing admissions of preterm infants were recruited from 2007-2010. All infants who met the study requirements received occupational therapy that addressed each infant's individual sensory processing needs. Prior to discharge when the preterm infant met their equivalent age in the NICU, each infant's neurobehavior was assessed using the NICU Network Neurobehavioral Scale. Other material that was collected before the infant left the NICU would be the infant's sociodemographic information infant sex, insurance type, socioeconimic status, race, maternal age at birth,

maternial marital status at birth, and medical factors. At four to seven years old the preterm infant participants returned for their SPD assessment. The assessment used was the Sensory Processing Assessment for Young Children (Ryckman et al., 2017).

Of the 104 infants 84 returned for the developmental follow up testing that occurred between four to six. It was also noted that only 32 children completed the sensory test due to scheduling conflicts and lack of an available tester. 26 infants completed the neurobehavioral testing when they reached term equivalent birth (Ryckman et al., 2017).

Researchers found that half of preterm infants born before 30 weeks displayed SPD. The impact of medical and sociodemographic factors on later sensory processing disorder could not be secluded for the study. Early behavioral check marks were noted; specifically signs of stress and sub-optimal reflexes that were noticed in later SPD. It was confirmed that 16 children had at least one abnormal score which indicated SPD. Both medical and sociodemographic factors related to SPD could not be isolated for this specific study. Lastly, a connection between SPD and early neurobehavior (Ryckman et al., 2017).

Mukhwejee et al. (2013) from UC San Francisco discovered that children with SPD had significant differences in brain structure compared to typically developing peers. This discovery was the first to indicate a biological basis for the disorder and separates it from other neurodevelopmental disorders. SPD can be overlooked because it occurs in children with ADHD and ASD (Mukherjee et al., 2013) ASD does not appear in the manuals used by psychologists and psychiatrists. The findings will help to establish a biological basis for the disease that could be easily measured and used as a diagnostic tool (Mukhwejee et al., 2013).

An advanced MRI called diffusion tensor imaging (DTI) was used to measure the microscopic movement of water molecules in the brain to provide information about the tracts of the brain's white matter. DTI illustrates the direction of the white fibers and the wholeness of white matter. White matter within the brain is vital for perceiving, thinking, and learning. The study included 16 boys between the ages of eight and 11 with the SPD but without a formal diagnosis of ASD. It also included 24 typically developing boys who paralleled in age, gender, right or left handedness, and IQ. Behaviors of the patients and control subjects were reported and measured by parents using the Sensory Profile (Mukhwejee et al., 2013).

Imaging detected abnormal white matter tracts in children with SPD in the areas of the back of the brain that included the auditory, visual, and tactile systems involved in sensory processing. Children with ADHD or ASD typically have abnormal white matter tracts in the frontal anterior. Abnormalities found within this study focused attention on a different portion of the brain which indicated that SPD may be neuroanatomically distinct. These tracts were emblematic of someone with sensory processing problems (Mukhwejee et al., 2013).

**Diagnoses**

Davies, & Gavin (2007) considered sensory integration theory and its relationship to brain maturation, function, and the behavioral manifestations of sensory integrative dysfunction. Sensory integration theory makes the assumption that the brain is immature at birth. Researchers hypothesized that when confronted with distinct stimuli the brain activity of children with SPD would appear differently to the brains of typically developing children without SPD.

Davies, & Gavin (2007) used electroencephalographic measures to examine brain processing in 28 children with SPD and 25 typically developing children ages five–12 divided

equally by gender. 28 children (22 boys, 6 girls) were identified with SPD and referred to the study by occupational therapists. All research participants completed the Short Sensory Profile. It was observed that the two groups scored significantly different on certain subsections of the Short Sensory Profile. Typically developing children scored within the normal range while children with SPD scored significantly different in the following areas; under-responsive/seeks sensation, auditory filtering, low energy, and weak. Children with SPD also had notable differences with tactile and visual/auditory sensitivity (Davies, & Gavin 2007).

Following due diligence each participant experienced two (EEG's). Children completed the sensory gating paradigm during one EEG and the sensory registration paradigm during the other EEG. Results of the study indicated that children with SPD demonstrated less sensory gating than typically developing children Davies, & Gavin (2007). Researchers noticed a significant relationship between sensory gating and age in typically developing children but not in children with SPD. Brain activity identified children with SPD with 86% accuracy. Results of this study provided empirical evidence that children with SPD displayed distinct brain processing functions. EEG assisted in providing extrinsic validity of SPD diagnosis Davies, & Gavin (2007).

## Interesting Connections

Fontes et al. (2019) considered the risk of children with SPD developing obesity and/or diabetes. Children with SPD can display a wide variety of abnormalities related to their behavior, socialization, communication, and learning abilities. Some children with SPD have sensory sensitivities related to food selectivity associated with eating problems. Fontes et al, (2019) aimed to discover the risk of obesity and diabetes in children with SPD by providing brief

summaries of research published from 2014-2018. Fontes et al, (2019) reviewed research articles from 10 sources that were found in Pubmed, Lilacs, and Scielo bases using the key terms ASD, ADHD, Obesity, Diabetes and Children.

Little et al. (2018) investigated SPD in 239 children ages 3-14 years with ASD, ADHD, and typical development. The study concluded that children with ASD showed an elevated rate of oral processing differences including enhanced feeding inflexibility compared to typically developing children. Children with ASD were also reported as being picky eaters with a low intake of fruits, vegetables, and high fiber foods. Little et al. (2018) also discovered that children with ASD had a higher intake of carbohydrates.

Fontes et al. (2019) reviewed research done by Crasta et al. (2014). Who compare the prevalence of feeding difficulties and the relationship with SPD. The study included 97 children diagnosed with SPD, ASD, and Intellectual Disability (ID). The children's ages ranged from three to 10 years old. Crasta et al. (2014) discovered that 61.0% of children with ASD and 46.4% of children with ID had feeding issues. Feeding issues were reported most severe in the young children with ASD. The study concluded that feeding problems and sensory processing were significantly associated.

Obesity is a health concern for the general population but specifically for children with ASD. Lawson & Foster (2016) investigated the connection between sensory processing patterns, obesity, and physical activity engagement in 77 children with ASD. Results concluded that 42.2% of the children in the study were overweight or obsese. Lason & Foster (2016) noticed that sensory avoiding behaviors were connected to higher body mass index (BMI). Another study conducted by Shedlock et al. (2016) considered whether children with SPD were at an

increased risk of obesity, type 2 diabetes, hypertension, hyperlipidemia, or nonalcoholic fatty liver. Shedlock et al. (2016) concluded that children with ASD had an increased risk for obesity and obesity related disorders.

The mega study results by Fontes et al. (2019) found a connection noting that children with SPD were at an increased risk of being overweight and developing diabetes. However, Fontes et al. (2019) strongly suggested that additional scientific evidence should be collected. Santos et al. (2018) wanted to determine the number of deleterious oral habits in preschool children with and without SPD. Deleterious oral or oral habits are highly related to changes in structures and functions associated with Stomatognathic System (SS), such as: breathing, chewing, sucking and swallowing (Santos et al. 2018). The inclusion criteria for this research study consisted of preschool boys and girls between the ages of two and six. The children had to be enrolled in a preschool program (early childhood) on a regular and routine basis. The preschool children were divided into two groups. The first group consisted of preschool children who had symptoms identified by their school or were diagnosed with some kind of SPD. The second group of preschool children was the control group with no symptoms or SPD diagnosis.

The important variables in the study included; gender, age, presence, and classification of deleterious oral habits within sensory processing and whether or not they were medicated. Data was collected between December 2014 and February 2015 by observations within the preschool classrooms, and interviews with parents, guardians, and teachers. The Sensory Profile was used to determine SPD and for deleterious oral habits Malo and Pontes evaluation was

applied. An occupational therapist accompanied some of the children to their preschool classrooms and assisted with the questionnaire and evaluation (Santos et al., 2018).

The research study concluded that out of the 374 preschool children 93 had either symptoms or a diagnosis of SPD. Sixty-four of those children who showed symptoms or received a diagnosis of SPD were boys. Parents mentioned deleterious oral habits at a rate of 61.8%. The oral respiratory preschool children were counted separately even though there was a direct link with the stomatognathic system. The oral respiratory preschoolers showed the following symptoms of deleterious oral habits; oral breathers 52.9%, pacifier 41.7%, nocturnal bruxism (teeth grinding) 38.9% and onychophagia (nail biting) 20.1% (Santos et al., 2018).

The percentage of preschoolers with SPD who showed symptoms of deleterious oral habits included the following; oral breathers 53.8%, pacifiers 39.8%, nocturnal bruxism (teeth grinding) 57%, digital suction 18.3% and onychophagia (nail biting) 28%. Deleterious oral habits were found in preschool children with the following sensory processing disorder subtypes; sensory based motor disorder 52.7%, sensory modulation disorder 37.6% and sensory discrimination disorder 9.7%. Of the children with the diagnosis of sensory processing disorder, 77.4% used medication to support development, and school performance. The research study concluded that more than half of the preschool children showed symptoms of deleterious oral habits which included children with SPD and without SPD. There was also a connection between nocturnal bruxism and onychophagia in contrast to children with SPD and without SPD. A significant number of children presented with SPD and were in need of differentiated care and instruction. Researchers suggested that if a child has three or more of the risk variables they should be monitored closely for SPD (Santos et al., 2018).

## Interventions

Music has been identified as therapeutic in nature. Recently, occupational therapists have used music as an important first step to prepare child clients for therapeutic activities. Occupational therapists do this based on the idea that the sensory input of music through the auditory and vestibular system can create a calming and organized affect. In the mid-1900s French physician Alfred Tomatis created a sound-based treatment using altered music for children and adults with many types of conditions including; attention deficit disorder, autism, developmental delay, head injury, learning disabilities and sensory system disorder. Tomatis believed that the main role of the ear's function was to organize all levels of the nervous system. Using a sound-based treatment plan developed by Tomatis researchers created a study that investigated the effects of incorporating a therapeutic -listening program and a sensory diet for children with SPD. The researchers hypothesised that children with SPD would display improved visual-motor integration after eight weeks of combined therapeutic listening and sensory diet when compared to just four weeks of the sensory diet alone. The researchers also hypothesised that children with SPD would display fewer negative behaviors (Hall, & Smith 2007).

The study included a sample of 12 children with ages ranging from five to 11 who displayed moderate to severe SPD and visual-motor integration delays. Children were referred to an outpatient occupational therapist clinic associated with a children's hospital. The participants were individually admitted to the study over a 10 month period. The participants acted as their own control and began the first four weeks with a traditional sensory diet and then received an additional eight weeks of therapy which included sound-based and sensory diet treatment.

Families were provided with strategies to use at home to help their child modulate their sensory responses and arousal on a daily basis. Home strategies included exercise, rhythmic rocking, deep pressure massage, and chewing gum. Following four weeks of only the sensory diet treatment plan the occupational therapist created and prescribed a sound-based treatment for each child to accompany the sensory diet. The sound-based diet included specific CD's and a daily music listening schedule (Hall, & Smith 2007).

Researchers used four standardized instruments to measure sensory responsiveness and visual-motor performance that included the Sensory Profile, the Draw-A-Person (DAP), the Visual Motor Integration (VMI), and the Evaluation Tool of Children Handwriting (ETCH). The Sensory Profile is a standardized 125 item questionnaire that evaluates sensory processing. The questionnaire was completed by a family member who has daily contact with the child. The DAP measures visual-motor integration. The child is asked to draw a person and given credit for each detail according to specific criteria. The VMI is a norm-referenced evaluation measure of visual-motor integration for children ages two to 15. The test has the child match figures on the basis of form, size, and position in space. The test also includes having the child draw lines within boundaries. Lastly, the ETCH evaluates the manuscripts and cursive writing skills and abilities of children in first through sixth grade who have a hard time with handwriting (Hall, & Smith 2007).

Researchers reported that 10 out of the 12 children completed the full 12 weeks of the study included children from ages five to 11. All children were identified with SPD or visual-motor delays and directed to finish two sound-based listening treatments per day for eight weeks. Based on the parental logs, two sets of parents did not follow the treatment plan

accordingly. Other qualitative results provided by the parents showed that children who were auditorily hypersentive became more tolerant of noise. Children who normally had tantrums either stopped all together or tantrums decreased in frequency and duration. Children with high energy became calmer. Children who struggled in school made improvements and children who struggled with eye contact started making better eye contact. The children in this study made great progress on certain subtests of the Sensory Profile which included auditory processing and behaviors associated with SPD. Results of this study suggested that sound-based treatment alongside the traditional sensory diet provided support and improvement in children's sensory processing based behavior. Other improvements documented and shared by parent's within the study included the following; attention, interaction with peers, fewer nightmares, increased listening, improved self-awareness, better communication, and improved sleep patterns. This research supports that providing occupational therapy with a mixed treatment plan that included sound-based and traditional sensory diet improved auditory processing and behaviors associated with SPD (Hall, & Smith 2007).

_____Researchers Ringland, K., Zalapa, R., Neal, M., Escobedo, L., Tentori, M., Hayes, G. (2014) conducted two studies to determine whether their multimodal Sensory Paint System could improve traditional interventions  with their systems support for children with Sensory Processing Disorder. The participants in the two studies included 15 boys with neurodevelopmental disorder who ranged in age from 10 to 14 for the lab study and four boys with Autism who ranged in age from four to 10 years old were part of the deployment study. The researchers felt that this was an adequate sample size.

Both studies used the Sensory Paint System. The lab study used the Sensory Paint System for up to one hour at a time each day. The children used the three following modes; free form, coloring book, and target practice during their one hour exposure to the Sensory Paint System. Following the third mode the children had the option of selecting a free choice fourth mode. The children were also allowed a five minute break between modes. The deployment study used the "use mirror" for the first two weeks and then for the next three weeks used the Sensory Paint System.

The researchers discovered positive results from the Sensory Paint System.The results showed that the Sensory Paint System balanced the children's attention between their bodies and sensory stimuli, improved sensory skills, and promoted socialization. The Sensory Paint System could help and support sensory integration interventions, and promote healthy and educational benefits specifically regarding socialization, body awareness, and sensory integration (Ringland et al., 2014).

## Chapter Three III: Application of Research

The purpose of this project provides teachers with sensory strategies to use with sensory sensitive students. My target audience is teachers who may not be equipped with the knowledge they need to meet the exceptional needs of all of students, especially sensory sensitive students. The project includes a PowerPoint presentation describing the different types of sensory processing disorders: (sensory modulation, sensory-based motor issues and sensory discrimination) with examples of how each may manifest in the classroom. Teachers will receive a quick reference handout as a reminder of the strategies and how to address specific sensory needs. In addition, teachers may request a consultation to discuss specific students or a classroom observation. Observations will be followed up with a meeting to discuss findings and recommendations.

Before presenting my project to my fellow colleagues I will meet with my principal to discuss the project and its benefits. I will share that not all teachers are equipped with the necessary knowledge needed to support students who have sensory sensitivities. I would also share that knowledge about sensory strategies can impact the students' learning and overall academic success.

Following discussion and approval from the principal, I will present my project to my fellow teachers. I recommend that the best time to present the information is during a inservice where I will present a 30-60 minute PowerPoint presentation.

Following the presentation I will provide time for questions and answers to address concerns about sensory processing, sensory sensitivities, or sensory strategies. I will distribute the sensory strategies project handout so teachers can add to their sensory sensitivities toolbox.

After the presentation I will send out a Google form that will provide an opportunity for teachers to sign up to discuss specific students or have me complete a general classroom observation. Before observations can be completed for a specific student, an occupational therapist will be consulted and parental permission received. Once observations are complete, I will schedule follow-up meetings with each teacher to review the observation and offer feedback and suggestions to support their growth and understanding about sensory input and strategies that may benefit students in their classroom.

# Chapter IV: Application

Sensory Sensitivities Teacher Handout

By: Katie Lavin

Fall 2021

A. **Sensory Modulation Disorder:** difficulty regulating sensory input.

1. **Sensory Over Responsivity:** Bodies are more sensitive to sensory stimuli; feeling sensations too easily or too intensely which puts students in a constant state of fight or flight. Being touched unexpectedly or loud noises are triggers. Looks like, withdrawing from the environment to avoid unexpected touch or covering ears with loud sounds.

A. Auditory

1. Allow the student to remove himself from the situation (allow student to take a break in the sensory room or other quiet space when a situation gets too intense for student).

2. Provide noise cancelling headphones (keep a bin of headphones in the classroom that are easy to access by student).

3.Prepare in advance for drills (fire, tornado, lockdown).

B. Tactile

1. Allow student to walk at the end of the lines (to avoid unexpected touch).

2. Create spaces for students to sit or stand (include carpet squares, tape or colored circles to the classroom to create functional space).

3. Provide additional transition time (students depart/arrive 1-2 minutes early).

C. Visual

1. Add light filters. (light filters can be found on Amazon).

2. Don’t force or demand eye contact (student may have enhanced ability to process verbal information by not making eye contact).

3. Limit the amount of visual stimuli (keep it simple, organized and plain).

4. Find textbooks, worksheets, and materials that have a clean design (ie. opposite of Jan Brett books).

D. Olfactory

1. Fragrant free classroom (including teachers perfume, classroom soap and air fresheners.

2. Allow student to sit by an open window (keep additional desk available by the window if needed for student).

3. Teach student to inform the teacher when smells are unpleasant (have student place a red magnet on teacher’s desk or verbally tell teacher that the classroom smells unpleasant).

4. Keep the classroom well ventilated (open windows, air purifiers, air conditioning, fan).

E. Gustatory

1. Ensure student calm environment for eating to reduce anxiety (sensory room, unoccupied classroom or library).
2. Do not persuade or force student to try new food because it may cause anxiety or stress ( instead allow student to view and select foods they are comfortable eating from the daily cafeteria selection).
3. Allow prefered foods (provide preferred foods as alternatives when cafeteria food selection is unfavorable or intolerable to student).

**2. Sensory Under Responsivity:** individuals are quiet and passive, disregard, or do not respond to stimuli. A student who does not detect the sensory input may appear to be self-absorbed or withdrawn.

A. Auditory Processing

1. Allow the student extra time to respond to questions (provide questions ahead of time).

2. Use visual supports to increase attention (objects of reference, photographs, videos).

3. Stand beside the student when giving directions (proximity).

B. Tactile

1. Call the student's name to gain attention.

2. Provide fidgets for focus (keep a sensory bin in the classroom that is easy to access fidgets and other sensory toys for student).

3. Use felt tip pens or weighted pencils (provide felt tip pens and weighted pencils that will be kept in a container at the front of the room for easy access for student).

C. Visual

1. Use graphic organizers, planners, assignment sheets.

2. Organize and label where materials belong.

3. Seat the student away from doors, windows, and colorful classroom displays (instead seat student in the front of the classroom).

D. Olfactory

1. To alert the student, use scented candles, lotions, essential oils, or markers.

2. Provide student preferred scent for focus and alert.

E. Gustatory

1. Allow student to add strong flavors to foods.

2. Teach student the difference between real food and fake food.

3. Include oral motor activities (such as blowing bubbles, balloons, and drinking fluid through a straw).

**3.Sensory Craving:** Driven to obtain sensory stimulation, when receiving stimulation results in disorganization and does not satisfy the drive for more. For example, students with sensory craving like flashing lights, spinning objects, loud voices, noisy environments, jumping, crashing, pulling, touching, feeling, tasting (spicy, sour, sweet,), texture (crunchy foods) and licking or biting nonefood objects.

1. Allow movement breaks throughout the day (jumping jacks, pushing and pulling heavy objects, running in place).
2. Create smaller, less stimulating spaces for regulation.
3. Incorporate regulating routines within the daily school schedule (e.g., yoga pose, deep breathing).

**B. <u>Sensory Based Motor Disorder</u> :** deficit in balance, gross and fine motor coordination, and the ability to perform skilled, familiar, novel motor actions.

1. **Dyspraxia:** difficulty with motor planning and coordination or sequencing with fine and gross motor, or speech skills. Difficulty with hopping, jumping, running, writing, using scissors', tying shoes, coordination, muscle weakness; learning disability, speech delay, or difficulty with building or drawing.

1. Simplify tasks into smaller chunks.

2. Encourage the student to be creative by inventing ideas even if they seem silly.
3. Have student play catch with a medium-sized ball before playing catch with a small ball to build physical strength and muscle memory.
4. Practice skills in short, frequent bursts.
5. Give a distraction free learning environment.
6. Supply instructions for specific activities in sequenced picture cards.

**2. Postural Disorder:** poor core strength and decreased endurance. For example, a student may struggle with postural disorder if they appear weak, easily fatigued. Looks like: student slumped while sitting in a chair, difficulty making and maintaining eye contact, has frequent tumbles and falls.

1. Provide the student the opportunity to do exercises that build core strength.
2. Evaluate the students' need for seating adjustments (e.g., ensure feet can touch the floor when the student is sitting).
3. Allow participation in all school activities to encourage connections and to reduce feeling isolation which promotes emotional and social development.

**C**. **Sensory Discrimination Disorder:** body is confused about the source of sensations. For example, a student with sensory discrimination disorder may appear awakward in gross and fine motor abilities, inattentive to people and objects within the classroom. Looks like: difficulty identifying letter sounds and shapes (i.e. the difference between cat and cap, ability to see the difference between p and q).

A. Auditory

1.Reduce background noise when possible (provide noise cancelling headphones to student).

2. Have the student sit in the front of the classroom or near the teacher to hear better.

3. Encourage use of assistive technology in class such as a personal FM system.

4. Teacher uses a microphone.

B. Tactile

1.Proactively provide tactile activity before fine motor tasks (use bean/rice bin, putty or playdough).

2. Teach using tactile media (such as putty, sandpaper letters, bumpy math manipulatives, shaving cream).

3. Never force a student to touch materials (instead allow student to touch only materials they are comfortable with touching).

C. Visual

1. Allow student to wear visor or light sunglasses (increase or change font on worksheet).

2. Use a visual schedule.

3. Experiment with colored overlays for reading.

4. Use colored lined paper.

D. Olfactory

1. Have a back up plan if the student needs to leave the classroom due to smells.

2. Avoid lotions or perfumes with strong scents (instead use non-scented lotions and perfumes in the classroom).

3. Teach student appropriate social reactions to offensive smells.

E. Gustatory

1. Slowly and repeatedly offer new choices; consult with occupational therapists.

2. Respect student preferences.

3. Never force the student to eat (allow student to eat only what they are comfortable with eating).

- Please contact Katie Lavin knl97234@bethel.edu with any questions or concerns in regards to the sensory strategies listed above.
- If student is in special education, contact the case manager or occupational therapist (OT).

# Chapter Five: Discussion and Conclusion

## Summary

Sensory processing is a neurological process that organizes information received from the senses and the world around us for use in our daily lives. Sensory processing includes the following; reception, detection, integration, modulation, discrimination, praxis and postural responses. SPD is difficulty in the way the brain receives, organizes, and uses sensory information, causing a person to have problems interacting effectively within their daily environment. Having a sensory processing disorder does not indicate brain damage or disease but rather a traffic jam of the brain. A brain with SPD struggles with integrating, modulating, organizing, and discriminating effectively, and efficiently. Children with SPD may demonstrate problems in the following areas; looking and listening, paying attention, interacting with people and objects, processing information, remembering, and learning new information (Carol Stock Kranowitz, 1998).

Recognizing the symptoms of SPD is a step in the right direction in evaluating and supporting children in the classroom. Teachers play an important role in supporting children with SPD. It is extremely important for teachers to recognize sensory challenges within their students and provide ongoing support. Teachers can learn about SPD and develop sensory awareness with the guidance from occupational therapists and special education teachers. Teachers can create a classroom and modify teaching styles to be sensory friendly. Teachers can begin to recognize the SPD symptoms in children by learning more about each of the following senses; auditory, tactile, visual, olfactory, gustatory and how each one is impacted by sensory processing disorder. By learning about each sense and how each presents in children with SPD teachers will be able to

recognize the signs a child has a challenge with a specific sense(s). For example, a child with an auditory sensory challenge will most often cover the ears with their hands or verbalize that sounds around them are too loud. A teacher can support this child in the classroom by providing noise cancelling headphones or providing the student with a quiet place to learn. Researchers, Lin & Min (2012) conducted a study to investigate the effectiveness of sensory processing strategies in improving the activity level of children with SPD at school. The research study concluded that sensory processing strategies could improve activity levels in children with SPD at school. Researchers, Hall & Smith (2007) set out to study the effectiveness of sound based intervention on children with sensory processing disorder as well as visual- motor delays. Based on their research they discovered that the children made remarkable improvements in behaviors when they addressed the reflect sensory processing disorder.

## Professional Application

I chose the topic of SPD because my son was diagnosed with it when he was three due to sensory sensitivities, speech delay, developmental delay. I made it my mission to learn as much as I could about sensory processing disorder so that I could better support him at home and at school. I also realized that it would be extremely beneficial to educate my colleagues on how to look for symptoms of sensory processing disorder and how teachers can better support children with SPD in their classrooms.

To better support my fellow colleagues and Minnesota teachers, I created a sensory strategy handout. The handout includes definitions, descriptions, and key details regarding the senses and sensory processing disorder. The sensory strategy handout also includes how to address each sense along with suggestions about what to avoid in each category of SPD. The

sensory strategy handout is conveniently structured and easily digestible. I believe the sensory strategy handout will be favorable in supporting MN teachers in their understanding and support of children with SPD.

## Limitations of the Research

The majority of articles I found on SPD included connections to the following topics; comorbid conditions, causes, diagnoses, interesting facts, and interventions. The first limitation of the research I noted was that interventions seemed more focused on the medical/clinical support provided by occupational therapists (OT) rather than interventions provided by special and general education teachers in the classroom. The reason for this is because interventions are typically prescribed by an OT, just like stuttering and speech therapy, or spinal adjustment and chiropractic. This is why you should be sure to work with your school OT when teachers approach with concerns. It's important to consult with the specialist to avoid crossing professional boundaries. Another limitation I discovered during my research was that there seemed to be a limited amount of articles, journals, and books focused primarily on sensory processing disorder. Research for sensory processing disorder was typically connected with other important topics, rarely in isolation. Limitations expressed by researchers included first time studies, small samples sizes, comorbid disorders, parental reports, and lack of scientific evidence.

## Implications for Future Research

Further research is needed to further understand each area of SPD. Research needs to expand so that all stakeholders are well aware of sensory processing disorder. The more we can learn about SPD the better off we will be in supporting our children at home and in the

classroom. More research needs to be conducted on interventions (sensory strategies) that teachers can use in their classrooms to better support students with sensory processing disorder. Future research needs to uncover the impacts of teachers using/providing sensory strategies to their students with SPD. Research needs to discover the benefits of having a sensory friendly classroom. Questions to consider for future research include: what is sensory processing disorder? What types of sensory strategies work best for students with SPD? How does the use of sensory strategies impact students with SPD on an academic, social, and emotional level?

## Conclusion

Sensory processing disorder is the inability to process information gathered through the senses to enable proficient daily functioning. The senses gather details from stimuli obtained both environmentally and inside the body. Sensory processing is the neurological process of organizing information received through the senses from the environment. It is important for teachers to learn about sensory processing disorder to support students in the classroom. Recognizing the signs of sensory processing disorder is the first step to providing sensory strategies and creating sensory-friendly classrooms. Researching SPD has been a wonderful experience and I have increased my level of understanding which is extremely beneficial both personally and professionally.

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